ERID-Watch

European Research Infrastructure Development Watch

Work Package 1

Deliverable D2

“Intermediate Benchmarking Report”

I.a. Preface

European Research Infrastructures play a major role for Europe's international position on the field of Research, Technological Development and Innovation and, thus, have a significant effect on the economic and societal growth of Europe as their capability to create and exploit new technologies and services is used. The main purpose of the ERID-Watch project is to assess and evaluate the efficiency and market impact of Research Infrastructures in Europe, their performance in terms of scientific exchange, public-private transfer as well as market demand and supply and, additionally, to contribute to an increase of public investment efficiency for European Research Infrastructures by benchmarking and the extraction of best practise examples.

Work Package 1's (WP 1) part of ERID-Watch is to take care about the "best practises and benchmarking" regarding Technology Transfer, Human Resources and Legal Environment for Research Infrastructures. Market impact, investment, finance and Public Private Partnership are dealt with in the parallel deliverable D5 of Work Package 2. The following report presents an intermediate benchmarking report, containing WP 1's results of the first year based on interviews with selected Research infrastructures from all over Europe.

An overall number of about 600 to 750 Research Infrastructures (RIs) is assumed for Europe. By the first year of ERID-Watch 50 of these RIs from at least 14 countries of the European Research Area (ERA) were interviewed. According to the large diversity of the RIs this report can not be seen as fully representative. Nevertheless the chosen sample is broad enough to show the existence of various trends among RIs organisation and key figures. Moreover, this report successfully fulfils the aim of this project, to show best practice experiences in several areas of RI which are important for the cooperation between RIs and industry – such as Technology Transfer (TT), Human Resources (HR), legal environment and general information. But, even if the project is called "European Research Infrastructure Development Watch", it has to be stated, that not all information could be gathered on a RI level, as it was shown during the interviews that many information as well as the organisation of TT and HR are very often kept on an overall institutional level and not on the single infrastructure's level. Also, it should be kept in mind that RIs are seldom built to truly serve two markets with different demands: the market of industrial users as well as the market of scientific users.

I.b. Executive Summary

Selection of RIs & Comparability

- For the sample of 50 interviewed RIs (out of 600+ in Europe) the clear European dimension combined with the number of external users was relevant for choosing those RIs. Other criteria were the type, the country and the scientific domain of the RI.
- All EIROFORUM as well as ERF members were interviewed. The interviewed RIs were very multifaceted in their scientific domains, their market (scientific users or industrial users) and ways of organising. The bulk of interviewed RIs are from EU 15.
- This multidimensional diversity makes it difficult to compare the gathered key figures. It is an inherent problem, that no clear benchmarking is possible among such unique scientific institutions. Any approach with too few analytical dimensions will fall short of even sketching the real situation, as one can’t compare apples and oranges.
- It has to be stated that across all European RIs the obtained data base is very diverse because of the above mentioned diversity of RIs and a lack of uniformity of answers regarding details and availability of RI focused key figures.
- A need for common key figures within European RIs, also clear on a RI level, is given.
- Consequently, the numerical results of this study have to be taken as semi-quantitative indicators for the qualitative issues of this study and many of those indicators will have to be deepened later.

RI Types & Markets

- More than 50 % of the RIs are clustered, i.e., more than the half of the examined RIs belong to a Research Institution which hosts several Research Infrastructures or major pieces of equipment.
- About 2/3 of the RIs are subject to public law, whilst only 1/4 is subject to private law.
- Just above 50 % of the interviewed RI serve the scientific as well as the industrial market, as they have beside scientific users also industrial users.

- The share of industrial usage in the single RIs spans from 0 up to 90 % and is on average around 7 %. This shows that industrial customers currently form a niche market for RIs. And for those 40 % of RIs without industrial users it is simply no market at all.
- 93 % scientific usage on average across all types of interviewed RIs means that science is the major and core market for all RIs in total and for most of them individually, as well.
- At about half of the RIs it turned out being problematic to retrieve exact figures about the shares of internal and external scientific use and the numbers of visiting scientists per year. As these figures are central for the definition of an RI as such, it is strongly recommended to collect the respective numbers much broader and more accurately in all RIs.

Technology Transfer

- Between all interviewed RIs there are extreme discrepancies in the TT approach, so that,even likewise manned and funded TT-offices could not be compared only by key figures as different focuses within their work may exist.
- Technology Transfer at the interviewed institutions includes mainly the two issues of patenting/licensing and industrial cooperation. Spin outs are only done in very few cases.
- Only 2/3 interviewed Research Institutions, which host one or several RIs have the possibility of using a TT-responsible, office, department or company, being always associated with the host institution and not the RI itself.
- In general, the policy regarding Intellectual property (IP) varies between institutions and countries and is mostly directly connected to the financial situation of the TT-part. Numbers of, for example, patents applied for or total patents held by the end of 2006 are relatively high in Germany as well as in the big RIs, i.e., the Intergovernmental Organisation like CERN and ESO. But they are still very low compared with industry.
- Most RIs do only administer passively the occasional inventions of their employees and do not try to activate TT as a source of additional income. In many cases the cost for the TT office is paid solely from the general budget and seldom more than 15 % of the TT cost may be covered by extra income out of TT activities.

- Within the answers about licences it shows that the number of staff in the single TT-offices, which ranges from 1 to, seldomly, more than 10, is in most cases too small to take care of extensive licensing, because on average less than 1 TT professional is responsible for marketing the results of 100 FTE in research.
- Consequently, RIs host institutions conclude on average only about 1 new license contract per year. In comparison with the found average annual royalties of 75 k€ per license it becomes clear that here a large potential is left unused.
- Only half of the interviewed RIs had created any spin-off company in the past, and only very few participated in the forming of more than 10 new companies.
- On the other hand, doing patenting or licensing seems not to be imperatively linked with the industrial usage of the infrastructures or the type of R&D with the RIs as the way of Knowledge and TT-Transfer in the RIs is very different.
- Furthermore, a central issue as regards TT policy is the duality between IP protection and the more traditional open science approach.
- Additionally, the lack of common TT-standards leads to a wasting of resources which could be saved with a set of commonly agreed and used TT-standards. These standards may benefit industrial partners, which then will find at each RI similar standards.

Human Resources

- The HR part of the interviews was the most intensely discussed part as many problems for the RIs are in direct connection with HR – for example, finding appropriate staff for running the RIs.
- Problems most often mentioned were low salaries compared to industry, the high number of fixed termed contracts vs. permanent contracts and therefore the difficulties to recruit staff. These topics may also influence other areas, as e.g. TT and the cooperation with industry.
- Problems mentioned as for example the low salaries are often followed by other problems as the difficulty to find appropriate staff. Also the exchange between industrial and public staff is influenced by the different level of the salaries.
- Fixed term contracts cause special problems as they are not very attractive for recruiting senior staff. Additionally, they are often not part of or even usable in a career track for qualifying junior staff.

- To ensure a high quality in running Research Infrastructures these problems have to be taken seriously and have to be solved on a long term perspective. A high quality of the RIs could also benefit the satisfaction of industrial users which may lead to a larger number of industrial users.

Further Work Programme

- The second year of ERID-Watch should be used in two ways:
  - Broadening the data base and filling the data gaps as well as
  - Verifying characteristic key figures, important parameters and processes.
- As the project looks at the interfaces between RIs and industry a much stronger focus should be on RIs with industrial users – but, interview partner should be industrial users of RIs beside RIs themselves as well. These additional results will complete the findings of this intermediate report and will lead to definite conclusions and proposals regarding the issues covered by this project.
- The whole set of information will then be included in the final report which will be presented in October 2008 in Prague.

II. Table of Contents

III. Table of Figures

IV. Glossary

- **EIROForum:** A partnership of Europe's seven largest intergovernmental research organisations, which are:
  - *CERN - European Organization for Nuclear Research*
  - *EFDA - European Fusion Development Agreement*
  - *EMBL - European Molecular Biology Laboratory*
  - *ESA - European Space Agency*
  - *ESO - European Organisation for Astronomical Research in the Southern Hemisphere*
  - *ESRF - European Synchrotron Radiation Facility*
  - *ILL - Institute Laue Langevin*
- **ERA:** European Research Area
- **ERF:** European Association of National Research Facilities, of which the initating associates are :
  - *Societe Civile Synchrotron Soleil (FR),*
  - *Gesellschaft für Schwerionenforschung GSI (DE),*
  - *Elettra – Societa Sincrotrone Trieste (IT),*
  - *Deutsches Elektronen-Synchrotron DESY (DE),*
  - *MAX-Lab Lund University (SE),*
  - *Grand Accelerateur National d'Ions Lourds GANIL (FR),*
  - *Paul Scherrer Institut PSI (CH),*
  - *FOM-Institute for Plasma Physics Rijnhuizen (NL),*
  - *Max-Born-Institut MBI (DE),*
  - *Hahn-Meitner-Institut HMI (DE),*
  - *Science and Technology facilities Council STFC (UK)*
- **EU 15:** Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Nertherlands, Portugal, Spain, Sweden, UK.
- **EU 12:** Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia.
- **FTE:** Full Time Equivalent
- **IP:** Intellectual Property
- **PG:** Pilot Group
- **RI:** Research Infrastructure

V. Introduction

An overall number of about 750 Research Infrastructures (RIs) is assumed for Europe. By the first year of ERID-Watch 50 of these RIs from at least 14 countries of the European Research Area (ERA) were interviewed. So the report can not be seen as fully representative but this is on the other hand not the aim of the project. The aim is to show best practice experiences in several areas of RI which are important for the cooperation between RIs and industry – such as Technology Transfer (TT), Human Resources (HR), legal environment and general information. The interviewed RIs were very multifaceted in their scientific domains, their market (scientific users or industrial users) and ways of organising. This makes it not possible to compare the key figures and so, no clear benchmarking is possible. Even if the project is called "European Research Infrastructure Development Watch" not all information could be gathered on a RI level, as it was shown during the interviews that information as well as organisation of TT and HR are kept on an institutional level. Also, it should be kept in mind that RIs are seldom built to serve two markets with different demands: the market of industrial users as well as the market of scientific users.

V.1. Purpose

The main purpose of the ERID-Watch project is to assess the efficiency Research Infrastructures in Europe, their performance in terms of scientific exchange and public-private transfer and to contribute to an increase of public investment efficiency for European Research Infrastructures by benchmarking and the extraction of best practise examples. This approach includes the exchange of experiences and policies in existing Research Infrastructures. It was examined, to which extend Research Infrastructures are open not only for scientific but also for industrial communities, and herewith follow the basic necessity of the knowledge-based development of the modern European Society. Due to their unique opportunities, RIs play an important role in this process. European RIs were invited to take part in ERID-Watch by sharing its good and bad experiences. The study was conducted on a voluntary basis.

As an outcome of the ERID-Watch project, the results of the performed assessment will be formulated into recommendations and best practices and presented to a broad audience at the Final European conference in October 2008. The European RI landscape should profit from this unique exchange and presentation throughout all scientific fields and European countries by learning from each other.

V.2. Objectives

Work Package 1 of this study is devoted to identifying and benchmarking “Good Practices” within the daily work of a Research Infrastructure, for example in the areas of Technology Transfer, Human Resources and Legal Environment. To do so, a broad and deep insight into the RI landscape is needed. WP1 tried to develop this insight through extensive face to face interviews with RI representatives. During these interviews, several key pieces of information were gathered. As the European RI landscape is very diverse – ranging from seagoing and polar Research Platforms over Synchrotrons to large databases in different scientific domains - not all questions were applicable to all RIs. This explains why a benchmarking analysis with complete information about all infrastructures turned out not to be feasible. Nonetheless, this report tries to draw a thorough picture of a major part of the European Research Infrastructure landscape. Due to the time factor, about 50 RIs from 14 European countries could be interviewed; therefore, the report can not be seen as a fully representative study of all RIs in Europe. But as stated before, this is not the aim – the **objective of this project is to show best practices in several areas.**

V.3. Elements in Focus – Research Infrastructures

The report is focused on Research Infrastructures, not on the institutions which host the infrastructures.

The landscape of Research Infrastructures in Europe is diverse. Below, a list of some examples from our interviewed RIs can be found. The whole list of RIs is provided as an appendix to this study. Further interviews are planned up until the Midterm Review – a final list will be presented in October 2007.

