Researching Success

by Marta Ferrari

An IAEA survey offers an interesting insight in the status of nuclear research institutes in Central and Eastern Europe.

Over the last few years, the role of the nuclear research and development institutes (RDIs) has changed profoundly. From being privileged and strategic research institutions with one customer, i.e., the government, they have become just one of many research institutions competing for attention and funding. Several nuclear RDIs are struggling to find their place in this world, with erosions of funding and status that has made it difficult to attract and retain talented staff. On the other hand, there are institutes that overcame a deep financial crisis and managed to complete the transition with great success.

Although there is a widespread feeling within the nuclear community that some nuclear RDIs are in financial distress, there are no current statistical data. A 1989 IAEA report and a 1996 OECD report reviewed the mission and status of nuclear RDIs but neither of them provided an analysis of the financial situation. To fill the gap and provide information about trends in the nuclear sector and the impact of Science & Technology (S&T) policy on nuclear RDIs in 2004, the IAEA initiated a Technical Cooperation Project to support Central and Eastern European RDIs working in nuclear power and non-power applications. Twenty-five research institutes from fifteen countries participated in a comprehensive survey and provided information on their financial status, revenue sources and trends, human resources, and their facilities for the period between 2001 and 2006. The institutes were also asked to supply data on selected performance indicators (including number of patents applied for and obtained, and number of publications in respected journals), legislation, policy and management.

The challenges have been particularly severe in the Central and Eastern European region, where structural political and economic changes affected the way science is funded and managed. Some nuclear RDIs have seen a sharp decline in funds and status, the loss of some of their most talented scientists, which jeopardises their long-term viability, and, in some cases, poses significant safety and security concerns. Findings from this survey may provide interesting insights in the situation of nuclear RDIs in other regions as well.

Global Trends in Science and Technology

The Science and Technology (S&T) sector is faced today with complex and diverse challenges. National science budgets are under pressure, and many countries are changing how Research and Development (R&D) is funded, reducing direct subsidies and introducing competition for both governmental and alternative sources of revenue.

On the other hand, the transition toward knowledge-based economies is creating new opportunities in the S&T sector as governments look to it to foster economic growth through innovation. A number of countries in Central and Eastern Europe have recently joined the European Union (EU) which defined the Lisbon Strategy to create a "knowledge triangle" of research, education and innovation to underpin the European economic and social model, as well as economic growth. This strategy seeks to increase investment in science and technology across the EU to a target of 3% of GDP by 2010, with two-thirds of funds coming from the private sector. By comparison, funding for R&D in most Central and Eastern European countries is only around 1% GDP, of which about 90% is provided by the governments.

Research Reactor WWR-K, Institute of Nuclear Physics, Almaty, Republic of Kazakhstan.
(Photo: NNC, Kazakhstan)

R&D has become more international, reflecting a more interdependent and globalized world. Governments still maintain national networks, but increasingly emphasize international cooperation, to avoid duplication of expensive infrastructure and because scientific excellence requires an exchange of ideas and cooperation that crosses borders.

These challenges and opportunities directly impact RDIs, including nuclear RDIs. It is important for these institutions to take these trends into account as part of their vision and strategy.

Millionaires or Nobel Prize Winners?

A 'Nobel Prize Winner ' institute has an academic focus, wishes to create an environment for excellence...while a 'Millionaire' institute is focused on linkages to commercial markets. (Photos: Photodisc)

Most RDIs develop their strategy and their internal management depending whether the mission is more oriented to basic research, applied research, services or production. Many of them are active across several areas, while a few attempt to cover the full continuum of activities. The distinction is helpful to understand how effective internal organization and policies are in fulfilling an institute's mission and strategy. A 'Nobel Prize Winner 'institute has an academic focus, wishes to create an environment for excellence in research and rewards mainly publications. A 'Millionaire' institute is focused on linkages to commercial markets, considers financial success a primary institute goal and rewards staff for revenue generation and commercial projects.

One of the major challenges facing nuclear RDIs is maintaining the balance between the institute's mission as perceived by its stakeholders, its strategy as defined by the institute management and the policies on such issues as staff incentives and control of intellectual property rights. Inconsistencies between mission, strategy and policy create obstacles to sustainability and success, because they impede revenue development and demotivate staff. A work environment that rewards creativity needed for basic science applications is not well suited to the repetitive, efficient production of radioisotopes, for example.

While there are RDIs with refined management systems, in general, their internal management is unsophisticated. Only one-third of the surveyed RDIs have either a business plan or a similar strategic document. Systems for staff incentives are not well developed, and in several cases do not align staff rewards with the institute's objectives. Examples include institutes engaged in service or production activities that exclusively reward their staff on the basis of academic reputation and publications. In some cases, these policies are set at a national level and are outside of the institutes' control, highlighting the need for dialogue between the institute management and their government policy-makers.

