

RTD Information Systems in Serbia: Mapping and Assessment

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Abstract: Based on previous analyses of the author and opinions of a group of experts interviewed for the purpose of this report, a critical assessment of the state of the art of RTD ISs in Serbia was made. The focus was concentrated on the level of integration and boundaries to integration. The overall quality of ISs was estimated as satisfactory. The critical shortcoming of the system as a whole was judged to be its fragmentation and unrelatedness, indicating lack of strategic planning. The other general weakness is the lack of internationality. Hence, the integration of individual resources at the national level and connectivity and interoperability at regional and European level are seen to be the natural next steps in further developments of the system of R&D information in Serbia.

1. Introduction: Methodological Remarks

This report is based on:

- (1) the previous report by the same author prepared in 2007 for joined euroCRIS –SEE-ERA.net session [1];
- (2) developments in the last two years as scanned by the author;
- (3) analysis of the state-of-the-art of integration of bibliographic RTD systems in Serbia performed for the SNTPI 2009 – the annual conference on scientific, technological and business information;
- (4) CEES report “Scientific Performance of Serbia in 2008” prepared for MSTD; and
- (5) expert opinions of five top national information scientist specialized in scientific information systems interviewed in October 2009 for the purpose of this report.

Evaluation of the individual systems was made by comparisons with analogues national systems in the countries of EU, not with the situation in other WBCs. Value judgments might be biased by the fact that the author is better familiarized with some applications, most notably the ones developed by the CEES as his own institution. Also authors selection of experts is correlated with the level of cooperation with various specialists active in the field.

The report is not concerned with the perception of the RTD system under consideration by individual researcher and decision-makers. This was left to another report describing situation in Serbia. However, in discussing prospects for integration of information systems in the country and in the region, some governmental documents and public attitudes of government officials have been taken into account.

Only RTD information systems produced in Serbia were submitted to the analysis. Mapping and evaluation of international products which are not intended to exclusively serve domestic academic community, such as citation or full-text journals databases have not been regarded as a matter of interest for this report. Consequently, services providing access to such resources, have not been treated as RTD systems, although some of them e.g. KOBSon services, are of utmost importance for the national R&D. For the same reasons regional pilot databases e.g. ERA West Balkan RTD Database were found to be uninteresting for this overview and evaluation.

2. Mapping Serbian RTD Information Systems

2.1. Inventory of existing databases and information systems on RTD capabilities

RTD information systems in Serbia are normally produced by small self-organized groups, mostly informal, rather than derived from the national R&D strategy and initiated by the government. The Government of Serbia traditionally saved its efforts for building ICT infrastructure, and other related priority programs, such as provision of international journals and databases. System of Science and Technological Information of Yugoslavia (SNTIJ), a large-scale project launched before this country disruption and continued in Serbia for some time in its survival form (as SNTIS), was concentrated on building infrastructure and library system support, leaving databases development literally “to interested parties within the academic community”.

In recent years, some of the individual projects earned the trust and support by the Ministry of Science and Technological Development (MSTD), or the Secretariat for Science and Technological Development of Autonomous Province of Voivodina (SSTD). Most of the resulting databases, repositories, registries, and online services are still in developing phase, some are at the early beginning of public exploitation, and only few of them entered the stage of mature development, stable financing, and regular maintenance (table 1).

The existing web-based databases, services, and registries in Serbia do not always meet criteria for modern ISs. Some of them are not robust enough or easy to use, while the other are not extensible or “future proof”. Still, their general quality and adequacy exceeds the level of their exploitation, especially by the decision makers. Some of the services e.g. MiuWOS are extremely popular in the country, while the other, such as SCIndeks are more visited by international users. Some of the ISs , e.g. Journal Bibliometric Report are explicitly built into the acts of the MSTD regulating RTD activities as a ground for decision-making.