Facility Type	Interviewed Ris	Scientific domain of RI
Fleets and Vessels	Polarstern, Pourquoi Pas	Environmental Sciences
Test Facilities	Large Wave Channel, Hyperbaric Tanks	Environmental Sciences
Research Station	Neumayer Station Antarctica	Environmental Sciences
Collections	Herbarium Kew Gardens, Musée Naturelle Histoire Paris, Natural History Museum London	Environmental Sciences
Plasma and Laser Facilities	JET, FORTH IESL, FOM Rijnhuizen	Material Sciences
Flow Loops	Sintef Petroleum Research	Environmental Sciences
Human Imaging Facilites	Cyclotron Liege	Biomedical and Life Sciences
Animal Imaging/ Testing Facilities	Copenhagen Animal Research Unit, Fleming Mouse Facility, HZI Mouse House	Biomedical and Life Sciences
Analysis Centres	Decode Genetics	Biomedical and Life Sciences
Databases	GBIF, ESS	Social Sciences/ Environmental Sciences
Clean Rooms	Danchip	Material Sciences
Synchrotrons	Hasylab, Elettra, ESFR, Soleil, Diamond, PSI, MaxLab	Material Sciences
Neutron Facilties	ILL	Physics
Free Electron Laser	FLASH	Material Sciences
Particle Accelerators	CERN, GANIL	Physics
Telescopes	ESO	Physics
Computation Centres	IN2P3	Computation and Data Treatment

V.4. Research Infrastructures and their market

As stated before, the main purpose of the ERID-Watch project is to assess and evaluate the efficiency and market impact of Research Infrastructures in Europe, their performance in terms of scientific exchange, public-private transfer as well as market demand and supply and, additionally, to contribute to an increase of public investment efficiency for European Research Infrastructures by the extraction of best practise examples. Before talking about “market” or the “market demand” or “market orientation” the terms have to be defined. Basically, Research infrastructures market of users is divided into two parts – the scientific market and the industrial market. It cannot be said that the RIS are not market orientated rather one could say that both markets seem to have different demands by now and most of the interviewed RIs core market is the scientific market. Their market orientation lies within the scientific community where the demands are for example the uniqueness of the RIs. By now, both markets could not be put together and be served at once with the same means. This may explain why it is relatively seldom that a RI has a half industrial and a half scientific users each – it is very much more likely that RIs mainly serve one of both markets.

VI. Methodology

For the sample of interviewed RIs the clear European dimension combined with the number of external users was relevant for choosing the RIs. Other criteria were the type, the country and the scientific domain the RI. All EIROFORUM as well as ERF members were interviewed.
The first year work was divided in three parts: 1) preliminary phase, 2) field work period and 3) analysis period. For the interviews during the field work two documents, a Pre-Questionnaire and an Interview Guideline/Questionnaire were used. As the study was conducted on a voluntary basis and also the information were given on a voluntary basis there was by now no possibility to crosscheck the data. That means, by now the numerical results of the study have to be taken as semi-quantitative indicators for the qualitative issues of this study and will be deepened in the 2nd year.

VI.1. Scope

The European Commission, DG Research, defines RIs as "facilities, resources or services that are needed by the research community to conduct research in any scientific or technological fields. This definition covers:

- Major equipment or groups of instruments used for research purposes;
- Permanently attached instruments, managed by the facility operator for the benefit of all users;
- Knowledge-based resources such as collections, archives, structured information or systems related to data management, used in scientific research;
- Enabling information and Communication Technology-based infrastructures such as Grid, computing, software and communications;
- Any other larger entity of unique nature that is used for scientific research.

RIs may cover the whole range of scientific and technological fields. They may be single-sited, distributed, or virtual. Examples include singular large-scale research installations, collections, special habitats, libraries, databases, biological archives (…)." [1]

As stated in the Deliverable D1 in the 2005 EU survey, conducted in the years 2004-2005, about 742 Research Infrastructures in different scientific fields in Europe were registered. The new survey, which will be published soon, assumes at least 598 validated research infrastructures in Europe. Nevertheless, **it is reasonable to assume a total number of at least 600 Research Infrastructures in Europe.**

[1] EU Survey 2007: 3

The categorisation of the examined Research Infrastructures in scientific domains was done according to the ESFRI-Roadmap. The Interviewees were asked to arrange their infrastructures according this codification – this was crosschecked with the categorisation of ESFRI-Roadmap and changed with agreement with the interviewees, if necessary.

As also presented in the introduction of this report, the study is focused on Research Infrastructures, not on the institutions which host the infrastructures. But, of course, some information is only available on an institutional level; for example, services such as licensing are generally done on the institutional level. The single chapters explain if and why the analysis is done on an infrastructural or institutional level. However, the term RI (or RIs) always refers to Research Infrastructures.

VI.2. Sample

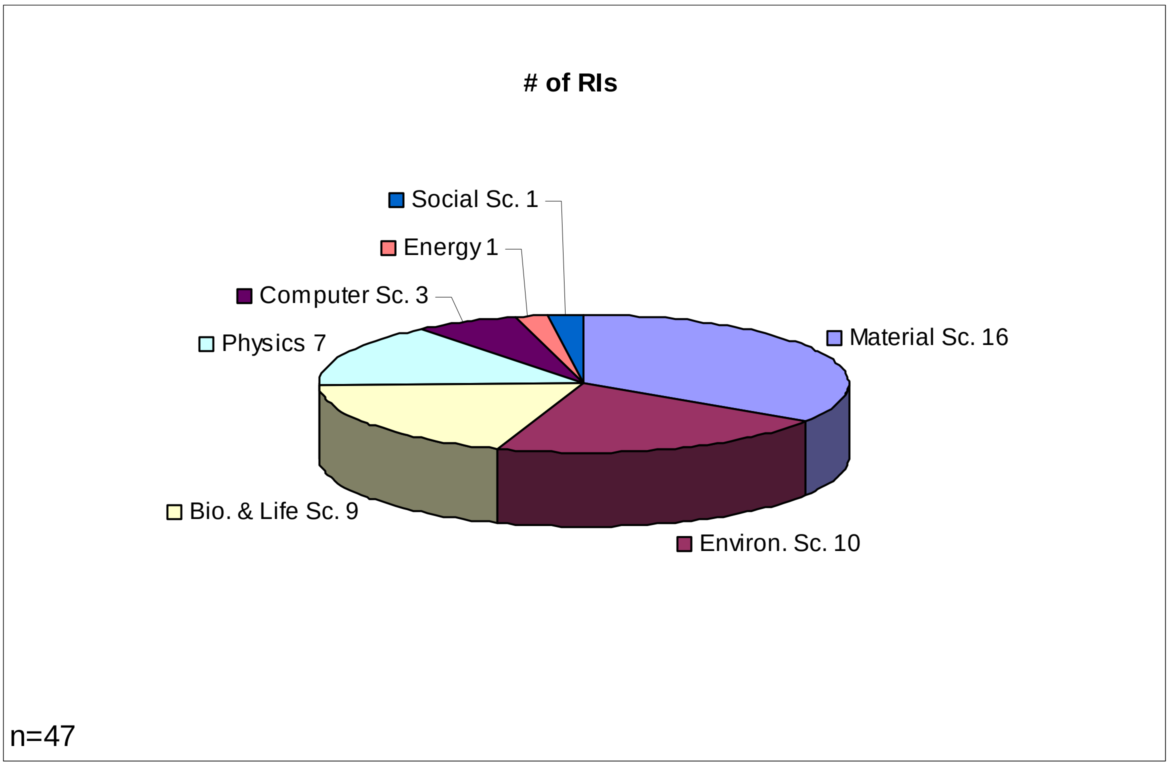
As the new 2007 EU Survey was not yet published at the start of this study, the EU survey of 2005 was the largest collection/evaluation of RIs in Europe available. Consequently, it was used as the starting point for this study. The ambitious scope and the limited timeframe of the study only allowed the evaluation of parts of the known European RI landscape. Two criteria were selected for the definition of the sample of RIs in this study:
1) The **clear European dimension** in the work of the RI; and
2) The **number of external users** compared to staff of the RI (more than an average of 20% external users).

Additional criteria for the study's sample were:
1) The **scientific domain** (according to the ESFRI roadmap). The domains should be represented roughly proportionally to their percent value in the ESFRI roadmap.
2) The **nationality –** Interviewed RIs should originate from all 35 states within the European Research Area (ERA) and should be represented in this study in a sense of proportion, if possible. In contrast to the EU survey, RIs operated by intergovernmental organisations were not classified under their host country but categorised as "EU".
3) The **type of RI** (single-sited, distributed or virtual). This study tried to consider the different types of RIs roughly proportionally to the respective percent values in the 2005 EU survey.

The criteria for the sample were discussed in several ERID-Watch bodies, and feedback was included. Two groups, the **EIROFORUM** members, who represent the large Research

Infrastructures with multinational shareholders, as well as the **ERF** members, who represent the large national RIs with international users, were defined as being essential for the sample. Furthermore, a target was set of interviewing all Research Infrastructures of the Expert Partners of ERID-Watch, if possible.

Scientific Domains of interviewed Research Infrastructures (Figure D2-1)



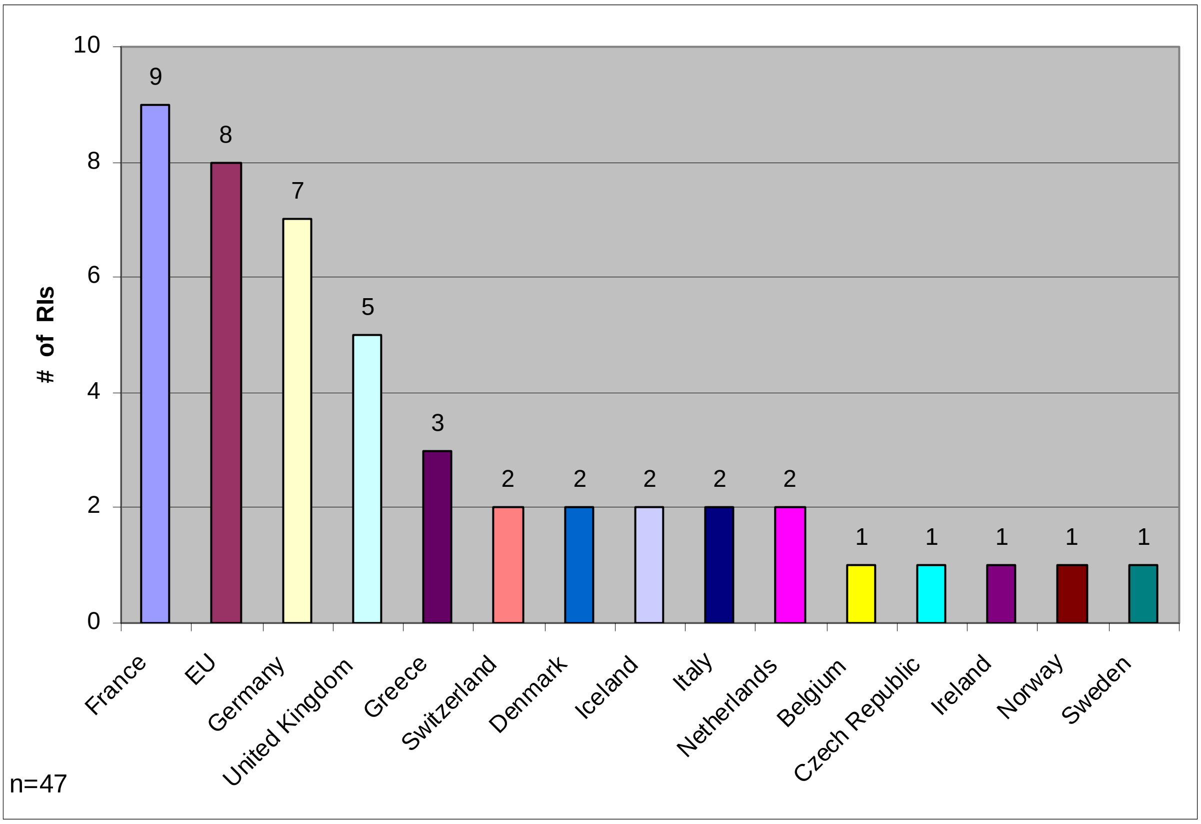
Material Sc	=	Material Science
Environ. Sc.	=	Environmental Science
Bio. & Life Sc.	=	Biological and Life Sciences
Physics	=	Astronomy, Astrophysics, Nuclear and Particle Physics
Computer Sc.	=	Computer Science
Energy	=	Energy
Social Sc.	=	Social Science

A sample was planned together with WP2 and the list given as an appendix to the D1 deliverable.

Already during the preliminary phase, it became evident that not all RIs listed in this manner were willing or able to participate in the study during the interview phase. Hence, the sample was updated with RI contacts from several origins. First, the members of all ERID-Watch bodies provided RIs and contact persons. Additional contacts arose from interviews WP2 conducted with governmental bodies of the member states. Direct contacts, e.g. at the ECRI conference, turned out to be a third way to encourage RIs to participate in the study. Especially towards the end of the interview phase, the aim of considering a wide range of countries and scientific domains in this study became the guideline for the choice of interviewed RIs.