Are nuclear RDIs in financial distress?

Significant changes have occurred in Central and Eastern Europe over the past two decades, including accession to the EU by some countries and rapid GDP growth. Overall, RDIs increased their revenues in line with the positive domestic economic climate, though this is not universally true. Some RDIs have been less successful, with revenues declining over the period.

Reliance on government funding varies significantly, ranging from near zero to almost the entire budget. Historically, government funds have been provided in the form of a direct subsidy, but there is an increasing emphasis on funding R&D through competitive grants. Many institutes are actively developing revenues from other sources, but for the majority of them, governments remain their most important sponsors and clients.

In many cases, researchers doubt that "new" revenues will benefit their RDI, as they expect the government to reduce its funding as other revenues are developed. This perception forms a powerful internal barrier to development of alternative sources of funds, to the point that RDIs are more likely to develop non-governmental funding sources if it is clear that government funds will not be reduced as a consequence.

Knowledge based societies need their RDIs to be an engine of GDP growth by creating and developing intellectual property and stimulating innovation. However, this role is not uniformly recognized in the RDI funding systems, which often do little to reward RDIs for commercialising technology or making expertise available through consultancy and services. RDI internal management systems address this strategic role only weakly, with less than half of the RDIs having a policy for the protection and management of intellectual property, and almost none earning revenues from intellectual property rights.

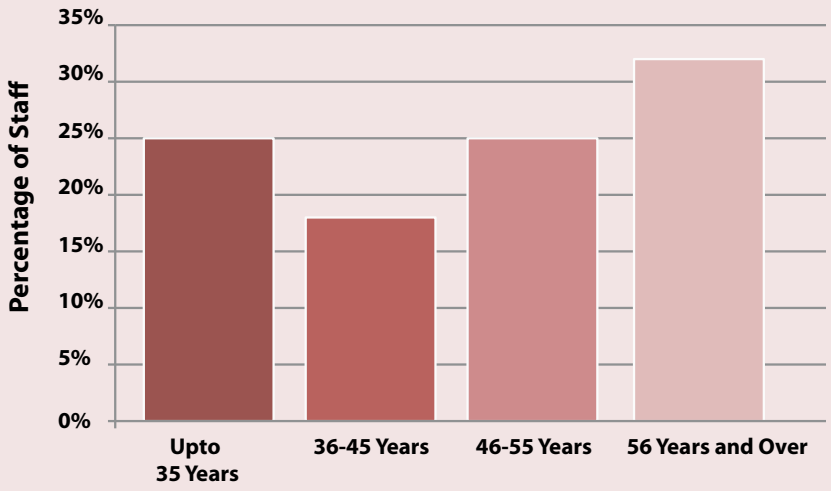
Reporting and Funding Relationships

The survey showed that funding and reporting relationships have become disconnected in a number of cases, making it difficult for RDIs to meet the objectives of the funding organization and thus setting the stage for chronic funding deficits. Just over half of the surveyed RDIs are strongly related to the bodies (Ministry of Science or equivalent, and the Academy of Sciences) that determine their country's S&T policies. Examples of conflicting relationships include RDIs that are controlled by the Academy of Sciences but funded by the Ministry of Economy to provide support services. Resolution of these types of conflicts will enable RDIs to better contribute to the countries S&T needs.

The Human Resources Challenge: the age gap

Staff age distribution showed that there is a major challenge in the institutes' future. Several RDIs have a deficit of experienced staff in the 36 to 55 age group and are facing problems with knowledge retention as the oldest members of staff retires. In aggregate, there is a deficit of scientific staff in the 36 to 45 age group, reflecting difficulties in attracting and retaining talented staff experienced over the last 10-20 years, but suggesting an increasing ability to attract new graduates.

