

Information systems as tools for managing research activities – how it works at the Slovenian Research Agency

Franci Demšar, Tomaž Boh

Slovenian Research Agency, Ljubljana

Summary

The paper starts with a short overview of the research system and activities in Slovenia. The complex environment of modern society requires continual reforms of the government (public) sector. Indeed, the development of modern information and communication technologies is increasing the demand for change whilst facilitating the ability to adapt quickly. In this paper, the authors analyse the elements of transparency within the context of public policies. They contend that the implementation of transparency principles is crucial for better efficiency. The implementation of transparency principles must be supported by modern information technology so as to reduce the monopoly over information and its interpretation. Through a case study of the Slovenian Research Agency, they present the effect of implementing transparency on the quality of research output in Slovenia.

1 Context of research activities in Slovenia

Slovenia lies at the crossroads of four major European geographic regions: the Alps, the Dinarides, the Pannonian Plain, and the Mediterranean. Slovenia has a developed, high-income economy which enjoys the highest GDP per capita of the new EU member states (about 15.000 EUR, or around 86% of the EU average).

When Slovenia became an EU member, it found itself at a developmental crossroads and facing new challenges. On the one hand, Slovenia is a part of the developed world and shares forward-looking values with the EU. On the other hand, Slovenia is striving to catch up with the more advanced EU countries. In order to achieve this goal, Slovenia has been applying modern development strategies. Some are more successful than others. Animated debates regarding the reform of society with the purpose of enhancing economic growth and implementing the Lisbon goals have been taking place since 2005. Knowledge and a knowledge-based economy and society are the most frequently used concepts when talking about growth. It is not surprising, then, that research and development (R&D) comprise a key part of strategic documents. Slovenia's primary development document relating to R&D is the National Research and Development Programme (NRDP), which incorporates the most general R & D objectives and policies from national strategic documents in a comprehensive range of sub objectives and measures for their implementation. From a total of 60 measures included in the NRDP, 41 (two-thirds) relate to supporting technological development and the economy, and 14 (almost one-quarter) are directly targeted at strengthening co-operation between the public research sphere and the business sector.

1.1 The institutional design of research policy in Slovenia

In Slovenia, research and development policy and funding is the main responsibility of the *Ministry of Higher Education, Science and Technology (MHEST)*, established in 2003 following a cabinet reorganisation. The *Government Office for Growth* was established for the purpose of coordinating R&D activities. Its main competences are:

- coordinating the comprehensive planning of Slovenia's development;
- coordinating and monitoring the implementation of Slovenia's Development Strategy and the economic and social reforms aimed at improving welfare in Slovenia;
- providing expert assistance and collaboration with government ministries in drafting acts, implementing regulations and other acts necessary for the implementation of Slovenia's Development Strategy and reforms;
- coordinating government ministries and offices in effecting economic and social reforms;
- coordinating the preparation of development documents and setting up institutional structures for implementing all the development documents incorporated in the 2007-2013 National Development Plan of the Republic of Slovenia.

There are also a number of other bodies of institutional design cooperating in that field. A number of other government ministries have been encouraged to invest in research activities, especially the Ministry of Defence, the Ministry of Economic Affairs and the Ministry of Education and Sports.

Pursuant to its decision of 26 December 2003, the Government of the Republic of Slovenia established the *Slovenian Research Agency*, which began its operations on 1 October 2004. The Slovenian Research Agency has a public charter and is responsible to the Ministry of Higher Education, Science and Technology (as of December 2004). The role of the Agency is to carry out professional, development and executive duties related to the implementation of the adopted National Research and Development Programme, as well as to perform other duties related to the promotion of research and development activities and technological development. The Ministry of Higher Education, Science and Technology is responsible for drafting strategic documents and general policy, while the SRA is responsible for implementing the policy. The Agency carries out its legally-defined tasks and duties in the public interest, making permanent, professional and independent decisions on the selection of programmes and projects that are to be financed by the National budget and other sources of funding.