Interviews were conducted with Research Infrastructures active in all scientific domains, of all different RI types, and originating from 14 European countries, including European Infrastructures with participation of several member states. All in all, by the 24th of August 2007, 33 institutions had been interviewed and information on 47 research infrastructures hosted by these institutions had been gathered. The study will be continued through to the end of September – allowing more institutions to be interviewed. The participation was made on a voluntary basis and even if a RI participated it was not obliged to answer all questions. That means that several questions have not been answered by all and not all parts of the analyses could be performed with a complete set of information. See annex D2-1 for details about the sample of the first phase of ERID-Watch WP1.

Countries of interviewed Research Infrastructures (Figure D2-2)



VI.3. Focus

Work package 1 - the Benchmarking activities and good practices selection - consists of an evaluation of the profile of the European Research Infrastructures. According to the Description of Work of the ERID-Watch project the following objectives were to be evaluated during analysis:

Best practices should be identified and benchmarked in the area of

- know-how and technology transfer (Classical TT, IP Management, Cooperation contracts)
- sub-contracted tasks to industry
- financial partnership (as, for example, public-private partnerships)
- human mobility and resources
- Legal environment in all areas described.

A Pre-Questionnaire as well as the face to face Interviews aimed to cover all different areas and to gather a sufficient set of basic information.

In November 2006, at a very early stage of the project during the Kick-off Meeting in Paris, the idea of common questionnaires for WP1 and WP2 came up. The main reasons for this idea were obvious: saving money for travel costs, reducing the contacts to the RI representatives to the required minimum for gathering all information, and a comprehensive understanding of the infrastructure versus only partial understanding of single areas of the RIs. Following this approach, common questionnaires were used and an ongoing exchange between the three interviewers of the two WPs ensured the quality of the interviews.

During this process, it became more and more obvious that parts of the Deliverables were better suited to the other Work Package. It was agreed that WP 2 would take over the Public-Private Partnerships section from the D2 deliverable, as this area is strongly connected with the financial data of the Research Infrastructures. In return, WP1 took on the task of reporting about human resources information and patents.

VI.4. Structure of Work

Work Package leader of WP1 is Dr. Karsten Wurr, head of the DESY Technology Transfer office. The basic work was carried out by Katharina Henjes-Kunst, the project scientist for ERID-Watch at DESY. The operational work was done in close collaboration with Gildas Buffed, project scientist at CEA-BEM and Peder Bylander, project scientist at Qi3 – both working for WP2. All interviews conducted by WP1 were done face to face with two interviewing documents – the Pre-Questionnaire and the Interview Guideline. Experience has shown that these kinds of interviews are more efficient when the questionnaire is completed prior to the interview where additional details could be clarified. Furthermore, the personal contact during the interviews contributed to the exchange about the project's basic messages with the RIs and encouraged the latter to become expert partners of and actively involved in ERID-Watch.

The Pilot Group of WP1 was involved in the definitions and the general processes. Two meetings of the WP 1 Pilot Group (PG) took place prior to August 2007 and a third meeting is planned for October 2007 at the project's Midterm Review meeting. The main issue of the first PG meeting on the 7th of February 2007 was dedicated to discuss the sample, the method, and the first ideas of the questionnaire. The Pilot Group members were involved in the pre-testing of the questionnaire documents, and these were reworked with input of the members provided via email. The complementing experiences of the different PG members turned out to be essential for the development of the documents. The second meeting took place on the 2nd of July 2007. It was concerned with the first results, the preparation of this report and a first discussions of scope of the second year study. Several additional contacts at RIs in countries or scientific domains which were underrepresented at that time were provided by the Pilot Group members. Unfortunately, the tight schedule did not allow addressing all of these contacts yet, but further meetings with these contacts are planned for the next months. A list of all Pilot Group members is provided in the appendix.

VI.5. Timeframe

The timeframe of WP 1 during the whole project is divided into three phases:

- Preliminary phase: Scope and Definition, summed up in D0 and D1
- 1st working phase: Broad Survey and Basic Conclusions, summed up in this D2
- 2nd working phase: Refining of data and Recommendations, summed up in D3

The **preliminary phase** lasted until the end of February 2007 (see D1 for description). It was basically concerned with defining the scope of this study, setting up the sample, and building the structures for the following phase. In the preliminary phase, the questions were developed.

The **1st working phase** will last until the end of September 2007 and could be divided again into three periods:

March- April 2007 – pre-testing period: The first two months of phase 1 were concerned with pre-testing of the questionnaires. From this phase, important input was transferred into further development of the interview documents. By the end of April 2007, two common final interview documents for both work packages had been established.

- **Pre-Questionnaire:** The Pre-Questionnaire mainly asks for figures (in the areas such as TT, HR, and Finances). The pre-tests showed that it is hard for the RI representatives to prepare figures offhand at the face to face interview without having any special information about figures needed beforehand. Therefore, the Pre-Questionnaire was developed to be sent prior to the face to face interview.
- **Questionnaire or Interview Guideline:** This document contains questions from both work packages referring to processes and activities and not to numbers or figures. Moreover, these questions may need some explanations, as not all contact people at the RIs drew the same understanding from the questions. Even the distinction we made between RIs and institutions was not clear to all. To ensure the quality of the answers, direct exchange was necessary.

April-September 2007 - **field work period**: During this period, more than 47 Research Infrastructures were interviewed using the Pre-Questionnaire and the Interview Guideline. Depending on the degree of preparation on both sides as well as the size of the infrastructures, these face to face interviews could last from 2 hours (small infrastructures with only 1 contact person) up to two days (big infrastructures with up to 8 contact persons from different departments).

July-September 2007 - analysis period: A WP1 Pilot Group meeting opened up this period where the main focuses of the D2 Deliverable and of the Data Analysis were discussed. This was followed by the crosschecking and complementing of the data with all involved interviewers and, in the end, the analyses. The analysis period included feedback on the report by several ERID-Watch bodies after which the report was reworked.

The **2nd working phase** will start after the Midterm Review in October 2007 with input from all ERID-Watch bodies and expert partners regarding the second year of this study. The general aim of this phase will be, as stated in D1, to broaden and to refine the available data. Furthermore, it is important to verify characteristic key figures and important parameters and processes and to identify additional ones. The 2nd working phase will be divided into several periods again: A preliminary period, a testing period, the field work, the analysis and in the end, the presentation of the final recommendations. Contrary to year one, the first two phases will be shorter, but therefore the field work and analysis periods will be longer, and there will not be as much overlapping with the other periods.

Chapter XI of this report includes more detailed information about the suggested planning for the 2nd working phase until the end of the project in October 2008.

VI.6. Reliability of the results

This report displays an analysis of all interviewed RIs. However, one must take the following into consideration:

- the number of RIs interviewed in the aforementioned thorough manner is low in comparison to the total number of existing RIs in Europe
- participation of RIs could not be achieved fully proportional across all countries and scientific domains studied
- not all questions in the documents could be answered by all Research Infrastructures with the same degree of detail
- there was no possibility to check the accuracy of numbers and information given

Therefore, the numerical results of this study cannot be seen as being fully-fledged representative figures. Rather, **they have to be taken as semi-quantitative indicators for the qualitative issues of this study.**

The study was conducted on a voluntary basis. There were a higher number of contacts and greater interest from the Research Infrastructures from the scientific domains of Particle Physics, Astronomy, Astrophysics as well as Material Sciences since most of the legal partners of this project originate from these domains. Moreover, two big groups which are partners of ERID-Watch, EIROFORM and ERF, are organising the above mentioned scientific groups. Other expert partners were involved from Environmental Sciences as well as from Biomedical and Life Sciences – the participation in these domains was good as well. The less represented domains, as seen in the Figure D2-1, are the domains of energy, social sciences and humanities, as well as computer sciences and data treatment. These experiences correspond with the results of the EU survey 2005 but are also coherent from the scientific domains of the legal partner of ERID-Watch. At the end, this means that the significance of the results is less meaningful for the underrepresented domains. Nevertheless, in the second year of the study, these domains should be included statistically representative with their experiences.

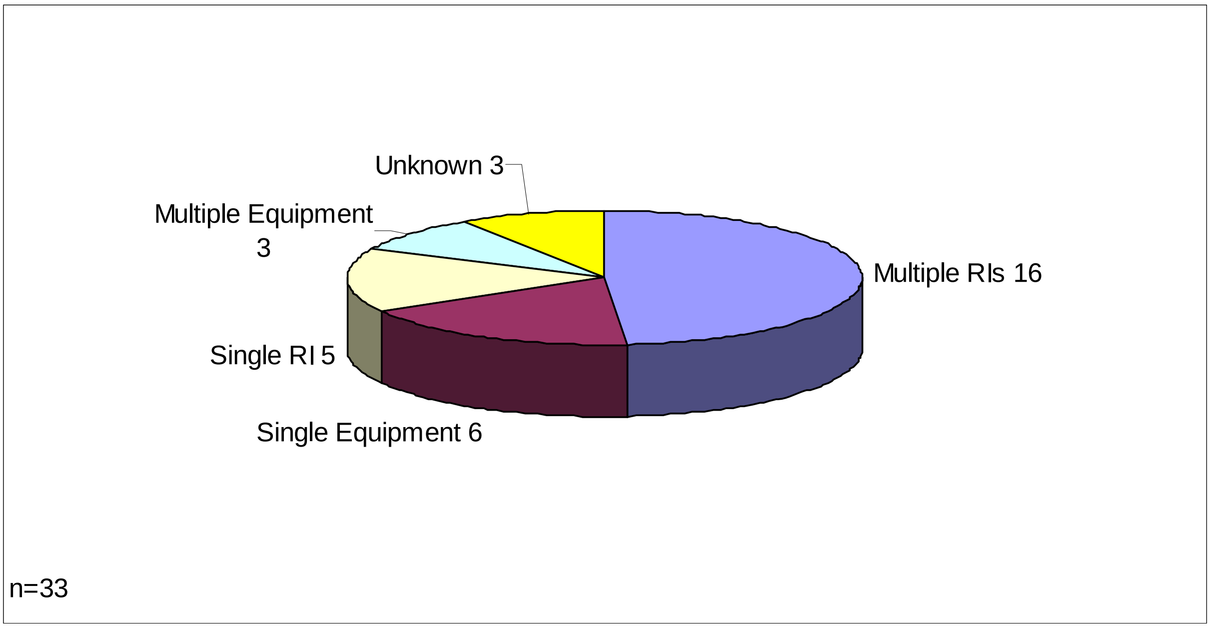
Most of the legal and expert partners are from old European member states (EU 15), which partly provides the explanation for the low participation in the study by the new European member countries. Moreover, as the 2007 EU survey shows (p. 8 ff), about 80% of the RIs that the survey designated as “EU” are located in the EU-15 countries, and here from, 50% are located in France, Germany, the United Kingdom, and Italy. This corresponds with the representation of these countries in ERID-Watch.

All these topics, from numerical results, scientific domains and less represented countries, which make the study less representative by now, will be intensively tackled during the second year of the study.

VII. RI general information

Four different types how RIs are organised were found during the interviews: More than the half of the examined RIs belong to a Research Institution which hosts several Research Infrastructures. The majority (70%) of the institutions which host the RIs are not integrated in any umbrella organisation, about 60% of the sample belongs to the group of Research institutions, agencies or universities attached departments under university law. A little bit more than the halves of the interviewed RI have beside scientific users also industrial users – even if the percentage of industrial usage is mostly very small. Furthermore, an amount of 40% of the RIs doesn't have industrial users at all. The number and the origin countries of visiting scientist of the RIs are seldom collected within the RI and seem not to say anything about the connection between RIs and industry.

