



Euro-BioImaging

European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences

WP9
Access to Innovative Technologies – Medical Imaging

Task 9.3
Infrastructure Survey

Deliverable 9.5
Report on surveys of European infrastructures for UHF-MR, phase contrast CT and emerging technologies

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1 Executive Summary

Work package 9 “Access to Innovative Technologies – Medical Imaging” is aiming to advance novel medical imaging methods in Europe and to provide access to such usually rare modalities. WP9 is thus an important aspect of Euro-BioImaging to guarantee sustained development of medical imaging to support or even expand the leading position of Europe in this field. As a consequence, WP9 has been designed to be able to quickly adapt and evolve in the reflection of technology development and user demand. Important and quickly developing modalities, such as ultra-high field MRI or MR-PET, had already been identified at the onset of Euro-BioImaging. The results of the survey fully confirm this selection and will be the basis for further extension to novel modalities. A third modality at the edge of becoming a clinical research tool is X-Ray Phase-Contrast Imaging that has also been identified in the survey as interesting imaging research modality although it is yet less well known to many scientists. Another novel modality that is not yet fully integrated into WP9 is magnetic particle imaging (MPI). This has also been identified and selected by the users and will be considered in the future development of WP9. The modalities that are considered most important vary according to geographic region, reflecting that researchers are most comfortable with technology that is only somewhat ahead of what is currently available. This may well reflect the dynamics of the field of emerging medical imaging modalities and demonstrate that it is a moving target, which needs to be updated according to the advances in the field.

While the identification of the need for these emerging medical imaging tools has been confirmed in the survey, it has also been confirmed that these modalities are in very short supply in Europe. Even those institutions that operate these modalities do not provide significant amounts of their infrastructure to external researchers due to limited system time and or limited financial and personnel resources. As a conclusion it is therefore evident that the construction of Euro-BioImaging will be highly anticipated to provide the medical imaging resources for a large number of imaging scientists in Europe. The high mobility and willingness to travel even across borders is a re-assuring statement by the users that a distributed infrastructure with a limited number of nodes will be able to cover the needs for a large portion of Europe's medical imaging researchers.

2 Introduction

This report is based on the outcome of the Survey for the Euro-Biomed Strategic Inventory Map (SIM). With respect to WP9 (Access to Innovative Technologies – Medical Imaging), all survey questions related to novel medical imaging modalities, i.e. regarding the current distribution of imaging systems and the user needs are considered. In addition, the required services to be provided to the users are described and analysed. Finally, the preferred cost model and training needs in this field are included.

Most of the aspects named above are analysed separately for providers and for users. In some categories “natural” differences can be expected (e.g. cost model). For other categories, this is much less obvious (e.g. types of service). In case of larger regional differences across Europe and if the number of responders permitted, the regional distribution has been taken into account and is described.

It has to be noted that despite the successfully large number of completed survey responses the data and results have to be interpreted with caution. Many questions included a large number of possible answers and thus the number of responses per answer may be low. In addition, any analysis of regional differences reduces the number of answers dramatically. Therefore, regional analyses have been performed by grouping of countries according to their geographic location.

The main objective of the survey for WP9 (Access to Innovative Technologies – Medical Imaging) was to gain information about the following questions:

- What are the medical imaging modalities most requested?
- Do regional differences exist in the requested modalities?
- What are the services to be provided?
- What are the current resources across Europe?
- What is the preferred cost model for external access?