The SRA uses several instruments in support of research activities in Slovenia. It is responsible for financing research activities, as well as for investments in research infrastructure and the development of human resources. In Slovenia, research activity is divided into research *programmes* and research *projects*. The main aim of research programmes is to ensure the *long term stability* of research groups across all main scientific disciplines. The last public call for programmes stressed the importance of the interdisciplinary research, networking and social and economic utility of the proposed research. Research programmes are carried out by programme groups at public research institutions, universities, independent education institutions and programme groups organised by public and private legal entities on the basis of concessions. Programme groups comprise a head of group, at least five researchers holding a doctorate and technical staff from one or more research organisations. Programme members can participate only in one research programme. The public call for

existing programmes stressed the importance of interdisciplinary research, whilst public call launched in April 2008 also emphasised the need to present the results of the research to the general public. The SRA is currently funding 262 research programmes.

Project funding has a more competitive basis. Post-doctoral projects and applied projects (of which at least 25% must be co-financed by the end user) are given priority. Both projects, however, are currently based on the bottom-up principle, with the exception of the targeted research project (CRP), where the approach to funding is top-down. As a result of the research policy orientation, the proportion of applied projects (compared to basic projects) is expected to increase significantly over the next few years, especially in engineering and life sciences. In order to follow the Barcelona aim, the public funding of R&D will gradually increase and will be progressively directed towards promoting research in priority areas, such as information and communication technologies, advanced materials (including nanosciences), genomics and health biotechnology, process management technologies, technologies for sustainable development, social exclusion and, of course, natural and cultural heritage. A *basic project* covers experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of the phenomena and observable facts, without any particular application or use in view. An *applied project* is also an original investigation undertaken in order to acquire new knowledge. It is however, directed towards a specific practical aim or objective. Applied research may include industrial research. An industrial project is planned research or critical testing to acquire new knowledge with the aim of using that knowledge in the development of new products, processes or services, or in the implementation of significant improvements in existing products, processes or services. Research within a CRP is problem-oriented and targeted towards improving Slovenia's competitive capacity, which should form the basis for successful development and increasing the standard of living of its inhabitants. It takes into account the basic guidelines from the Slovenian Economic Development Strategy on the sustainable development of Slovenia and the interrelation and dependence of economic, social and environmental dimensions of development. This means that a CRP must be understood and used as one of a set of tools that directly implements the Slovenian Development Strategy and other development programmes in Slovenia.

The programme for funding *young researchers* is one of the most important and successful financial instruments. Its aim is to develop the critical mass of researchers (PhDs) necessary for a successful research system. Funding postgraduate studies and research training for young researchers is an important scientific policy instrument at the Agency. The programme, which has been running with great success since 1985, has played a significant role in increasing in the quantity of research taking place in Slovenia and reducing the age profile of research groups. The programme's success has led to the Agency dedicating a significant amount of its budget to the funding of training. To date, a total of 5,347 young researchers have participated in the programme. Funds for the training of young researchers are allocated for a fixed-term, up to a maximum of four years and six months for a science PhD programme (doctorate). This instrument also provides an important link between research institutions (academia) and the business sector. There are also efforts to stimulate trade-offs and synergies between policies. For example, an extensive programme run by the SRA – the Young Researchers Programme – which funds the education of PhD students, attempts to establish a connection between the academia and the economy. We recently witnessed the introduction of the Young Researchers for Enterprises programme, where PhD

students are partly financed by the SRA and partly by private enterprise. This represents a direct link between academia and enterprises. In Slovenia, reforms aimed at delivering the Lisbon Strategy's goals are firmly integrated within a comprehensive strategic development framework. Adopted in 2005, Slovenia's Development Strategy sets out the main developmental goals based on the Lisbon Strategy's objectives and defines the priority measures for their realisation. The Programme responds to the challenges of the Lisbon Strategy through measures aimed at restructuring the economy, further liberalising markets and increasing competitiveness, improving government efficiency and boosting the growth of the economy and employment.