Organisation types of interviewed Research institutions (Figure D2- 3)



Single RI	=	Main Research Institution hosting one Research Infrastructure
Multiple RIs	=	Main Research Institution hosting multiple Research Infrastructures
Single Equipment	=	Main Research Infrastructure hosting one major piece of equipment
Multiple Equipment	=	Main Research Infrastructure hosting several pieces of equipment

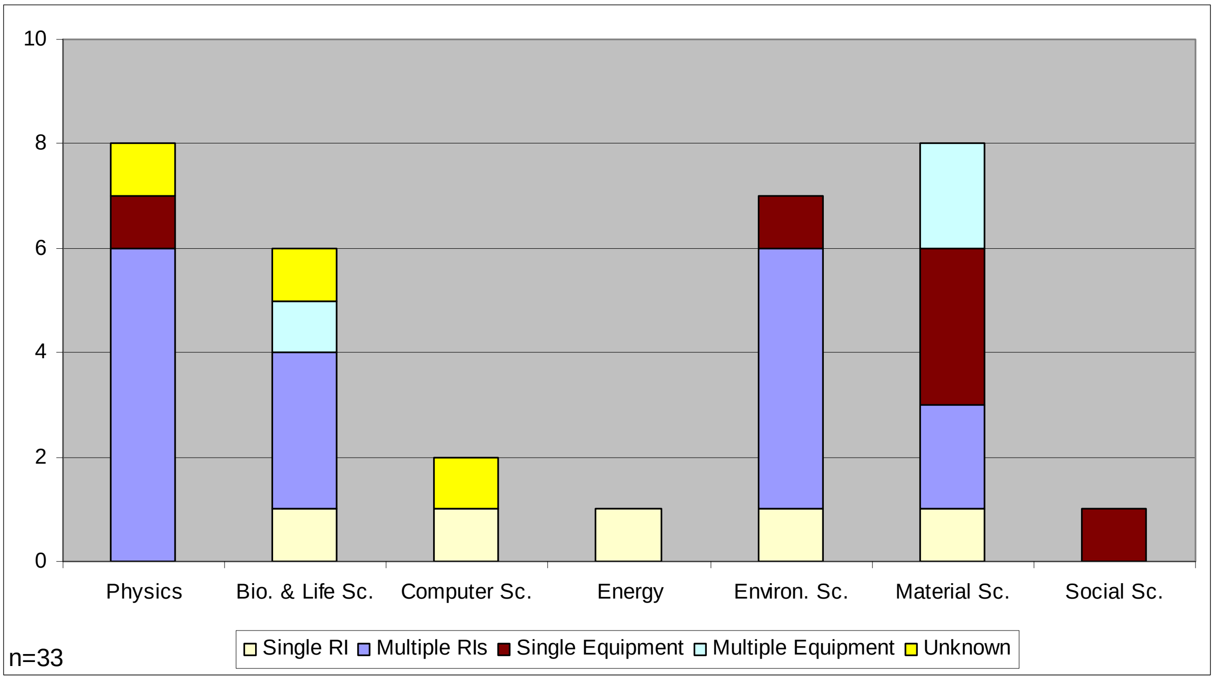
VII.1. Organisation of Research Infrastructures

During the ERID-Watch 1st phase, different organisational types of Research Infrastructures were analysed. As explained in the methodology, Research Infrastructures are to be distinguished from Research Institutions. During the field work several types of relations between these two were found.

- **1) Main Research Institution hosting one Research Infrastructure: 4 out of 33 institutions** interviewed are of this kind. An example therefore is the "L'Institut national de physique nucléaire et de physique des particules" (IN2P3) in France, which hosts the computation centre. In this case the research institution does not only exist because of the RI, the RI is just one part of its research facilities.
- **2) Main Research Institution hosting several Research Infrastructures: More than half** of the examined institutions are of this type. However, the number of infrastructures which are hosted by the institution vary significantly – from two to more than ten infrastructures. Among these sixteen Main Research Institutions which host several Research Infrastructures were six institutions which host 2 infrastructures, two institutions which host 2-5 infrastructures, three institutions which host more than 5 infrastructures and five which host or participate in more than 10 infrastructures. Examples of the latter are: DESY, CERN, ESA, AWI. This type of organisation seems to be typically for the scientific domains of PHYSICS and Environmental Sciences.
- **3) Main Research Infrastructure hosting one major piece of equipment: This type of organisation was found in 6 institutions**, for example at Soleil. The Soleil Synchrotron for example is one big piece of equipment which constitutes the RI. French RIs made up the majority of this organisational type.
- **4) Main Research Infrastructure hosting several major pieces of equipment: These made up the smallest group of interviewed RIs – only 3 of this type were found,** among them the Copenhagen Animal Research Unit. As the number of RIs in this category is so small, no further statement is possible about the spread of countries or scientific domains.

Three of the interviewed institutions could not be categorised in that way, as not enough information were available to ensure a solid categorisation.

Organisation of Research institutions within the scientific domains (Figure D2-4)



Material Sc	=	Material Science
Environ. Sc.	=	Environmental Science
Bio. & Life Sc.	=	Biological and Life Sciences
Physics	=	Astronomy, Astrophysics, Nuclear and Particle Physics
Computer Sc.	=	Computer Science
Energy	=	Energy
Social Sc.	=	Social Science

VII.2 Umbrella organisation

Umbrella organisations mostly exist on an institutional level. This means that the institution, not the infrastructure, is part of the umbrella organisation. From the 33 interviewed institutions, the large majority of them, 24 (72.7%), are not integrated within any umbrella organisation. 7 of them (21.3%) are university departments or institutions, but in these cases, the universities are not seen as umbrella organisations. 7 institutions are integrated within an umbrella organisation, for example the Helmholtz Association, CNRS, or FOM. Whether an institution is integrated within an umbrella organisation seems to be independent of the type or the scientific domain of the institution. 6 of the 7 institutions which are integrated within an umbrella organisation were found in France or Germany.

VII.3 Age of the Infrastructures

The age of the interviewed Research Infrastructures varies significantly. Some of the interviewed infrastructures were founded as early as 1750 – the collections in the interviewed museums or botanical gardens. This explains the high number of Research Infrastructures founded before 1950 in the domains of Environmental Sciences or in the Biomedical and Life Sciences.

A high number of RIs in the environmental sciences (e.g. research vessels) were built in the 1980s, while in the last ten years, the number of Research Infrastructures in the Material Sciences and Biomedical and Life Sciences increased: twelve of the interviewed Research Infrastructures were built in the last ten years; 41.6% of these were Material Sciences RIs and 25% Biomedical and Life Sciences RIs. The number of total established RIs increased every examined period. Three of the interviewed RIs could not be used for this analysis.

VII.4 Legal Status of the interviewed institutions

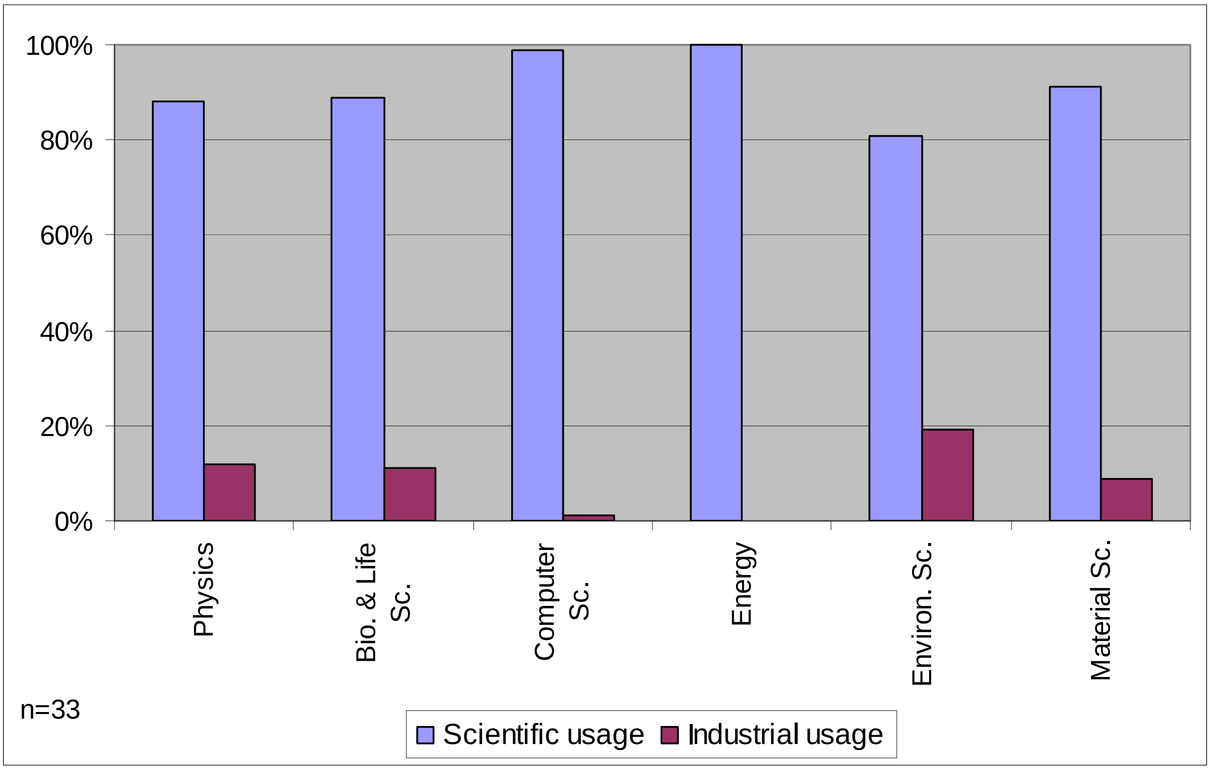
The legal status of the different infrastructures interviewed was the same as the legal status of their institutions. Formally, the legal status belongs to the institution, not to the infrastructure. The differentiation between the four different categories was made on an institutional level:

- **Private Companies:** 2 of the examined institutions (6.25%) are private companies. No correlation to country or scientific domain is identifiable. Both private companies are single-sited.
- **Public entities under private law:** These institutions are found mainly in France. 6 of the institutions (18.75%) have private law status.
- **Research institutes, agencies or university attached departments under public law:** Nearly two-thirds (62.50%) of the institutions could be grouped in this category. No correlation with countries or scientific domains could be found.
- **Intergovernmental organisations:** 4 of the interviewed institutions (12.50%) have the legal status of an intergovernmental organisation – these are the big European Institutions, like for example ESA and CERN.

One institution is only planned and not yet founded and is therefore not considered in this analysis.

VII.5 Users of the interviewed institutions

Users of the interviewed Research Infrastructures (Figure D2-5)



After asked for the target group of their users, more than 50% of the interviewed Research Infrastructures answered that they have internal, external and industrial users, even if most of them added that the percentage of industrial usage is very small. Indeed, 27 Research Infrastructures, which make up more than 50% of the RIs interviewed, are used to about 16% by industrial clients. This seems high but derives from the fact that four infrastructures have a relatively high usage by industry – 90%, 60% and twice 30% (from Material Sciences, PHYSICS, Environmental Sciences and Biomedical Sciences). If they are not taken into account, the average percentage of industrial usage lies at 7.08% for each RI.

About 40% percent of the RIs have no industrial users at all. In the scientific domains where fewer than 3 RIs were interviewed, only scientific users were found or, in the case of the social sciences and humanities no information was available; however, this may be related to the small sample of these domains. In the area of Biomedical and Life Sciences, the number of RIs without industrial usage is relatively high compared to the average. In this domain, the sample was rich with basic research institutions and museums which have a lower industrial usage. The flipside of this phenomenon could be found in the domain of

Material Sciences – of fourteen existing RIs, only one does not have industrial users. Not all Research Infrastructures could make differentiations between external and internal scientific users, but in the area of Material Sciences for example, the internal scientific usage lies at 30% while the external scientific usage is about 70%.
4 RIs gave no information about their users as they were newly built or not yet in use.

The visiting scientists are hard to compare – only 24 Infrastructures gave information about the number of their visiting scientists, and even some of the numbers were only roughly estimated by the interviewees. Other RIs did not count them at all or the information was not available. The spectrum of answers spans from 5 a year to 1500 visiting scientists – the average is 442 visiting scientists/year. Information about the average stay of the scientists at their institutions was even more difficult to retrieve. The average stay varies from 1 day to 210 days. The median was 44.5 days. The information differs within the scientific domains in a similar way.

Similarly, information about the countries from which these users come was also relatively unavailable. In conclusion, it could be said that the majority of the RIs have European or international guest scientists. About two-thirds of the RIs which could answer this question had users from non-European countries; in particular, the United States, Canada, Japan, Russia, as well as African countries were mentioned. **The origin of the users does not appear to depend on the size or average number of users of the infrastructures, nor on the scientific domain.** Some of the interviewed RIs mentioned that they are now beginning to collect more data about visiting scientists.

VII. Preliminary conclusions

Commonly shared and agreed definitions seem to constitute a major problem in the evaluation of different types of RIs .This problem is not so relevant in the case of stand-alone surveys. But it becomes very important for guaranteeing consistency in the comparison and integration of results from different studies in this field. The future work dedicated to evaluation of RIs has to keep an eye on uniform definitions for all reviewed aspects, like types pf RIs and users, fields of activities and key figures. The complex task of examining those highly diversified objects of investigation must not additionally be confused by obscure definitions. Further work should thus strictly follow the predefined terms from e.g. the ESFRI roadmap and the 2007 EU survey.

Concerning the origin of users, **it has to be stated that across all European RIs the data base is very diverse with large informational gaps**. Thus, a basic conclusion from this part of the study is the **recommendation for a simple but comprehensive scheme to register the users in all European RIs**. It should cover the categories internal user, external scientific user and external industrial user and the origin from at least the member state, European Union and other countries.