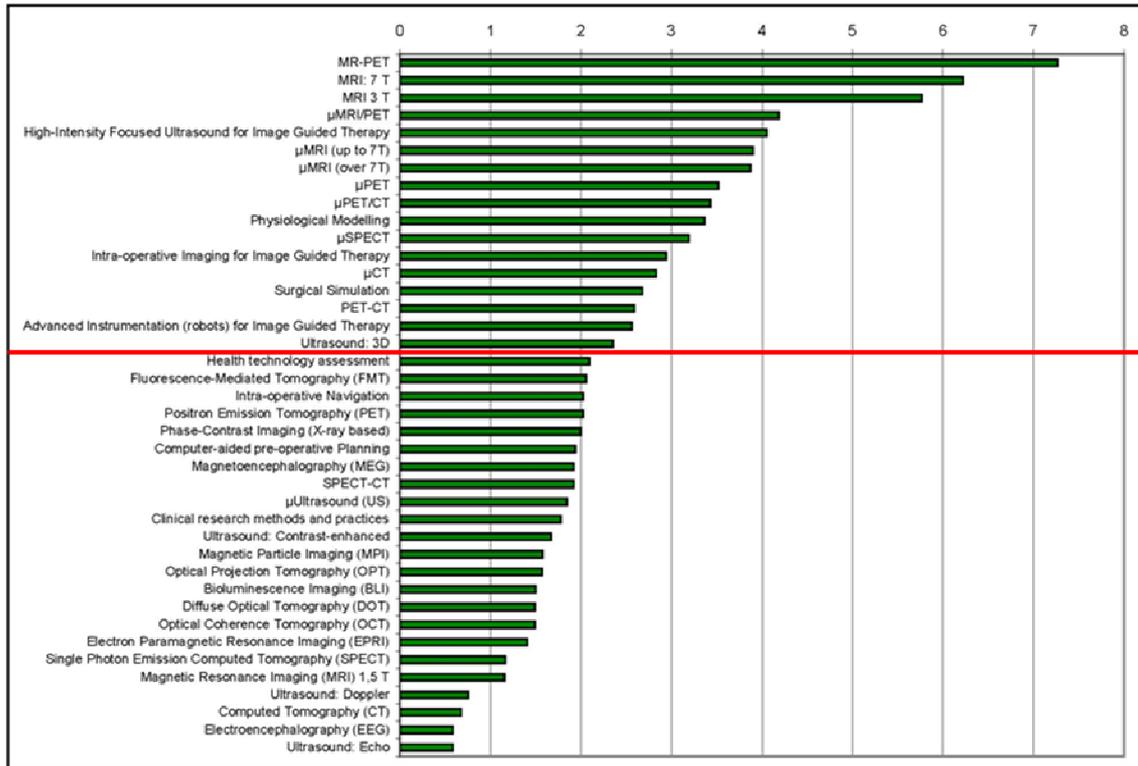
The main results of the survey were first presented at the 3rd Euro-Biomed Stakeholder Meeting in January 2012 and were discussed in more detail in a WP9 meeting on the same occasion.

3 Presentation and analysis of the survey results

The survey results are presented and discussed in this chapter, according to the main objectives named in the introduction.

3.1 Requested medical imaging modalities

A clear path of access to biomedical imaging technology for every researcher in Europe is the main objective of *Euro-Biolmaging*. For the construction phase of Euro-Biolmaging, the modalities for external access have to be defined. The following figure shows the most requested medical imaging modalities among all imaging researchers across Europe.



Many of these modalities are commercially available and some are even well established tools in clinical research and clinical diagnosis and/or treatment. Within WP9, MR-PET and high field MRI have been included from the start of Euro-Biolmaging and are the most requested modalities. This may be a consequence of multiple aspects. Both modalities are now commercially available but require large investments that have only been made at a few centers across Europe. Thereby, MR-PET and high field MRI are both known well within the community but only very few researchers currently have access. 3T MRI and animal MRI or animal PET/SPECT may constitute a somewhat different category. These modalities are more established and have been used for a longer time. Therefore, they are well known to many researchers and although more systems are available, by far not all researchers have access to them. As they are better known, the threshold for requesting such modalities may also be lower. A third category that is particularly interesting with respect to WP9 are newly emerging technologies such as phase contrast CT, electron paramagnetic resonance imaging and magnetic particle imaging. These modalities are not well known among researchers and in some cases not even available yet. However, even these modalities have been requested although to a lower extent.