The funding of research programmes and projects represents the main instrument for promoting scientific research at universities and non-university public research establishments, and accounts for 48% of all budget funding. Another 19% goes for funding young researchers, 12% for funding research infrastructures, and 20% for other funding. In the mid-1990s, the National Research Programme established a structure of funding according to the main scientific fields.

2 Transparency and information systems

The institutional design for supporting science in Slovenia determines the SRA as an independent public research funding agency. As an intermediary institution, it bridges the space between the state and the research community (van der Meulen, 1998). The role of intermediary institutions is to balance the interests of two ends of the same stick and to enable exchanges of information and bottom-up ideas. The nature of these institutions is to build relations based on consensus and inclusion rather than instruments of classical state control. The aim of such a system is to build 'control on a higher level' based on interactions and the functional as well as the relative autonomy of the participants (Mali 1998). The role of independent institutions of this type is to launch political interests in the sphere of science and to transfer the interests of science into the political arena (van der Meulen 2003). These institutions are predominantly formed with the aim of implementing governmental research policies. It is characteristic of specific research policies of the last few decades that they no longer follow the principle of *laissez faire*, but are ever more focused on achieving economic benefits for societies (Van Rossum 1994). Hence, knowledge management is becoming a key factor of competitiveness, leading to a fundamental reconsideration of the principles of strategic management (Rodrigues 2003). One key question to be answered by research councils is how to distribute money as impartially as possible, based on criteria of scientific excellence and at the same time to motivate scientists to achieve standards of scientific excellence (Braun 1993; Braun 1998).

The formal introduction of public access to information as implemented at the beginning has not adequately resolved the question of transparency in the modern sense. The *de jure* right to access all information was not exercised efficiently, while real access to information was limited by high barriers. *De facto* access was only assured to a very limited audience, while it was usually accompanied with high costs of physical access (Demšar, 2006). Therefore, the real transparency of governmental actions was not achieved. Broad public awareness of the importance of the transparency concept grew by the end of the 1980s, with the emergence of stronger demands to incorporate elements of the private sector into public services. But the true revolution was brought about by the invention and broad use of the

Internet. Information technologies based on the Internet enable effective analytical work and consequently the optimisation of the policy-making process. At the same time, they provide a tool for end-users and the general public to control policy-making bodies and the performance of publicly financed institutions (Meijer 2003).

2.1 The SRA's transparency system

In the light of stimulating scientific excellence, maximising cost efficiency and fairness of money distribution, the SRA introduced several instruments to ensure the transparency of its work. The implementation of a transparency system involves a complex and evolving process. Its aim is not only to disclose the procedures within the institution but, ultimately, to improve the quality of scientific results – to achieve good value for the public money that is invested. Modern information technologies and new approaches to collecting and processing data provide grounds for the development of procedures which were hard to imagine only a decade or two ago. Traditionally, the results of publicly financed research were sent to authorities where reports were usually checked only for the formal achievement of aims, and scientific results were published in academic journals. The availability of these results or even the substance of research (especially if not published) were unavailable to the broader research community and especially the general public. Scientific journals are usually very specialised and directed at specific target groups, whilst files sent to public authorities often ended up on the shelves of public servants or in institutions' archives. This is in contrast to the principle of the '*right to know*' and counterproductive from the perspective of implementing the Lisbon agenda. From both perspectives, the dissemination of results is crucial if the desired effect of public funding is to be achieved. The limited availability of results disables broader collegial critiques of research work and makes networking between researchers more complicated (due to the lack of basic information about research interests and experiences). Such conditions create fertile grounds for research activities which do not really contribute to the development of further synergies and social progress.

Building and implementing a transparency system is a high priority of the SRA and, over the last decade, great effort has been made along these lines to establish a complex and sophisticated transparency system. It is clear that the implementation of transparency does not have direct and immediate effects, but some indicators already show effects. The SRA transparency system rests on the three pillars presented in the figure below.