Age Distribution of RDIs' Staff Members

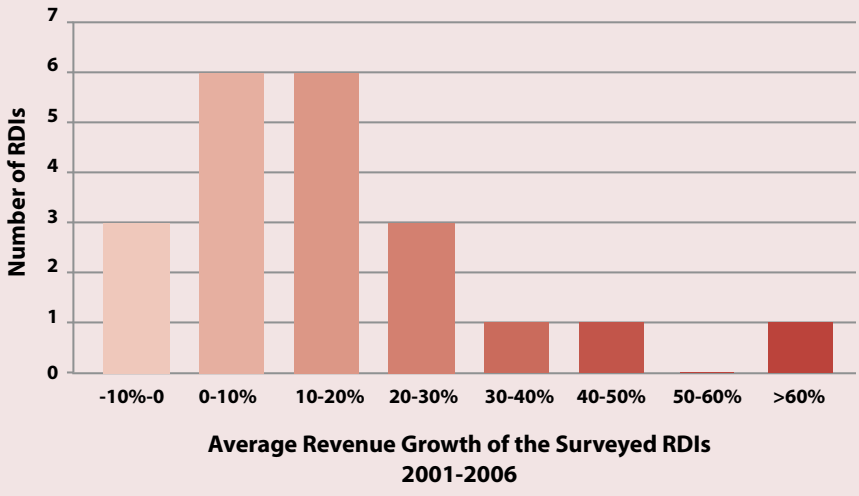


source: IAEA

Key success factors

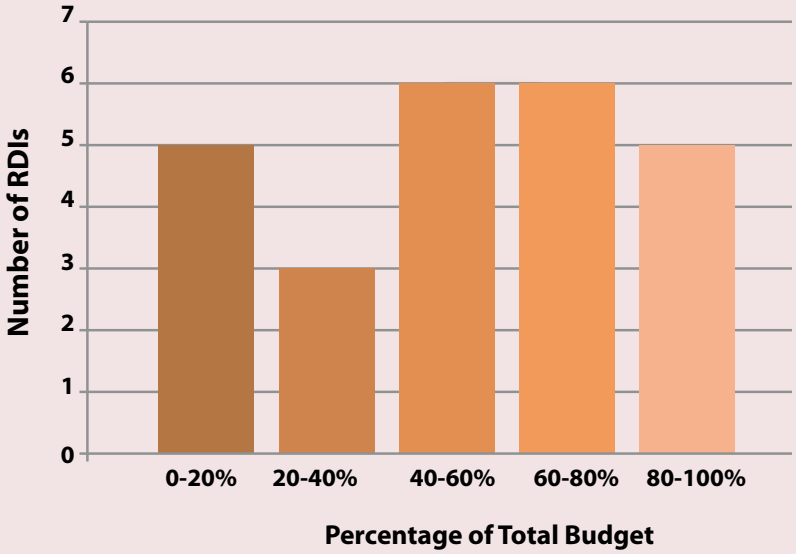
There are several possible models for successful RDIs, and the key success factors for nuclear RDIs are similar to those for institutes in other scientific disciplines. A crucial key to success is for RDIs to align

RDIs' Revenue Growth



source: IAEA

RDIs' Government Funding
as percentage of total budget



source: IAEA

themselves, their policies and their strategies to their capacities, their environment and the needs of their stakeholders.

RDIs exist within the environment created by their governments' regulations and policies, which can either help or hinder the institutes in their quest for sustainability. Thus, RDIs need to proactively manage their environment and nurture relationships with the government and other stakeholders.

The S&T environment is increasingly international, so it is also essential that the RDIs develop peer group networks to supplement their capabilities to provide international visibility and standing, and ensure access to major international programmes. RDI managers interviewed for the survey stressed that even though participation to international programmes such as the EU Framework Programmes does not provide a major source of funding (rarely rapresenting more than 5-10% of the institutes budget), it is essential to foster the institute reputation and eventually important to gain national funding.

RDIs that participate in commercial markets with either products or services, have a particular need for effective accounting systems and accounting policies that can realistically calculate costs and so make possible meaningful profitability assessments. They should also develop a purposeful business development function to build the customer base and business revenues. To succeed, these RDIs need to retain some of the revenues gained in the commercial sector and have flexibility in staff recruitment and retention policies so that they can meet the demands coming from the marketplace.

The Way Forward: Challenges and Opportunities

RDIs face significant challenges to respond to the changes in S&T priorities and in the structure of R&D funding. This requires new approaches as well as application of new skills.

Yet, there are also many opportunities. The renaissance of nuclear electricity generation is creating a new demand for the skills, experience and capabilities of RDIs. This includes training of professional staff, material investigations, development of the science and supporting technologies for new reactor systems. Outside nuclear energy, there are new opportunities in many fields. For example, expertise in nuclear physics and nuclear technologies can be combined with that from other scientific disciplines to address problems in agriculture, industry and medicine. The commitment of the European governments to substantially increase national R&D funding levels envisages also new opportunities for RDIs.

There is not just one possible model for RDIs: there are several, all successful in their own way. The main key to success is to have high quality RDIs that align themselves, their internal policies, and their strategies to their capacities, the environment and the needs of their country. Successful RDIs have demonstrated the importance of institutional policies concerning key strategic elements such as incentives for staff, intellectual property ownership, and sound financial management. Particularly crucial is the establishment of the right incentives in term of human resource policies, the ability to mobilize and motivate research staff in line with the institute's mission and the stakeholders' objectives.

Whatever the specific model, it is crucial that institutes take a proactive stance to shape their environment and determine their future.

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