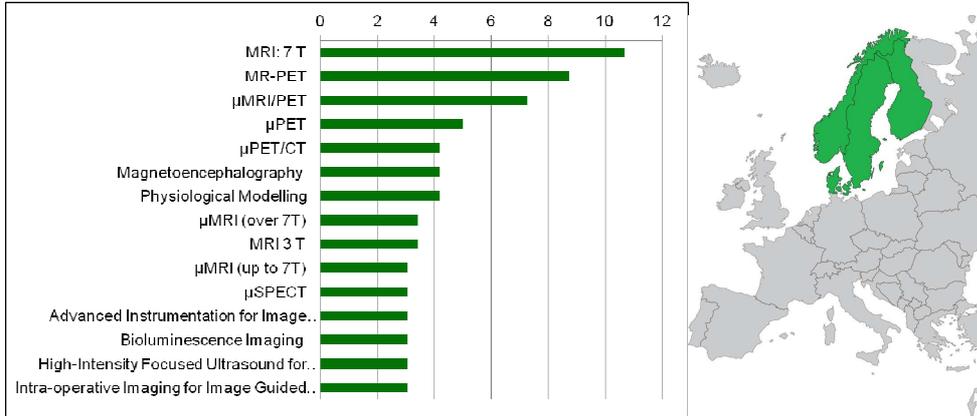
3.2 Regional distribution of modalities requested

When the above responses are differentiated according to geographic origin, a pattern may become visible. In northern and central Europe, emerging modalities (MR-PET and high field MRI) are most requested. These countries are also among the first in Europe to operate such systems making them better known to the researchers. Modalities such as 3T MRI are rather well established in these countries for research and even for clinical diagnosis leading to fewer requests in these very well developed regions.

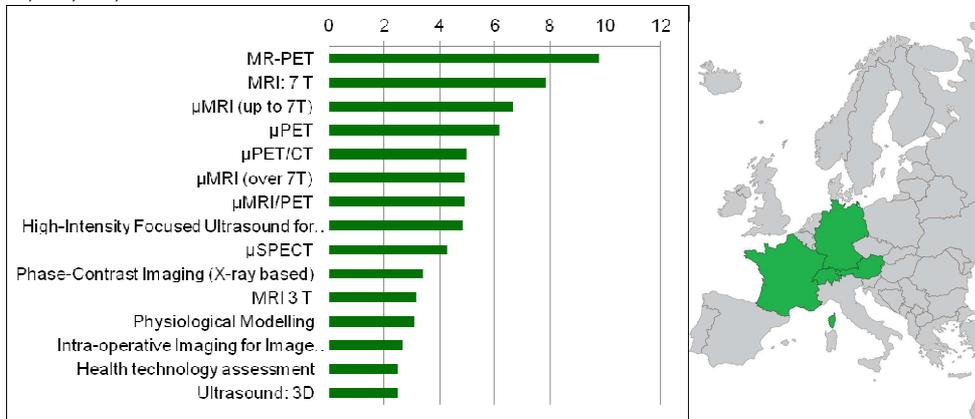
In eastern and southern Europe the responses were somewhat different. In these countries even 3T MRI is less well established and fewer researchers have access to such systems. Therefore, the demand for such systems is higher. MR-PET, however, is of equally high demand. Potentially because this modality requires very high investments not only in the

imaging equipment but even more so in local infrastructure and expertise since facilities and departments for radiochemistry such as an isotope laboratory and a cyclotron are required and render such modalities very rare.