The first pillar represents *financial transparency*. The crucial question of all public systems is how to minimise anomalies in the system, especially how to minimise uncontrolled and mismanaged financing. The selection process based on peer reviews and quantitative (bibliographic) data has proven to be a good solution for the selection of promising research proposals, but the financial aspect is often neglected. The financial aspect is important for both the general public and researchers. The public has the right to detailed information regarding public funding. This goal is traditionally achieved by annual summary reports. Accurate financial information is important for researchers as well. For the efficient management of projects, it is important to have good and up-to-date information about financial transactions. Due to the frequently poor communication between financial departments at centralised research institutions and researchers, the lack of information regarding money flows was often seen as a barrier to a more optimal planning of research activities.

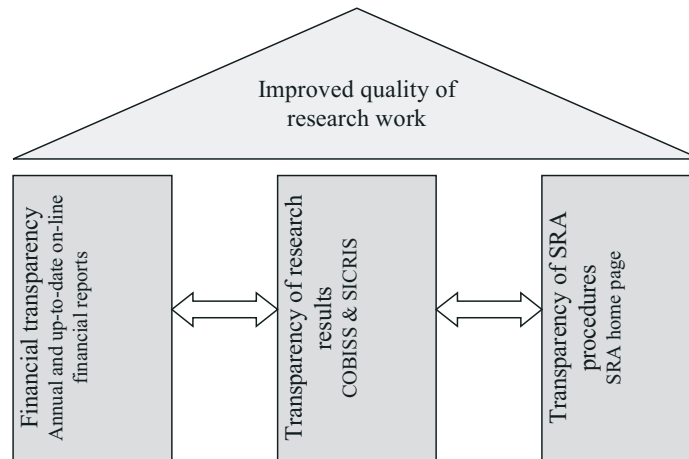


Figure 1: The transparency system as developed by the SRA

Hard-copy annual reports on funded projects have been published in Slovenia since 1958. In 1998, an e-version of the report (a so-called white book) was posted on the SRA's home page. This e-publication improved access to the publication significantly. Annual reports improve control over financed activities but due to their ex-post nature, they do not contribute much to project management. A revolutionary innovation which enables up-to-date insight into research financing was introduced in 2006. The 'up-to-date' online white book was created to enable researchers and anyone interested in financial information to check all financial transactions with researchers. The white book allows searches according to different parameters (researchers, institutions, projects...) of financial transactions. This system enables the tracking of entire SRA financial flows in real time. The new system has provided researchers with complete information about the money they receive, which helps them plan their activities. The new instrument also enables any individual to verify the amount of public money transferred to a certain institution or individual.

For the purpose of presenting an accurate figure for research activities, the financial pillar is supplemented by a pillar providing the *transparency of results*. Two information systems have been developed by the Institute of Information Sciences (IZUM) to represent the entire research output of each individual researcher. As mentioned, it is widely accepted that publications are a fairly accurate measure of the quality of research output. Slovenia has a centralised system of researchers' bibliographies (COBISS). COBISS was introduced in 1994 and became an obligatory part of the evaluation system in 1997. In the COBISS information system, all publications of all researchers are presented in a standardised manner. The system for categorising publications was prepared in co-operation with researchers. The introduction of COBISS as an evaluation tool increased the objectivity of the evaluation process. The criteria for evaluating publications are available and anyone is easily able to determine the significance of publications according to pre-set criteria. Bibliometric criteria are also combined with the peer review procedure, whereas it is necessary to combine criteria on the researchers' track records with the substance of the proposals for the selection of the best researchers and proposals.