VIII. Know-how and Technology Transfer

20 of 33 interviewed Research Institutions which host one or several RIs have the possibility of using a TT-office/ department or company. Further 9 institutions don't have this possibility. In general, the policy regarding Intellectual property (IP) varies between institutions and countries and is mostly directly connected to the financial situation of the TT-part which makes the situation of doing a benchmarking with the help of the key figures hard. Numbers of, for example, total patents held by the end of 2006 are high in Germany as well as in the big RIs: the Intergovernmental Organisation like CERN, ESO…Within the answers about licences it shows that number of staff in the single TT-offices is too small to take care of extensive licensing. Doing patenting or licensing seems not to be imperatively linked with the industrial usage of the infrastructures or the type of R&D with the RIs. Furthermore, a central issue as regards TT policy is the duality between IP protection and the more traditional open science approach.

The area of Know-how and Technology Transfer is discussed here on an institutional level because no institution was found during the interviews where the issue of Technology Transfer (TT) was handled at the RI level.

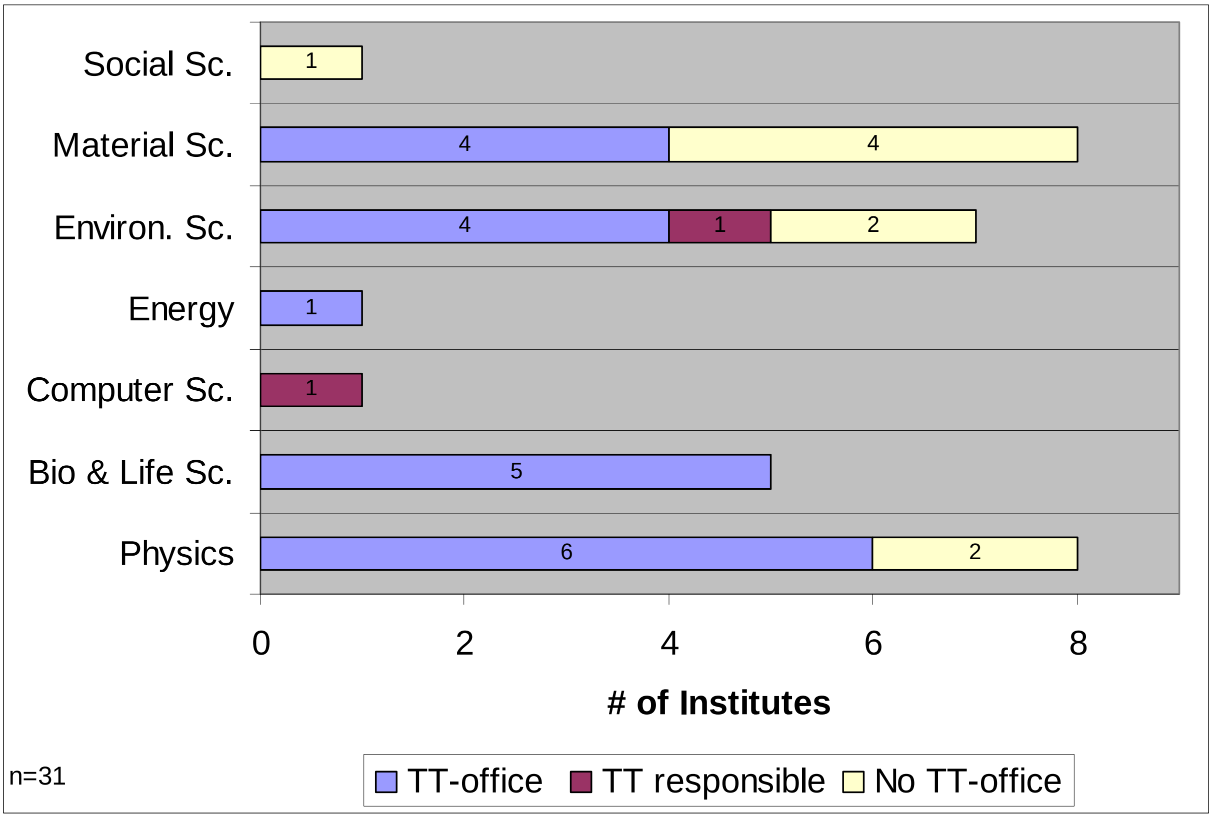
Three different kinds of TT-organisation were found in the interviewed institutions:
a) TT-office,
b) TT-responsible person,
c) No TT-Office or person.

- **Of 33 interviewed institutions, 20 have the possibility of using a technology transfer department or office**. The Technology Transfer Offices are mainly attached *as a department or directly* to the director's office (in about 60% of the 20 interviewed institutions). 4 interviewed institutions have their own companies (which are counted as TT-offices), which they sometimes share with other institutions that handle TT; 3 of these institutions are Biomedical and Life Sciences institutions and one is from the Environmental Sciences domain. In 3 cases, university-attached institutions could use TT offices of the university. However, having the opportunity to make use of a TT office does not automatically mean that it will be used: 3 interviewees said that they were not really using them – either the university-attached TT offices or the companies.
- 2 institutions mentioned that they have a person who is responsible for TT.

- Further two institutions gave no information.
- 9 institutions did not have a TT office or even a person responsible for TT concerns.

But it should be taken into account that not for all scientific domains and organisation forms of RIs the classical TT offices with the tasks of patenting/licensing, R&D cooperation, spinouts and services make sense – as for example in the social sciences naturally not so many technological inventions are made which could be developed into patents.

Organisation of TT in the different scientific domains (Figure D2-6)

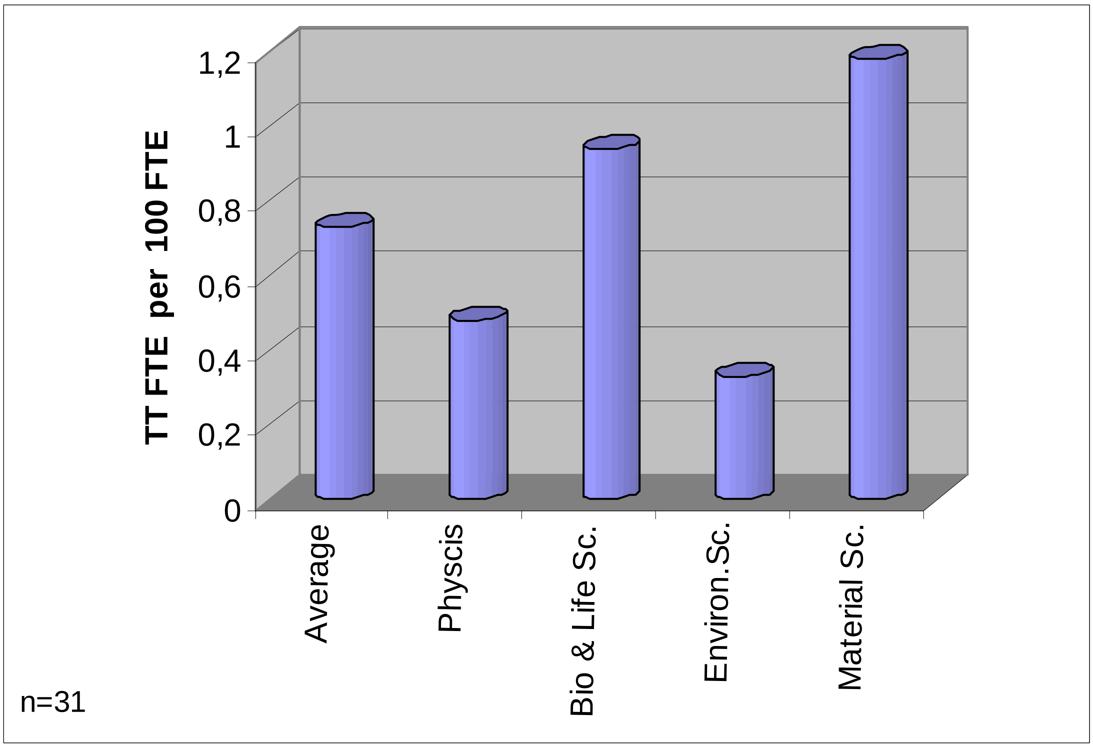


Material Sc	=	Material Science
Environ. Sc.	=	Environmental Science
Bio. & Life Sc.	=	Biological and Life Sciences
Physics	=	Astronomy, Astrophysics, Nuclear and Particle Physics
Computer Sc.	=	Computer Science
Energy	=	Energy
Social Sc.	=	Social Science

The number of staff (FTE) per TT-office differs quite a bit between the different scientific domains. The smallest TT offices have only one staff member, while larger ones have up to thirteen persons working for TT. The fact that TT is given different priority at different institutes is demonstrated by two centres in the same scientific domain and doing very similar research: the first has one TT staff member and the second has thirteen persons working for TT. Even if one of these centres had twice as many staff members as the other one, there would still be a ratio of 6.5 FTE to 1 FTE.

In total the number of TT-staff is highest in the domain of Astronomy, Astrophysics, Nuclear & Particle Physics. It derives from the fact that among this interviewed domain are some of the biggest institutions (CERN, ESA …). In the chart the number of staff members compared to the size of the institutions (per 100 staff member of the institution) is shown: The domain of Material Sciences has the largest number of TT-staff per 100 institutional personnel, the domain of Biomedical and Life Sciences have also a comparable high number of TT-staff.

Average Number of TT-staff members per 100 FTE (Figure D2-7)



Technology Transfer offices perform very diverse tasks within the RIs: Patenting and Licensing, (R&D) Cooperation's, Spin-outs as well as other services. The diversity of tasks shows that even two with personnel well equipped TT-offices could not be compared only with key figures as different main focuses within the work may exist.

Technology Transfer at the interviewed institutions includes mainly two major issues: patenting/licensing and industrial cooperation. Spin outs are only done in very few cases. The importance of these issues may explain why 9 of the 33 institutions do not have a TT office or a similar department. For some of the institutions, industrial usage is not important, as they are doing very basic research or do not have the opportunities to give industrial users time to use their RIs. On the other hand, **the policy regarding intellectual property varies from institution to institution as well as from country to country** – for example, while the strategy of protecting and licensing IP is widespread in German and in French interviewed institutions, in many institutions throughout the rest of Europe, open source usage policy is followed.

The main funding source of TT-office seems to be the general budget of the institution. Less than 10 Research institutions obtain parts of their incomes. Royalties, contract research, selling access to the infrastructure and special national programmes are mentioned as source for income. Mostly the share of their income from other sources than the general budget accounts for less than 15% of the TT budget. Only in two known cases, in institutions of the domains of Physics and Material Sciences in France, the TT-office is being run with 50% of external income.

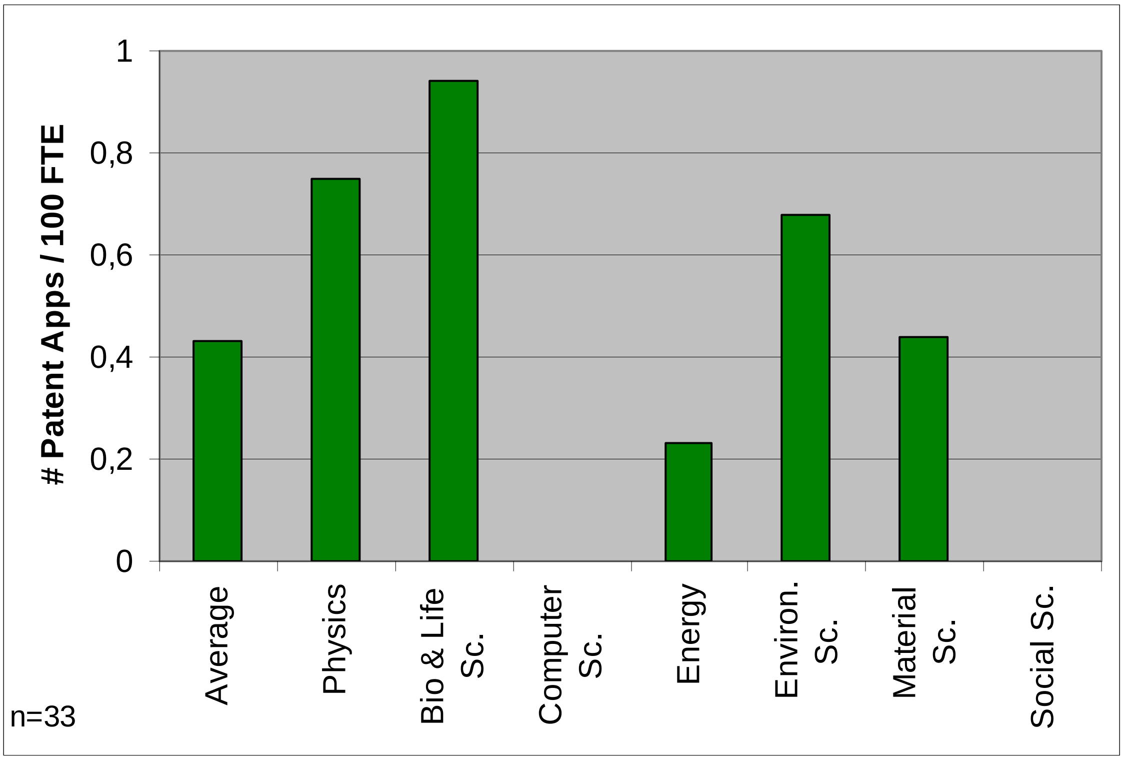
VIII.1. Number of patent applications

Various key figures in the area of Technology Transfer exist, but they are hard to compare. As discussed before, different policies are predominant in different countries and institutions. Furthermore, various scientific domains have different potentials with regard to, for example, the number of patent applications. Furthermore, the finances of an institution may contribute to this number – several institutions mentioned during the interviews that high costs for patenting (especially during the international phase) make them give up their patents after a few years or even stop them from patenting altogether. For these reasons, the key figures in the area of Technology Transfer are hard to compare.