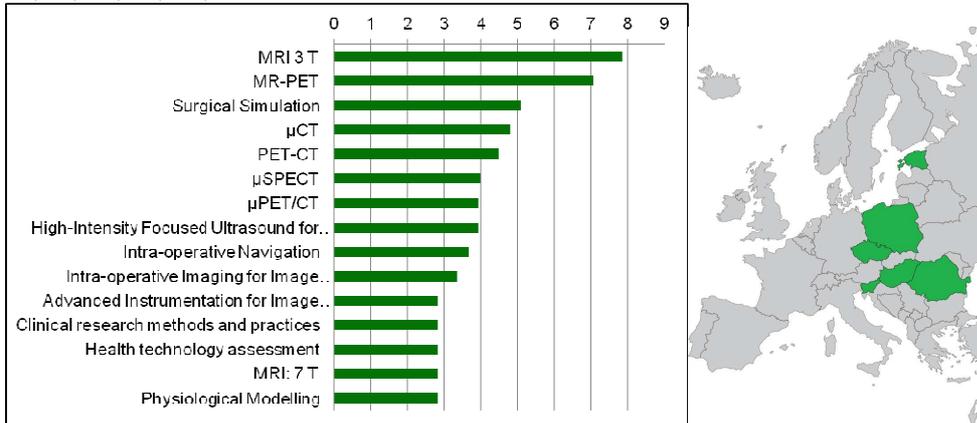
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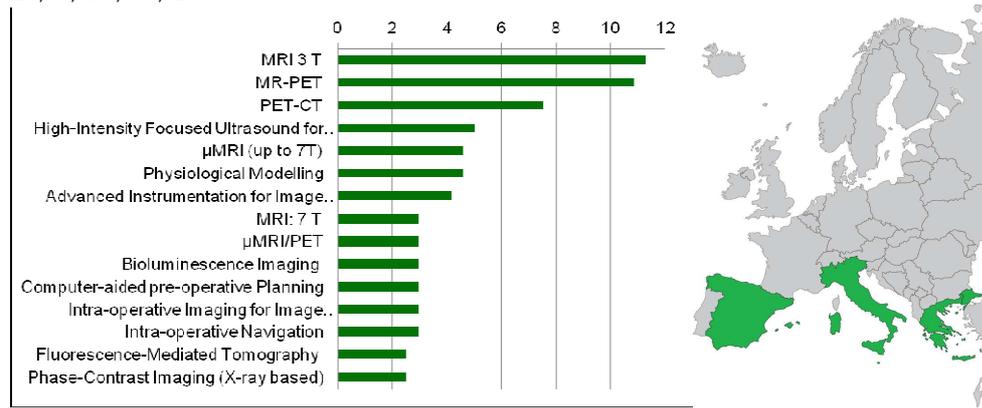
AT, CH, DE, FR