The second system is SICRIS (Slovenian Current Research Information System), introduced in 1998. SICRIS incorporates substantial information on research and the most important research results (of scientific and socio-economic significance). The SICRIS system provides information on all projects funded by public money.¹ It is, therefore, an integral system which in a significant way supplements COBISS with more substantial information. It is also of much interest and use to the wider public and industry. Namely, it provides information about existing knowledge and fosters the transfer of knowledge between researchers as the manufacturers of knowledge and industry as the final user.² The SICRIS system is also a crucial source of information for the general public and the scientific community, whilst helping to integrate knowledge and create new synergies. The real value of the first two pillars is achieved by their interrelation. All three information tools (the online white book, COBISS, SICRIS) are interrelated and it is a simple matter to examine all parameters in the one place (e.g. project funding, project's bibliographic output and a useful description of the most important results).

The last pillar of transparency refers to the SRA's *internal procedures*. The aim of the first two pillars is to raise the quality of research and integrate knowledge into the economy. The aim of implementing the last pillar is to optimise the SRA's internal procedures and make them fully transparent and available to the public. All procedures have to be disclosed with the goal of improving the legitimacy of the system. All data are available on the SRA's home page where it is relatively easy to find information on all existing and planned project tenders (a year in advance), timetables for project evaluation procedures and evaluation methodologies, as well as a list of selected and rejected applications. The names of all members of permanent or temporary expert bodies are listed on the SRA web page. The legitimacy of procedures is determined by the acknowledged scientific merits of those participating in the decision-making bodies. Therefore, it is important to attract eminent scientists to the decision-making process and present them to all those interested via the institutional web page. The traditional role of researchers as peer reviewers is therefore upgraded with decision-making powers. The relative influence of researchers on the decision-making process varies between procedures, but their voice is heard in all SRA decisions.

The three-pillar transparency system of the SRA enables the mutual control of all actors interested in research activities. It also means implementing of the principle '*the right to know*', which refers to the right of the general public to have an insight into the distribution of public funds and its results. The system is also valuable for the mass media which is able to receive up-to-date information about research activities. Nevertheless, it is important that the public has independent access to unfiltered information and can therefore scrutinise or supplement information received via the mass media. Thus, the SRA transparency system indirectly influences the mass media to present correct and accurate data about research activities and research policies. Implementation of the transparency system requires significant institutional effort. It drastically changes existing procedures and the perception of the relationship between the scientific public and the institution and general public. It challenges the hierarchies and filtering of information, which is leading to a situation whereby

1 The system also contains some information about privately funded research, but these records are submitted by researchers or enterprises on a voluntary basis.

2 Over the last few years, the importance of SICRIS has risen rapidly. In 2005, the system registered about 140,000 'search' operations, whilst in 2006, the number increased to more than 220,000 operations (IZUM, 2007).

all actors are exposed to the permanent control of all others participating or interested in the field of science.

2.2 Impacts of the system

The introduction of the transparency system challenged the SRA's internal structure and procedures. These challenges go beyond administrative procedures and have influenced the institutional design and perception of work. The main SRA statutory function is to deliver national research money according to the priorities set by the ministry responsible for science and national strategic documents. Within this general framework, the SRA has autonomy to establish operating procedures. The implementation of the transparency system introduced changes and enhanced the inclusion of researchers in the decision-making process. From the institutional point of view, the leitmotiv of transparency is the predictability of procedures and criteria. All procedures which the SRA operates under are adopted by the *Management Board of the Agency*, comprising the representatives of different stakeholders. The second set of rules refers to the process of project/grant selection. Since it is sub-optimal to use the same criteria for all branches of science, separate methodologies were prepared for each discipline and for each instrument used by the SRA. The proposals were discussed by representatives of the research community (separately for each discipline) who participate in the SRA's permanent working bodies. Once the methodology was adopted, it was published on the SRA's home page where it is available to anyone interested in it. A broad discussion of the methodologies and assessment criteria and its public availability make the procedures more legitimate and anyone can verify whether all the procedures are progressing exactly according to the agreed system. Such permanent control of all partners forced the SRA to strictly follow all procedures and optimise its internal processes. A precise timetable is prepared for each tender, where all operations regarding the tender are linked to a precise date. The predictable time scale creates an environment where researchers are informed about forthcoming tenders and have enough time to prepare high quality project proposals.