Table 1. Web based RTD databases and services in Serbia

title and location	publisher	content	size	status	CERIF compliancy
Science and Research Organizations http://147.91.185.4/nio/fakulteti.asp http://147.91.185.4/nio/instituti.asp	MSTD	accredited institutions	small (127 entries)	under development	none
Serbian Scientists Abroad http://nasiunvetu.nauka.gov.rs/index.php?lang=eng	MSTD	persons	small (307 entries)	under development	none
Capital Equipment http://www.nauka.gov.rs/nip/	MSTD	equipment	small (376 entries)	under development	none
PhD Repositories at the University of Novi Sad, Niš and Kragujevac http://diglib.ns.ac.yu/frontOffice/index.jsp http://oramiror.junis.ni.ac.yu/docr_web/plsql/-doc_pretraga.pocetak http://www.kg.ac.yu/dokd.asp	University libraries	PhDs	small (165+ 647+ 133entries)	under development	none
Researchers Files http://apv-nauka.ns.ac.yu/vece/indexd.jsp?zd_dokumentId=-80&Oblast=13	SSTD	persons	medium (aprox. 2.600 entries)	irregular maintenance	partial
E-CRIS-SR: Information System on Research Activities in Serbia http://e-cris.sr.cobiss.net	IZUM, UBSM	persons, institutions	large (7657 persons, 91 institutions)	under development	partial

title and location	publisher	content	size	status	CERIF compliance
SCIndeks: Serbian Citation Index http://scindeks.nb.rs/	CEES	locally published journals	large (more than million references from more than 100.000 articles)	updated weekly from 2008 on	indirect
DOPISNIca: Digital Online Portal of Integrated System of S&T information http://dopisnica.ceon.rs/	CEES	projects, persons, institutions, funds, and journals	large (10.515 persons, 186 institutions, 1.626 projects, 8 funds, and 483 journals)	beta version, evaluation data updated weekly	full
Journal Bibliometric Report http://scindeks-bic.nb.rs/	CEES	journals	large (523 national journals)	regular annual publishing since 2002 on	indirect
MluWoS http://kobson.nb.rs/nauka_u_srbiji/nasi_u_wos.3.html	NLS	Articles of Serbian authors published in WoS journals	large (more than 21.000 articles)	regular update from 2000 on	none
NLS Repository http://repozitorijum.scindeks.nb.rs/	NLS	national journals, archived	large (590 journals)	regular update from 2002 on	none
doiSerbia: Digital Object Identifier Repository http://www.doiserbia.nb.rs/	NLS	Cross-Ref national journals	small (48 journals)	regular update from 2002 on	none
* given by five experts on five-point scale; MSRS: Ministry of Science and Technological Development; SSTD: Secretariat for Science and Technological Development of Voivodina; NLS: National Library of Serbia; CEES: Centre for Evaluation in Education and Science; IZUM Institute of Information Science, Maribor; UBSM University Library "Svetozar Marković", Belgrade					

Most of the RTD ISs in Serbia don't follow international standards. Practically, only DOPISNIca is fully CERIF (Common European Research Information Format) compliant. Obviously, they are almost exclusively intended for domestic users. Only a few of them have a proper English interface and professional Help, and some are even accessible only for the users of the Academic Network of Serbia. This is somehow in discord with the fact that Open Access is well accepted in Serbia. Namely, almost all of the national scientific journals are now published in OA regime, and there is also several comprehensive and regularly updated institutional repositories.

All ISs listed here, except DOPISNIca, E-CRIS-SR and PhD Repositories, are supported, either by the MSTD or SSTD. There is some duplication of ICT projects supported by the two governmental bodies indicating lack of strategic planning and coordination. It seems that R&D authorities and information scientists in Voivodina tend to gather and publish information about R&D activities in the region which are already contained by the ISs developing for the national level, which is a classic case of duplication of efforts

2.2. Coverage of various R&D entities

Not all CERIF entities are evenly covered by the existing RTD ISs. As evidenced in table 2, bibliographic products of individual researchers are generally best covered. Other data on individuals, especially their technical skills and research interests are less available. The most poorly represented are data describing research organizations, most notably information on their capacities (equipment, facilities).

There is also a visible discrepancy between data availability and data quality. As to the quality, up-to-dateness is the chronic problem. Also reliability of data in many applications are below standards. Generally resources used for evaluation purposes are of highest reliability. Journal Bibliometric Report and SCIndexs contain more accurate information than their famous international counterparts, Journal Citation Report and WoS.