The number of patent applications is a basic number in the area of TT, but as stated before, the number is dependent on the specific patent policy, the scientific domain, and the budget of the institution and should be used carefully. In total, the number of patent applications is high in the domain of Astronomy, Astrophysics, Nuclear & Particle Physics. Again, the reason for this lies in the fact that the interviewed institutions are comparable large. The chart shows that in comparison per 100 staff members of the institution Biomedical and Life Science Institution have a higher number of patent applications. Environmental Sciences, and Astronomy, Astrophysics, Nuclear & Particle Physics as well as Material Sciences are higher then the average numbers of patent applications since the domains less represented in the sample

(Energy, CDT and Social Sciences and Humanities) have a very small number of patent applications.

Patent applications in average/year per 100FTE employee (Figure D2-8)

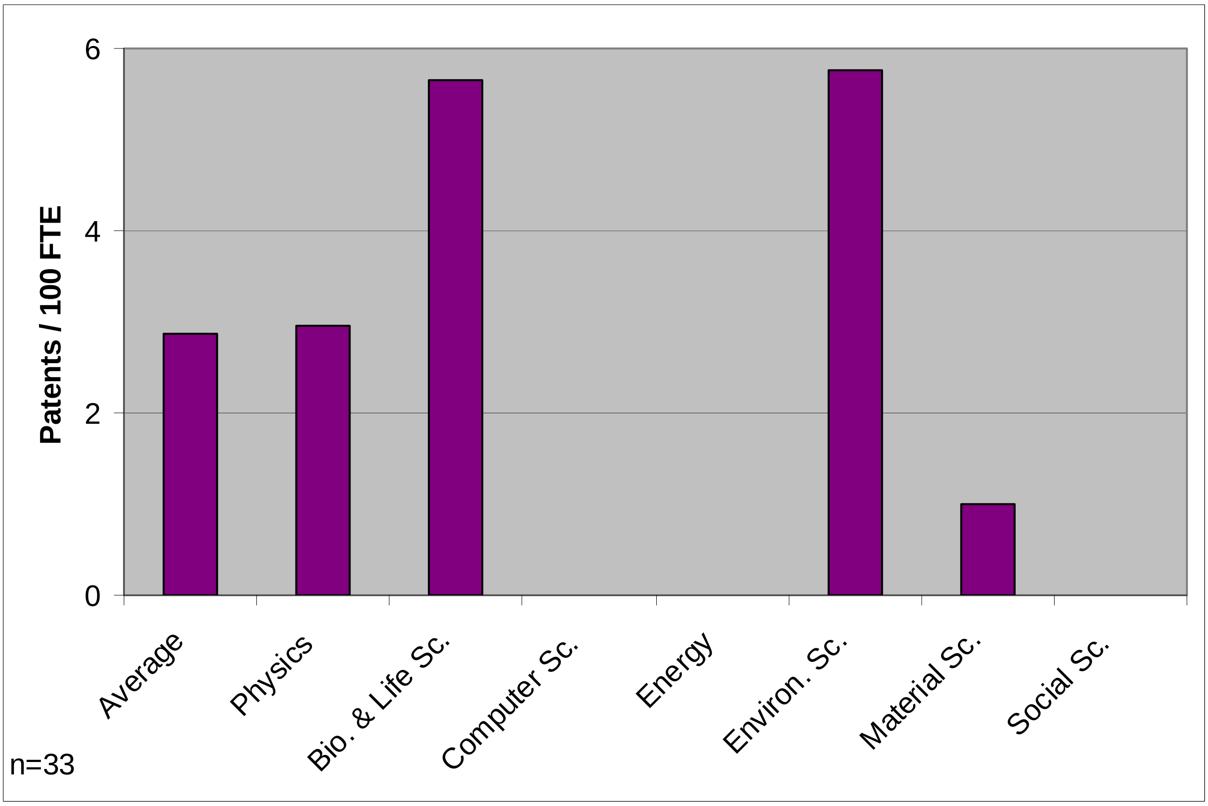


The number of patent applications in the domain of Astronomy, Astrophysics, Nuclear & Particle Physics looks very high compared to other scientific domains. But this chart refers to only two-thirds of the interviewed institutions, as the other ones did not have information available for this. In the Physics domain, two institutions (both intergovernmental organisations) had very large numbers of patent applications per year, while the other institutions in this domain had very few or none at all. This is typical for all scientific domains: most of the institutions have no patent applications or up to one or two per year, and a small number of institutions have large numbers of applications. For example in Material Sciences of four institutions we have ensured data the spreading varies between 0 patents per 100 employees of the institution over 0.05 and 0.20 to 1.50. This could be seen in all scientific domains where more than three institutions were interviewed. But while looking at the aforementioned numbers, it should be kept in mind that some of the infrastructures/institutions are relatively new or virtual databases – in either case, patent applications are not that likely. Furthermore, it should be taken to account that the European patent law does not allow the patenting of software itself– which might be relevant for RIs, especially from the domain of Computation and Data Treatment.

A clear linkage between country and the number of patent applications is visible: out of the countries where several institutions were interviewed and had such information available, Germany has the highest patenting activity, with an average of 6.83 patent applications annually per institution. France and the UK have on average less than one patent application annually per institution. Slightly higher numbers of patent applications are only reached by the European Research Organisations such as CERN and ESA. However, in many countries, only one or two institutions were interviewed, and therefore these results are not comparable.

VIII.2. Total number of patents

Number of patents per 100 FTE by the end of 2006 (Figure D2-9)

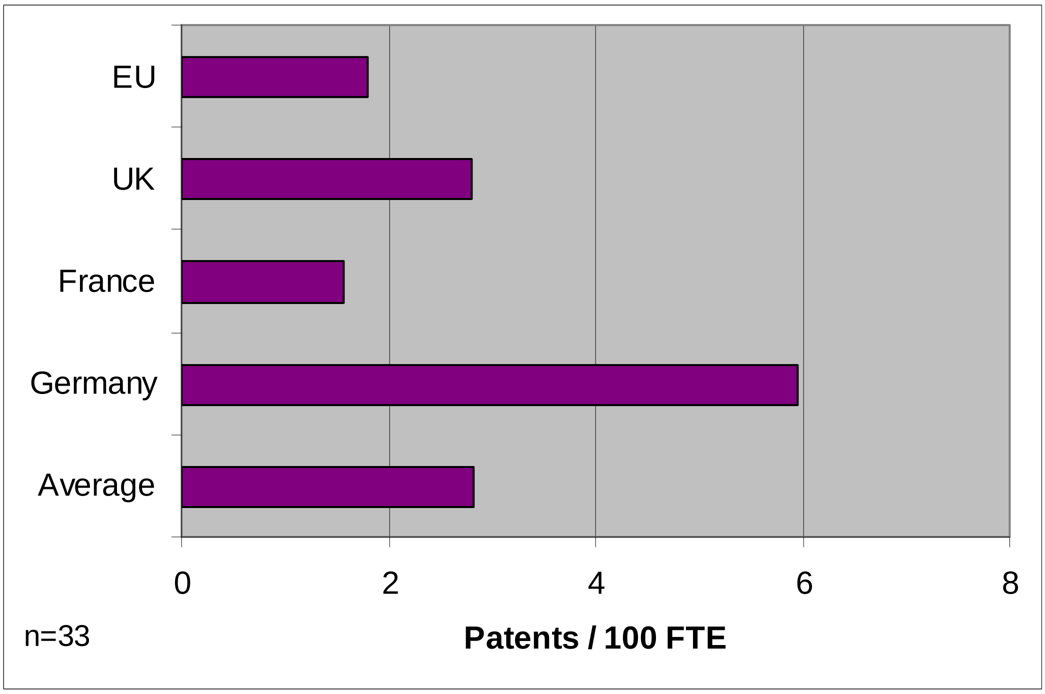


The number of total patents held by the end of 2006 is also difficult to compare. As said before, due to financial reasons, several institutions do not keep their patents very long. Others give or sell the complete patent to industry. The number of total patents in the Physics domain is very high because of the two intergovernmental organisations with large numbers of patents which are represented there. The chart shows that the total number of patents held in Physics is only slightly higher then the average number while the numbers in Biomedical and

Life Sciences as well as Environmental Sciences is higher. Again, the average is quite small because the less represented scientific domains had no total patents held.

Similar to the number of patent applications per year the number of total patents held is quite high in Germany compared to other countries where more than two institutions gave answers. Again, only the European Intergovernmental Organisations have higher numbers. Compared to the size of the institution the number for European RIs is smaller then the number of total patent applications in the UK or Germany.

Patents held by the end of 2006 by country (Figure D2-10)

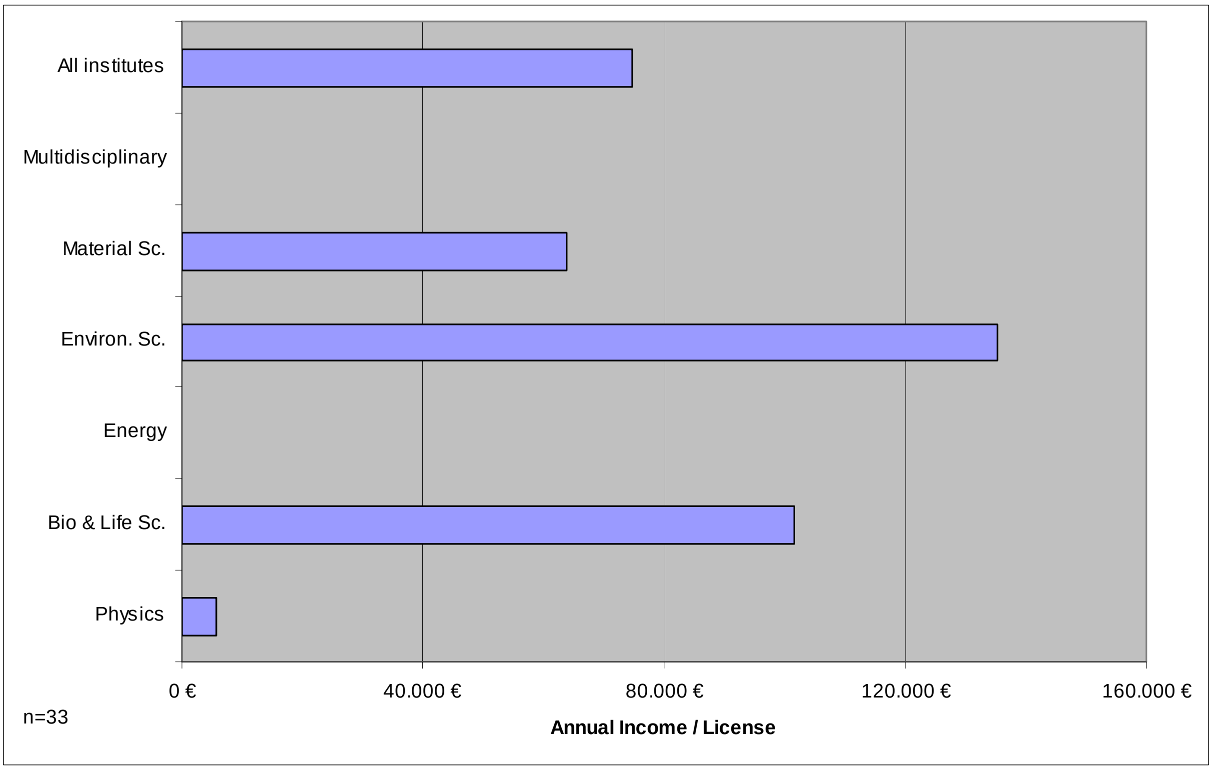


VIII.3. Number of licences and license income

Licensing is an even more difficult topic within the daily work of the institutions. On the one hand the number of licenses depends on the patenting/licensing strategy of the institution; on the other hand some of the interviewed institutions said that the **number of staff in the TT-office is too small to take care of extensive licensing**. Without patent protection no license contracts can be used. A few institutions support the idea of open sources which includes the free usage of their developments by others. From their experiences their developments are mostly used in other scientific institutions and if industry uses them it is seen as honour. 11

institutions made no statement about this topic, whereas 22 institutions gave information but for example also that they had not given any license**. At average 27 licenses were made in the last three years in the 22 institutions which made statements** about their activity in this area – that means a little bit more than one licence for each institution and a sum of **74.778 € in average for each licence**. In the figure below it can be seen that especially in the area of Biomedical and Life Sciences the number of licensing contracts as well as the annual income of licensing is high. As stated before, three of the Biomedical and Life Sciences Institutions have companies doing TT for them. If only the sum of payment for each licence is regarded (figure D2-15) the payments in the area of Environmental Sciences are the highest.