The second set of transparency system influences is connected with research performance. Science is international *per se* and publication in eminent international journals is a dominant criterion for the evaluation of research outputs. As one's scientific reputation is mainly based on quality publications, we presupposed that easy access to a standardised and reliable list of publications enhances the interest of researchers to boost their reputation by publishing their work in international journals. Namely, their bibliographic record is only a few clicks away from anyone interested in a particular scientist.

Figure 2 presents the volume of publications by researchers from Slovenian research institutions in ISI-indexed journals. The figure uses cumulative numbers of publications for the whole of Slovenia. We found that the fracture of the straight line occurred in 1998. The yearly increase of publications after that year is significantly higher than before. Since the introduction of COBISS, the reputation of researchers is no longer based on abstract criteria but is grounded on solid quantitative data available to all. Potential partners, students or users can examine individual publication records and use this information as a factor when deciding about co-operation.

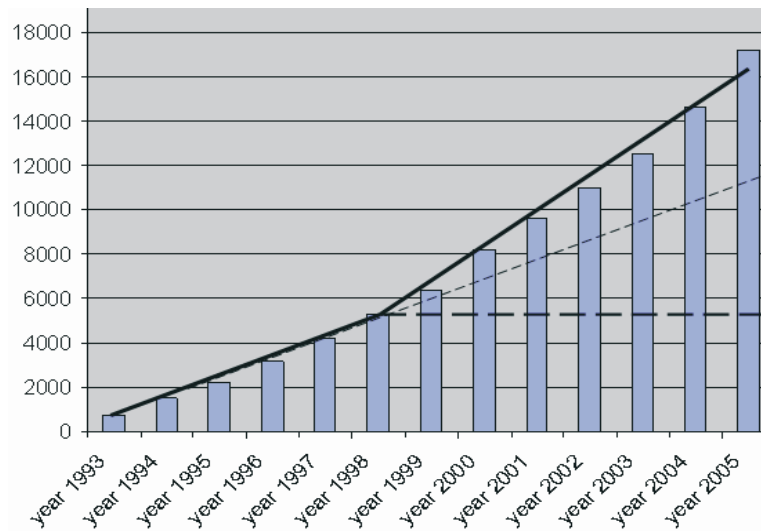


Figure 2: volume of publications in ISI-indexed journals
 source: http://wos.izum.si/NSI/wsi_cgi/begin.cgi

Other effects of the implementation of the transparency system in the SRA are not yet as evident or cannot be distinguished from other effects. For illustration, we emphasise that the ongoing changes in the development of the SRA's transparency system have been very well accepted by the research community and users of knowledge. The up-to-date white book is a new tool which promises much, and the initial feedback from the research community has been very positive. The new system enables them to plan their research work better. The whole transparency system is especially important when looked at through the lens of the implementation of the Lisbon strategy. The definite goal of allocating 3% of GDP on research and technology development is an ambitious target that is difficult to achieve. The transparency systems contribute significantly to achieving this goal from two perspectives:

- they underline the argument that the invested money is being spent efficiently; and
- they show why there is a need to invest in research – by displaying the concrete results of these investments.

The influence of the SICRIS system is also very hard to evaluate directly but, as stressed above, the enormous increase in use of the system shows that the topic is also of interest to the wider public. The number of 'search' operations in the SICRIS system is selected intentionally as it shows the level of interest in concrete information and does not simply indicate all visits (including those visiting a page by coincidence).

3 Conclusion

In the paper, we presented the implementation of the transparency system at the Slovenian Research Agency. The results show that the disclosure of institutional procedures and data about the researchers and their outputs establishes a climate that brings about a spontaneous increase in research quality. The 'soft' instrument of self-evaluation and the building of sci-

entific merit through respective bibliographic records encourage researchers to publish their research results in respected journals. Their work is under the constant scrutiny of their colleagues and the general public and the total disclosure of their work helps identify the most successful scientists very easily. Data from the ISI information services shows that the effects of transparency are visible and that quality has increased following the introduction of transparency instruments. Over the last few years, the use of information tools has become an important instrument when deciding about collaboration with researchers. But as the case study of the SRA shows, the implementation of transparency systems is a long-term project, which is not easy to implement and where the results are usually not immediate or easy to measure.