CZ, PL, HU, EE, RO, SI



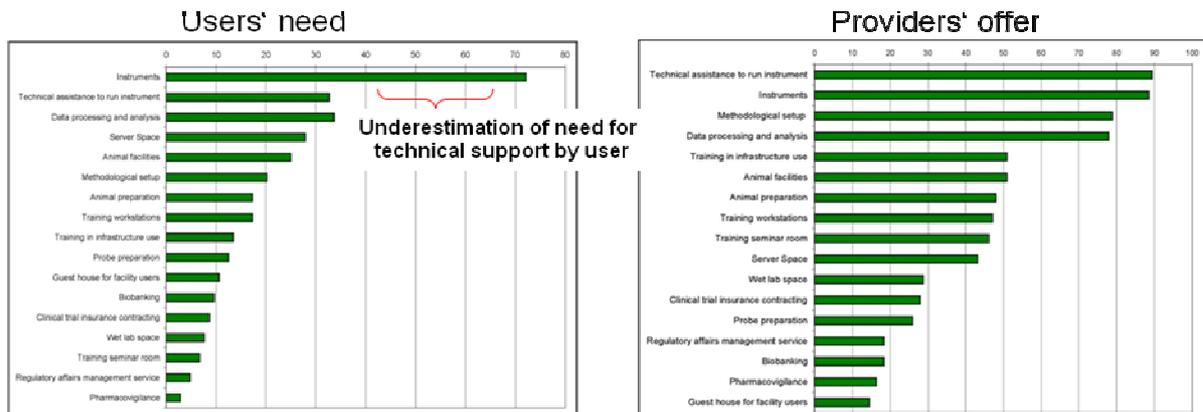
ES, IT, GR, TR, IL



3.3 Services requested and offered

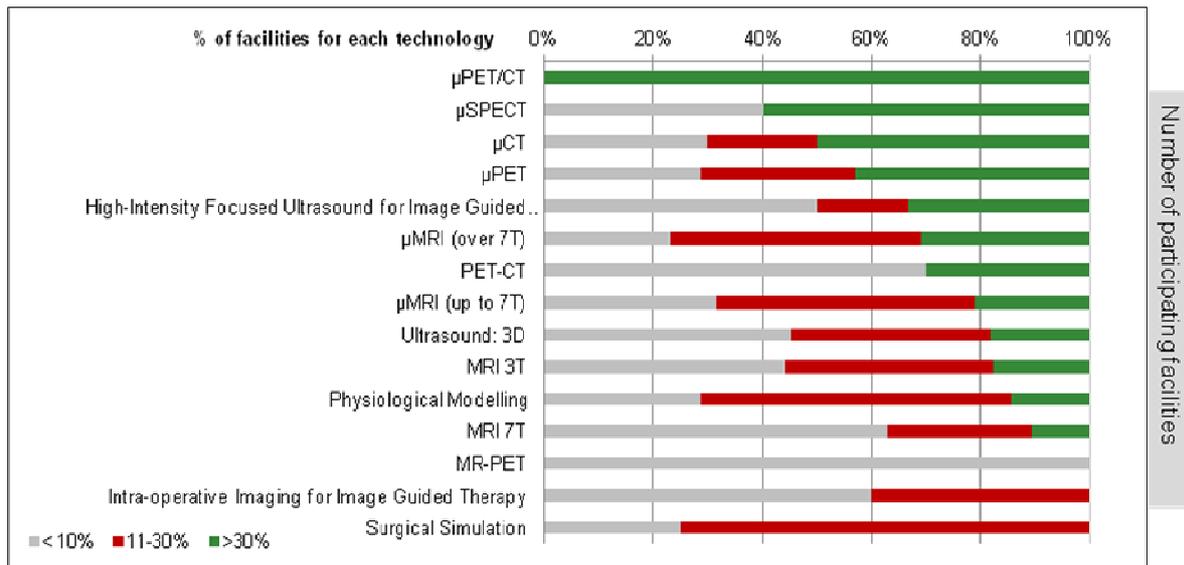
The provision of access to medical imaging instrumentation is not sufficient to allow cutting edge research. In addition, to access to the imaging infrastructure, most users will need training and technical assistance in running the instruments, support in setting up the experiments, data analysis and processing facilities, animal handling support and facilities, local assistance with subject or patient recruiting, and/or regulatory support.

The assessment of the needs for such services is very different between users and providers. While most users mainly request access to the instrumentation, the providers foresee as much need for technical assistance, experimental set-up, data processing and training. Since most of the potential users have limited experience in using open access medical imaging modalities, many of the providers have at least some experience in providing such services. It may thus be a reasonable conclusion that the users significantly underestimate the required level on service to successfully conduct experimental studies using these facilities.

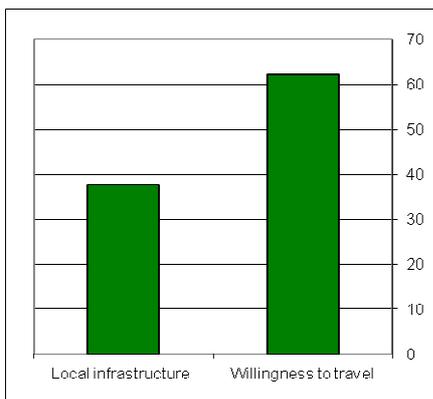


3.4 Current resources for external access

Among the potential providers that have participated in the survey, only few do currently grant external access to their facilities. In the figure below, the green bar represents sites that provide more than 30% external access while red represents between 11 and 30 % and gray up to 10%. It is evident that those modalities, which are in highest demand according to the survey, are also in shortest supply (in particular MR-PET and high field MRI). Although the number of provides sites is generally low and therefore these results have to be interpreted with caution, this documents the striking unmet need for access to emerging medical imaging modalities across Europe and the requirement to invest in infrastructure for external access.