Average annual income per licence (Figure D2-11)



III.4. Number of spin-offs

Spin-offs could be found in all domains with the exception of CDT and Energy which could be explained by the small sample in these domains. 8 out of 33 gave no information about this topic, another 8 institutions have no spin-offs until now and 17 had some. **The number of spin-offs per institution normally is below ten spin-offs**. **Only three institutions have more than ten, one institution even mentions more than 65 spin-offs.**

VIII.5. Encountered difficulties and problems: general comments

A problem often mentioned in this chapter is the difficulty to compare all research infrastructures based on simple key figures. There are several fundamental reasons which lead to a totally different situation in different RIs:

- The character of research carried out in the RI could be of the more basic or applied type. The former impedes, while the latter facilitates the success of a commercial TT-approach.
- The scientific domain of an RI defines the potentially addressed industry branch(es) which each have their own preferences in the patent and licensing business and special attitudes towards joint or even external inventions. These effects are increased by national differences of the European industry.
- The type of RI is pretty much defining the results of its TT: Virtual RIs are in a very different situation than distributed or single-sited RIs. Those with a large share of external users, who keep their own intellectual property and do their own TT, cannot be as successful in TT as RIs with a large share of internal users.
- The TT policy of an RI forms an important switch for all TT operations. Sometimes this policy is a sole institutional decision, in other cases it is given by the member states. In either case the national framework for TT, e.g. tax and funding rules, special TT funds or PPP initiatives, heavily affects the final TT results.

Doing patenting or licensing seems not to be imperatively linked with the industrial usage of the infrastructures or the type of R&D within the RIs.

A central issue as regards TT policy is the duality between IP protection and the traditional open science approach of public research. Institutions, funding agencies and governments have to be properly aware of the different advantages and drawbacks of these two basic models. Whilst, e.g., industrial partners of an institution with an open science strategy may be glad that they don´t have to pay for transferring these ideas, they will on the other hand not have any protection for these ideas. Thus, me-too-products are likely to show up on the market, soon.

Having only a badly resourced TT-office or even none at all doesn´t necessarily mean that the reason for this circumstance is a strategic decision. During the interviews it was sometimes mentioned that the budget situation is the main reason that for example patents are given up one or two years after the application as soon as cost increases. During these one or two years the chance of finding a company which is interested in a license is very small for these normally premature technologies and the patenting cost.

Only very few institutions invest enough time, money and personnel to be able to really go proactively into the markets for a transfer of patent applications to industrial licensees. Mostly the TT process consists of the steps of securing the IP, waiting for interestees and finally giving a licence away, if a representative of a company or another institute asks for it. Only few institutions are actively seeking for licensees via direct business contacts or the presentation of examples of their commercially available results on their website. Business development seems to be a foreign word to the bulk of RIs.

Another overall problem is determined by the **extreme discrepancies in the TT approach** not only among different scientific fields but as well within the same field. Firstly, this lack of common standards leads to a wasting of resources as partners meeting for the first time or on a new issue always have to "reinvent the wheel" to define their contractual relation. Secondly, this circumstance makes it totally confusing for newcomers in the public TT business, like e.g. from the EU12, to define and organise their own TT approach. **A set of commonly used standards could simplify the process.**

Last but not least, a more successful TT, whose potential is indicated by patent applications and whose success is proven by license income and contracts and it licenses or co-operations with industry, still **requires the commitment of the researchers**. Some institutions started measures towards this change already years ago and tried to integrate the researcher in the TT process. But only a few institutions until now have established rules about the handling of rights and compensations for patents and licenses in favour of the researcher.

VIII.6. Preliminary conclusions

In the light of the aforementioned problems, **it is quite hard to find appropriate key figures to compare all different RIs**. For a second year study the concentration should lay on a few key figures which are clearly understandable. Moreover these key figures should base on reliable data which are easily gathered. For this reason the following ones are proposed to be used in the Web-Questionnaire:

- Number of **patent applications/year** for the last three years at average: the disadvantages of this number were already discussed above. However, this key figure is internationally used, easy to gather and at least provides an idea about the innovation arising from an RI.

- The number of **total patents held by the end of 2006**: As stated before this number depends on the financial possibilities of the institutions and also is hard to compare between all scientific domains. This figure is also internationally used and easily gathered. It may indicate the relevance of patents for the RI and its specific market.
- Number of **given licences** by the end of 2006 as well as the numbers of licences given the last three years in average: As both key figures above information about licences are easily gathered and internationally comparable.
- **Licence income annually** for the last three years at average**:** This is another internationally used key figure. To have information about the meaning of the number of given licences a sum should be made of the annual licence income and the number of licences annual – this sum should be used for comparison.
- **Number of Spin-offs** of the last ten years which were still active three years after establishing: Also an internationally used key figure. But during the interviews the definition of Spin-offs was very different. It could be difficult to get the number of spin-offs which were still active three years after establishing but only the number of established spin-offs may lead to wrong results as many of them are closed after a short while. Still, spin-offs are key know-how transporters, so this number should use.
- **Number and volume of Industrial cooperations:** This number is easily gathered but the difference compared to licence contracts as well as contract research has to be pointed out. On the other hand it is a clear indicator for industrial contact of the institution.

All of these suggested key-figures should be gathered on an institutional level. In first year of the study it was clearly shown that most of the data are not available on a RI level. If they were given it was mostly no reliable answers. In the case study more emphasis should be made on TT beside key figures.

A further task for the second year of **ERID-Watch will consist of a precise definition of the state of the art for Technology Transfer in different scientific fields.** This includes especially

- the existence of a **TT strategy** for each RI and/or its hosting institution
- the definition and use of **IP and TT standards**

- the **funding and manning** TT units
- the respective **national frameworks** regarding legal, organisational and tax regulations as well as funding schemes dedicated to TT aspects
- the use and role of **TT networks**

The final aim for a TT policy will be a cultural change which allows for the entry of a breath of entrepreneurial spirit into the academically dominated RI community and which guarantees that the current mere administration of innovations and patents is shifted towards a pro-active licensing and business development. This case could very well be aided by the inclusion of relevant key figures and verbal descriptions of innovative effects into applications and reports for the funding of scientific projects and institutions. This does not mean to change all research to short-termed applied tasks, but to guarantee that inventions and corresponding innovations are not ignored and have the chance to be transferred to the market in any type of research – be it of applied or a more basic type.

IX. Human Resources

No special program of exchange of staff between RIs and industrial partners/ companies was found during ERID-Watch Interviews. But about two third of the interviewed RIs are offering training for the staff – among this training is also soft skills training. The HR part of the interviews was the most discussed part as many problems for the RIs are in direct connection with HR – for example, finding appropriate staff for running the RIs. Problems mentioned were low salaries compared to industry, the high number of fixed termed contracts vs. permanent contracts and therefore the difficulties to recruit staff.

Human Resources administration is, in all institution where this part was interviewed, done on an institutional level; it is even difficult to get information about the number of staff working for one RI as only few make separations between the different RIs. So this chapter again focuses on an institutional level, apart from the average number of staff per infrastructure which is mentioned further down. The recruitment of scientific personnel in nearly all institutions is done in cooperation between the Human resources department (or in smaller institutions between the administration) and scientific groups – depending on the level of the position with scientific committees or group leaders.

No special programs for the exchange of industrial and public staff members could be found during the interviews. Some institutions don´t really care about the exchange while others already thought about a way to handle an exchange, but no special programme were developed. At the moment most institutions don´t gather information about if the last employer of their staff was industrial or public. Data were mainly estimated by the interviewees. In the scientific area it was estimated that only a very small (less than 3% in total) percentage had industrial experiences – mainly the idea predominated that once left academia towards industry no return is possible. This was explained with different focuses of industrial and academic scientific work. While in academic institutions exchange with colleagues and through this an ongoing update of the latest scientific developments is daily work, most of the industrial scientists are not any more in this process: their focus changes. Only in the area of administrative staff, on average, was more experience within industry found.

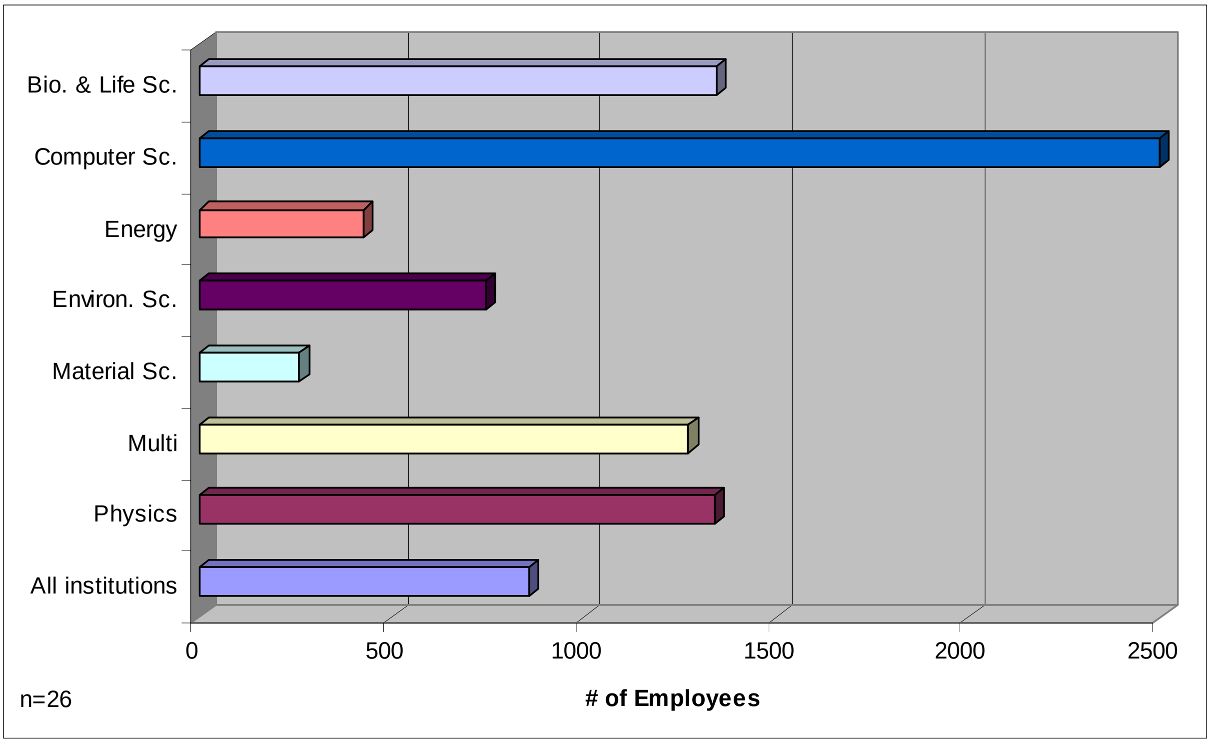
Similar poor data basis were found about the question from which countries the staff members do come. Only a few, among them most of the EIROFORUM members, had numbers available as they are concerned about a fair origin of staff from their member countries. But as only such a small number and then also mainly a special kind of RIs had numbers available an analysis of these data does not make sense as it is not representative at all.

About **two third of the interviewed RIs are offering training for the staff** – some in cooperation with external organisations. Under those which are not organising training courses none scientific domain or country is dominant. But these are the smaller institutions with less than 100 staff members. Education of non-scientific staff, for example gardeners, is only done by less than five RIs.

The questions of Human Resources were during the interviews often some of the most discussed questions. **Often the problem of salaries was picked out as central theme – al lot of institutions have problems with this.** Additional it was mentioned that it is getting hard to find appropriate staff – sometimes this was mentioned in the context with the salary level mainly in public research organisations.