Extensive communication is crucial to achieving the above-mentioned goals. Without the co-operation of the general public, the role of the 'invisible hand of the public' will be limited. But with the inclusion of modern information technologies, the active role of the general public is made possible and feasible. Motivating the general public to participate, instead of only enabling them to participate, is one of the main motivations for the further development of transparency systems, which are at the same time crucial for their survival and success. We believe, and on the basis of the SRA's experiences it has proven to be the case, that the implementation of transparency instruments and latent public control have produced a climate where all actors actively participating in utilising public money are interested in a positive image for themselves and thus improve their performance in order to improve their reputation. By using transparency instruments and modern IT technologies, these actors are 'forced' to optimise their procedures and the quality of their performance. We therefore believe that the introduction of transparency instruments in the public sector is an effective substitute for the economic instruments prevailing in the business sector. We believe that in terms of effectiveness, the public sector will close the gap with the business sector and that transparency is one of the most important instruments for ensuring that this goal is achieved.

4 References

- van der Meulen, B. (1998): 'Science policies as principal-agent games. Institutionalisation and path dependency in the relation between government and science', *Research Policy* Vol. 27, No. 4, p. 397-414.
- van der Meulen, B. (2003): 'New roles and strategies of a research council: intermediation of the principal-agent relationship'. *Science and Public Policy* vol. 30, No. 5, p. 323-336.
- van Rossum, W. (1994): The political economy of research councils: Different roles of research councils in science policy. *Knowledge & Policy*; Spring 94, Vol. 7, No. 1, p. 63-79.
- Mali, F. (1998): Intermediarne strukture in dru beni sistemi znanosti. *Dru boslovne razprave*, Vol. 14, No. 27/28, p. 171-182.
- Braun, D. (1993): 'Who governs intermediate agencies? Principal agent relations in research policy-making'. *Journal of Public Policy*, Vol. 13, No. 1, p. 135-162.
- Braun, D. (1998): 'The role of funding agencies in the cognitive development of science'. *Research Policy*, Vol. 27, No. 8, p. 807-821.
- Demšar, F.; Boh, T. (2006): Transparentnost raziskovalne dejavnosti v Sloveniji. *Organizacija znanja*, Vol. XI, no. 4, p. 128-136
- Guades, V. S.; Pereira, A. G. (eds.) (2006): *Interfaces between Science and Society*, Sheffield: Greenleaf Publishing.

Meijer, A. J., (2003): Transparent Government: Parliamentary and Legal Accountability in an Information Age. *Information Polity*, No. 8, p. 67-78.

5 Sources:

(2004): Statut javne agencije za raziskovalno dejavnost Republike Slovenije, dostopno na: <http://www.arrs.gov.si/sl/agencija/akti/statut-ARRS.asp>

NRDP (2006): National Research and Development Plan 2006-2010, Government of the Republic of Slovenia.

Internet 2: <http://www.transparency.org> (15.4.2008).

Internet 3: <http://www.arrs.si> (30.3.2008).

Internet 4: http://wos.izum.si/NSI/wsi_cgi/begin.cgi (10.8. 2007)

Internet 5: http://www.bis-rtd.net/documents_wp2.php

6 Contact information

Dr. Franci Demšar

Slovenian Research Agency

Tivolska cesta 30

1000 Ljubljana, Slovenia

phone: +386.1.400.59.51

fax: +386.1.400.59.20

e-mail: franci.demsar@arrs.si

Dr. Tomaž Boh – corresponding author

Slovenian Research Agency

Tivolska cesta 30

1000 Ljubljana, Slovenia

phone: +386.1.400.59.68

fax: +386.1.400.59.57

e-mail: tomaz.boh@arrs.si