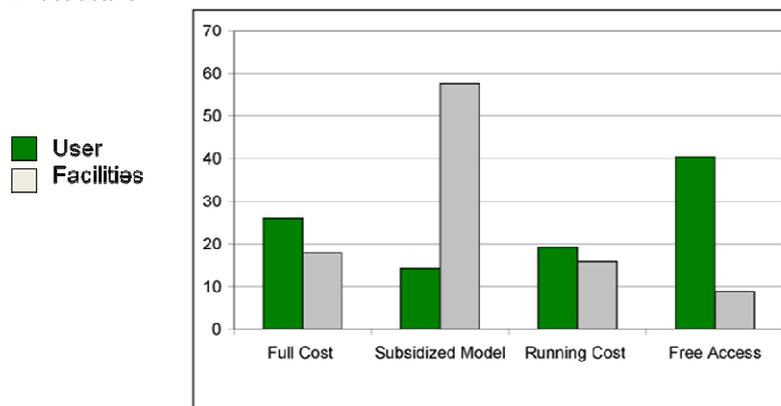


An important aspect for the success of a distributed infrastructure providing external access is the willingness of the users to travel between their institution and the infrastructure. From the survey results it is evident that the majority of researchers are willing to travel to an infrastructure to be able to conduct their research projects. 25% of the researchers are even willing to travel more than 250km and even across borders.



3.5 Cost model for external access

For medical imaging infrastructure, the majority of users (40%) prefer free access but a significant number (25%) is also willing to pay full costs. On the other hand, only less than 10% of the providers are able and willing to provide free access and the majority of providers are willing to allow access to the infrastructure at a subsidized cost model. Correspondingly, these is a gap between what users can afford and what infrastructure facility providers need to request in order to be able to allow access to emerging medical imaging infrastructure. Therefore, there is a clear need for support of a European imaging infrastructure.



4 Conclusions

The infrastructure survey has been a large success in that it has been able to attract a high number of replies to serve as a valid basis for the planning and development of WP9 within the Euro-Biolmaging project. A number of important conclusions can be drawn from the responses and the evaluation. It is re-assuring that the most frequently requested infrastructure modalities requested by the users are identical to the modalities that have been pre-selected in WP9 as important emerging medical imaging modalities for future research projects. It is within the nature of WP9, that the most current emerging modalities are not frequently requested as they are not even well known among many researchers. WP9 will continue to evaluate medical imaging modalities that are at the forefront of technical development and may become important tools in the future. Therefore, the evaluation process in particular of these newest imaging technologies, such as phase contrast X-ray imaging, magnetic particle imaging, or electron paramagnetic resonance imaging will continue throughout WP9 in order to be able to provide the European researchers with the best imaging technology for their research projects. A related important aspect is the difference in what is considered cutting edge technology depending on the geographic region. While some medical imaging modalities are considered standard in some northern or middle European countries, they may still be desirable research instruments in other areas. These results also clearly demonstrate that a European infrastructure that provides cutting edge and emerging medical imaging modalities is aiming at a moving target. The current situation is therefore exemplary for the development in the field and will require continuous re-evaluation and upgrade of facilities to provide the best imaging infrastructure.

Another important result is the conclusion that a comprehensive set of imaging services should be provided by the infrastructure including access to the emerging medical imaging technology and assistance in experiment preparation, operation, and data processing and evaluation. Although this may be required to different extent by various users, the services should be available if requested. The survey also demonstrated, that even in countries, where a number of installations of the most requested medical imaging modalities exist, the need for external access is largely unmet. Most medical imaging infrastructures are only open for external access to a small percentage and require significant extension, upgrade, and financial and personnel resources to provide the comprehensive service that is requested by the users at a subsidized cost model. It is very re-assuring that researchers are willing to travel longer distances to access top medical imaging infrastructure. Therefore, a distributed network of infrastructure nodes will be able to serve the needs of the research community.

5 Next Steps

Based on the results of this survey and the unmet needs that have been demonstrated, WP9 will define the modalities of highest demand and estimate the required number and density of infrastructure nodes. The technologies and the need are continuously monitored by the expert groups for each of the technologies currently under study and the plan will be updated periodically. New emerging technologies with the highest scientific potential and the highest demand by researchers will be further developed into future infrastructure modalities.