IX.1. Average number of employees

Average numbers of employees per institution and scientific domain (Figure D2-12)



Material Sc	=	Material Science
Environ. Sc.	=	Environmental Science
Bio. & Life Sc.	=	Biological and Life Sciences
Physics	=	Astronomy, Astrophysics, Nuclear and Particle Physics

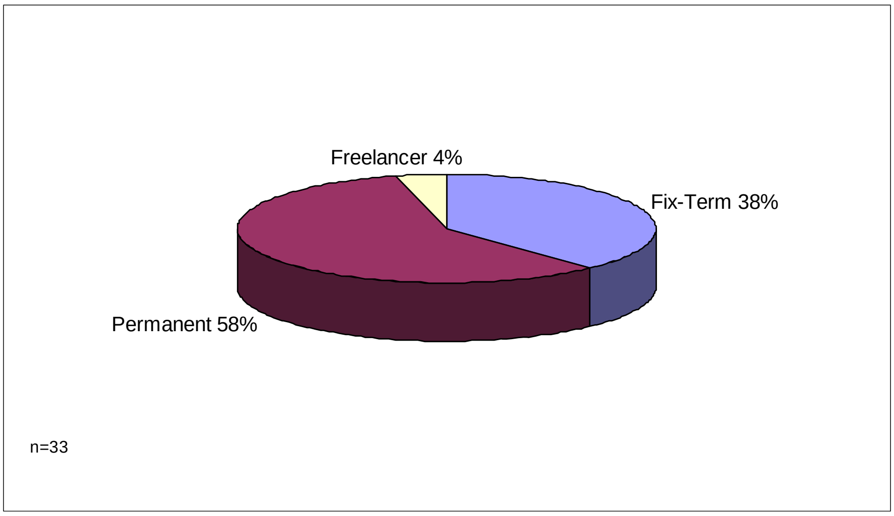
Computer Sc.	=	Computer Science
Energy	=	Energy
Multi.	=	Multidisciplinary
Social Sc.	=	Social Science

The number of employees is one of the few existing numbers which could be gathered on the level of Research Infrastructures as well as on the level of the institution. On the institutional level seven institutes gave no reliable answers while on the research infrastructure level 21 did not reply. In the second phase of ERID-WATCH WP1 there should be a focus to gather these missing data for a final and reliable analysis in the end of the project. In both cases, in the scientific domains CDT and Energy (no results for Social Sciences in this case) only one institution each was interviewed – thus, in these two domains the numbers are not representative. This may explain the comparatively high number of employees in the area of CDT: The institution has a total number of staff of 2500 but only a very small part of them are occupied with the RI while the others are doing services for other public institutions. An average interviewed institution has roughly about 850 staff members while an average infrastructure has about 300 staff member. Again, the EIROFORUM members influence the sample: They have the largest numbers of staff members per infrastructure as well as per institution.

IX.2. Type of employment contracts

Only a little more than half of the staff of the interviewed institutions have permanent contracts. There is no difference in scientific domains about this fact but it could be seen that in French institutions the number of permanent contracts is comparatively high with about 79% permanent contracts.

Employment contracts on an institutional level (Figure D2-13)



IX.3. Practice examples

One example should be mentioned but it could be debated if this is seen as an outstanding positive or negative example – it depends on the point of view. In one of the interviewed institutions a policy of having less than 11% permanent contracts is used. All other contracts are at maximum 9 year termed contracts, separated in several smaller contracts (3/3/3 or 4/5). This policy is used for all staff members – also the administration. This ensures an exchange of personnel with other organisations and countries – the excellent educated staff members go back in their countries and spread their knowledge. On the other hand this policy was mentioned by the institution as problem: some people may avoid to become employed by this institution even if they would be a benefit for the staff. Moreover people with outstanding experience in very special areas are hard to be replaced after nine years.

Another outstanding example is the staff exchange between two very similar institutions in two different countries. The exchanged staffs spend a special time in the partner institution. With this exchange the staffs is kept on one experience level and best practices could directly be taken in the institution in the other country.

IX.4. Problems

Three major problems were often mentioned during interviews:

- Fixed-term contracts
- Low salaries
- Difficulties to find appropriate staff

The problems may occur as single problems but may also be connected with each other. One example of fix-term contract problems was already given above. Especially in Germany the problem of fixed-term contracts was also mentioned as often only two or three years contracts are given. Especially for running an infrastructure which is quite complicated in the usage and small changes lead to changes in the measuring this is a major issue. In one special case it was mentioned that the education to use the infrastructure needs nearly two years. Furthermore in this case also the level of the salaries was added as a disadvantage – the institution was concerned about the future quality of their infrastructure. It was generally agreed that it is especially hard to find senior personnel with fix-termed contracts.

Beside the answer that salaries are too low in general it was mentioned that salaries are in nearly all institutions lower then in comparable industry position which the person could have. Within some countries where for example the employment rate is comparably high this was mentioned as problem on the one hand. On the other hand it was argued that the greater freedom of designing their own work in academia is why some people choose the lower paid job. But this becomes even more problematic in countries or cities where the living costs are so high that choosing an academic career in the beginnings may be a real financial problem. But nearly all interviewees agreed that the level of salaries is another major reason why industrial scientists stay in industry after they had once chosen this way as with only one or two exception no Research institution is able to keep on the same salary level with industry. Even within Europe different salary levels within the academic world are a problem – national levels are very different and only a few want to go back to the country where they earn less. Some interviewees were concerned about the quality of future science as the gap between industrial and academic salaries opens up more and more.

Also it was argued that it is difficult to get senior or more experienced staff from even other European countries because of the negative effects on pensions and retirement plans.
Some institutions made the first attempts to solve some of these problems: to attract also non-national staff members one institution pays an additional 450€/month for short term contracts while another institution offers more than a third more vacation days as a small excuse for less salaries. Others are paying additional excellence or other allowances to offer interesting salaries to their staff.

IX.4. Preliminary conclusions

The second phase of ERID-Watch WP1 should be concentrated on good practices to solve the above mentioned problems. For this reason explicit examples should be introduced in case studies. These case studies could help other institutions by showing how others solved parts of their problems.

Further key figures could be gathered if possible. The percentage/ Total numbers of types of working contracts is interesting as well as the number of staff for each institution and infrastructure. It could be interesting to gather data about average incomes in different positions (PhD, Postdocs…).

Overall it could be seen that problems in the area of Human Resources are often predominating – with influence also on other areas, as e.g. TT. Problems mentioned as for example the low salaries are often followed by other problems as the difficulty to find appropriate staff. Also the exchange between industrial and public staff is influenced by the level of the salaries.

To ensure a high quality in running Research Infrastructures these problems should be taken seriously and have to be solved on a long term perspective. A high quality of the RIs could also benefit the satisfaction of industrial users which may lead to a larger number of industrial users.

X. Perspective

The second year of ERID-Watch should be used in two ways: Broadening the data base and filling the data gaps as well as verifying characteristic key figures, important parameters and processes. This should be done via Web-Questionnaires (broadening of the data), phone or e-mail contact (filling gaps), personal interviews as well as literature study for preparing a number of case studies in example areas. Interview partner may be industrial users of RIs beside RIs themselves as well. As the project looks at the interfaces between RIs and industry a much stronger focus should be on RIs with industrial users. The timeframe for the second year is divided into five parts – from Preliminary period starting in November 2007 until presentation period in October 2008. Compared to the first year the analysis period is with five months much longer then in first year.

As stated in the timeframe section of the methodology chapter, the second year of ERID-Watch WP 1 (Phase 2) aims at:

- Broadening and refining the available data;
- Filling data gaps,
- Verifying characteristic key figures & important parameters as well as processes.

Broadening and refining data is necessary, as only about 47 Research Infrastructures have been interviewed during the first year. Not all of them could deliver answers for all of our fields of interest, as some areas, e.g. patents, are more interesting to special scientific domains or the strategy of patenting is not undertaken by the infrastructure for whatever reasons.

Furthermore, from certain scientific domains (CDT, Social Sciences and Humanities), only one to two infrastructures took part in the first year study.

All missing information from first year interviews should be collected with telephone or email enquiry. The aim is to have a completed data base for the final analysis.

X.1. Best practice study extension: Case study RI

Case studies are suggested for the second phase of ERID-Watch WP1 to illustrate full length best practices examples in selected areas and show success stories. It is suggested to focus on best practices in the areas of:

- Technology and Knowledge Transfer/ R&D

- Human Resources
- Networking/Cooperation
- Funding Scheme and origin of financial resources
- Operating conditions

The aim of the case studies is to show the European RI landscape "best practices" which may motivate them to discuss and ultimately to adopt some of these practices for their own Research Infrastructure. The case studies should show practices from all scientific domains as well as different types of RIs, if possible. In this way, it is ensured that nearly all Research Infrastructures may find practices that are appropriate to them.

Case studies are time intensive as they deliver a wide range of information about a case. Several steps have to be taken in order to ensure the quality of the study:

- Gathering data about the infrastructure and the processes. This may be done via questionnaires, interviews or literature study. In our case, some of the information was already gathered in the 1st phase. In RIs that have already been interviewed, a one-day visit is most likely sufficient for deepening the information about the case.
- Organising the data in order to highlight the focus of the study (e.g. special process in a TT office)
- Developing a narrative case study underpinned with key information around the focus of the study.
- Crosschecking of the case study with the interviewed person and RI.
- Presenting the case study.

In contrast to data gathered in the 1st phase of ERID-Watch and to the data collected in the Web Questionnaire, the data in the case study process cannot be kept confidential, as key information about the case is integrated in the study. The timeframe should allow a total of about 10 case studies for ERID-Watch, WP 1. In addition to European RI experiences, international RI perspectives might also be of interest.

Worst practice case studies could also be done. However, since few RIs are likely to be willing to publicise their bad experiences, it is unlikely that volunteers will be found for this approach, although serious poor practice observed during the study could be reported without attribution.

X.2. Benchmarking extension: Web Questionnaire

As stated above, some domains were underrepresented in our sample from year one. Furthermore, not all questions fit well with each infrastructure. For the evaluation of their key figures, web questionnaires could be developed.

In particular, a set of multiple web-questionnaire formats could be developed, based on the specialities of the specific domains (databases, collections, big instruments) which may form clusters for further analysis. It should be easily completed in a short time. Therefore, a set of questions that are all answerable with numbers or simple yes/no responses would be ideal. Additionally, some core information (age of the infrastructure, country, staff members) about the infrastructures would also be requested. All numbers would be asked in categories (10-20; 20-40…) to ensure that the questionnaire is easy to complete. Before this process a defining and definition of important key figures has been done. These key figures should be questioned within the questionnaires.

The web questionnaire should be password protected – an email with the password and the web address would be sent to the contact person at the infrastructures who would be asked to forward it to the responsible department/person. The web questionnaire should then be filled in directly on screen. The data asked in the Web-Questionnaire should also be available from the first year interview partners – that means that all first year answers have to be crosschecked and missing data gathered, as stated before. Data from this questionnaire would be kept confidential according to the confidentiality agreement and would only be used in a processed and collective form.

It should be discussed if the web questionnaire should focus on one area of interest or contain questions about two or more areas. The disadvantage to the latter approach is that if one questionnaire covers two or more areas, it is not easy for one person to fill it in – and as a result, it is likely that fewer questionnaires will be filled in.

Data from the web questionnaire may be automatically imported into a database. The analysis of the data would be much easier without having to make spreadsheets manually.

X.3 Timeframe 2nd phase

The second phase of ERID-Watch starts at the beginning of November 2007 and will be divided into several periods. In contrast to the first phase, the periods will have separate timeframes.

Preliminary period: This period is planned for one month, lasting until the beginning of December 2007. At this stage, not as much familiarisation with the topic is needed as compared to last year. The time will be mainly used for developing the web questionnaires and developing the database. First contacts with case study RIs should be made.

Testing period: A fourth Pilot Group Meeting of WP 1 is planned for January 2008; with the feedback from the Pilot Group, this date would make a good stopping point for the testing period. The web questionnaires will be tested at about 10 RIs. Changes to the document and to the database, if necessary, can then be made. No testing is necessary for the case studies, but more contacts/appointments will be made, possibly also the first interview.

Field work period: Starting in mid-January, the web questionnaires should be sent out with a closing date four weeks later. A second batch of web questionnaires will be sent out then – again with a closing date four weeks later. If necessary, a third group of web questionnaires may be sent out. For all web questionnaire recipients, a reminder will be sent out two weeks after the initial invitation to take part in the survey. All results should be available by the end of April with a buffer of two weeks due to the Easter holiday in March. Interviews for the Case Studies will be done over these three months.

Analysis period: As the final recommendations must be prepared, the analysis period is proportionately long – until the middle of September. First, the case study narratives have to be completed, because they have to be agreed to by the interviewed RI. Then the analysis of the web questionnaire follows. The time frame of more than four months allows for enquiries with the RIs. Parallel to this, the Final Benchmarking Report must be prepared, starting in late June. It should be sent out to the ERID-Watch bodies for discussion by the end of July. Feedback can be incorporated during August and the beginning of September. By the middle of September, the report should be ready for delivery to the EC.

Presentation period: The Final Conference is planned for October 15^{th}-17^{th}. From mid-September until this time, all presentations of the results will have to be prepared. A well-designed summary of the case studies could be printed as a poster for the conference. The results from the first year with the deepened results from the second year will be prepared in a report and presented. Results will also have to be prepared for the website.

Timeframe 2nd phase of ERID-Watch WP1 (Figure D2-14)