Table 2. Coverage of various CERIF R&D entities

	Data Availability	Data Quality
Persons: Conact, CVs	++	+
Persons: Skills, Interests on cooperation	-	
OrgUnits: Contact, Basics	++	+
OrgUnits: Facilities	-	
OrgUnits: Equipment	+	-
OrgUnits: Services	-	
Ongoing Projects	+	-
Results: WoS publications	+++	++
Results: WoS citations	+	+
Results: Local publications	+++	+++
Results: Local citations	+++	++
Results: Monographs	+	++
Results: PhDs	+	+
Results: Patents	-	
Results: Products	-	
+++ very good; ++ good; + satisfactory; – non-existent or bad		

2.3. Conclusion

In conclusion, individual web-based RTD ISs in Serbia are generally of a good quality. They suffer the problem of non-timely maintenance, they also vary in data coverage and reliability, but taken together, they meet basic needs of the members of academic community. Also, they offer decision makers more than they are presently ready to utilise for evaluation, quality control, and strategic planning.

What Serbian ISs lack the most is friendliness for users outside national academic community, both international and those coming from industry. To achieve the former, developers of ISs have to ensure multilingual interfaces, common exchange formats, and international classifications. In years to come, this challenge will be difficult to meet without more coordination, or even centralisation, ending with an integrated national RTD information system, entirely incorporated in the European system of information exchange. This task would be easier to achieve if undertaken within international projects.

3. RTD Information Systems Integration in Serbia

Considering scope and quality of the few already operational systems and the importance of existing in-house databases of the MSTD and SSTD, building national RTD information system from the scratch is not necessary. Instead, an integration of all present databases and registries into a modern distributed controlled system (DCS) is a more feasible solution to the problem. In a paper prepared for

the Annual Conference on the System of Research Technological and Business Information integration of RTD information systems in Serbia were analyzed from developmental point of view, within the context of building e-Government in Serbia [2]. State-of the art of such systems was mapped with the focus on bibliographic information. Results achieved and barriers to further integration were discussed. Almost all findings are directly relevant for this report.

It was claimed that in Serbia, a relatively high level of integration of the bibliographic information systems has already been achieved. At least some of the existing applications can be said to have been developed within e-government, since they are funded by the Government, i.e. MSTD or SSTD, and have been utilized in their decision support systems.

3.1. The transition model for the national system of scientific information: CRIS-TraM

Present level of integration of RTD ISs in Serbia was achieved under CRIS Transition Model (CRIS-TraM) developed within the Centre for Evaluation in Education and Science (CEES). The only purpose of CRIS-TraM is to serve integration of domestic SSTI and its harmonization with European standards. It is a custom version of CRIS (Core Relating Information Systems; also Current Research Information Systems) based on CERIF.

The main difference between the general model of CRIS and CRIS-TraM is in a position of national journals as entities. In CRIS journals are not treated as a separate entity, while in CRIS-TraM they are given the status even of the core entity. Privileged position of the local journals in CRIS-TraM comes from their special role in the development and evaluation of science in Serbia, both in the past and in the transition period.

Other differences are mainly related to the use of different classification schema for the description of S&T entities that are officially used in Serbia, and can not be abandoned without changing the respective national legislations. The solution to this problem was found in the double, mutually convertible metadata descriptions, one of which are used for domestic and other for international needs. Such a procedure (called "double accounting") was conceived as a temporary solution. It should be used only during the transition period, until domestic R&D sector is fully harmonized with practices within the European research area.

3.2. The level of organization: Integration of CEES resources

Based on the CRIS-TraM an application called DOPISNica (Digital Online Portal of Integrated System of Scientific and Technological Information) was developed. DOPISNica contains information on research institutions of Serbia, their projects, employed researchers, and programs under which they are financed, as well as information on the locally published scientific journals. It also contains information on performance of all subjects in WoS and SCIndeks, as the two most relevant evaluation databases. In the present stage of portal development, only information concerning the projects, journals and researchers are available to a satisfactory extent. Information on organizations, especially those that are subject to frequent changes, are missing or are outdated. The process of their regular update is suspended until the decisions of the competent ministries on support for further development DOPISNica are made.

DOPISNica was made integrated with SCIndeks (table 3). To ensure the full integration, SCIndeks data model was redesigned to be entirely compatible with CERIF. Data on bibliographic performance of researchers are in DOPISNica given in the same format as in the MSTD act regulating evaluation and promotion of scientists. Thanks to integration with SCIndeks (and WoS) the Results Table of researchers and organizations in DOPISNica are updated online, on weekly basis, as soon as the new records appear in the two evaluation databases.

In addition, tools for the transfer of data from the MSTD registries on accredited institutions (SRO/NIO) and capital equipment (NIP) were developed and utilized in DOPISNica initial data inhabitation. SCIndeks was recently integrated with Open Journal Systems, an open source platform for journal editing and publishing. The result of this operation, the system called Electronic Editing (e-

Ur), is in testing stage. Development of separate module for extracting from e-Ur information intended for evaluation of journals is in due course.

Finally, CEES is about to finish the development of a system for cross-checking originality (vs. plagiarism) of papers submitted to SCIndeks journals. The system includes a home-made tool for screening and subsequent automatic use of iThenticate, the leading plagiarism detection system also implemented in the CrossRef system. Otherwise, SCIndeks is linked with several international disciplinary base and services in a way that significantly raises the reliability of information and user comfort.

		Type of integration initiatives	
		Program specific	Enterprise Capacity Building
Organizational level	Inter-Governmental	NIO-SCIndeks*	NIO-DOPISNIca* Capital Equipment– DOPISNIca*
	Inter-Organizational	MiuWoS-BIC, VBS-DOPISNIca	MiuWoS-DOPISNIca
	Organizational	BIC-DOPISNIca, VBS-SCIndeks	SCIndeks- DOPISNIca, SCIndeks – iThenticate* SCIndeks-eUr
* data exchange established, without full interoperability			

3.3 Interorganizational level: Integration of resources of the NLS and CEES

The functional integration of bibliographic S&T resources of the National Library of Serbia and the CEES is achieved to a considerable extent. On the basis of long-term agreement on cooperation which, as a subject, has exchange of scientific information exclusively, the following information resources are interconnected: Repository of NBS, Virtual Library of Serbia, MiuWoS, Journal Bibliometric Report, DOPISNIca and SCIndeks. Integration is achieved to a different degree, at different levels (logical or data layer) and by various technological interventions, depending on the characteristics and requirements of individual services. In some cases it was necessary to make significant changes in the architecture to enable the sustainability of the development process. Due to integration costs of databases maintenance are dramatically reduced, reliability of data significantly raised and user-friendliness of all services. Integration of SCIndeks with Virtual Library of Serbia brings to the National Library of Serbia substantial savings which are reflected in the radical reduction of costs of bibliographic processing of information from local periodicals. On the other hand, MiuWoS provides DOPISNIca with information on the international performance of local authors and institutions.

3.4. Governmental level: Initiatives towards MSTD

In CEES plans for conjoining of non-bibliographic information (e.g. patents etc.) to already achieved integrative resources are completely worked out. Within the project for further development DOPISNIca initiative has been launched to interconnect existing NLS and CEES databases with registries and internal databases of MSTD. Several successive initiatives towards MSTD aimed at further information exchange and deeper integration have been launched. The responses of the MSTD are slow and unclear, mainly due to budget constrains. However, MSTD doesn't seem to be efficient neither in creating a more favourable climate for capitalizing on potentials of individual groups involved in R&D software engineering. In a previous analysis of national information systems it was suggested that no single institution in the country has the capacity to create a functional, integrated RTD system of a national scale independently. It was suggested that only "joint venture of all the

active development groups, supported by experts from universities and innovation centres, coordinated by MSTD can lead to the success" [1].

3.5. Barriers and obstacles to integration

It can be seen from the above brief review that in Serbia an enviable level of RTD ISs integration is achieved, but only in the field of bibliographic information. The results worth mentioning comes from the two institutions only. Integration within a single organization is an easy task, even when it is technologically demanding. Hardly more complex is integration between the two institutions. In the case of CEES and NLS, there was no obstacles since both institutions share the same organizational values and seek the same goals, among which is the dominant open access to scientific information.

Much more difficult is to achieve the integration of applications produced by the number of institutions of various levels of aggregation. According to our insight, such an integration, either horizontal or vertical, has not been accomplished in Serbia so far. Neither it was accomplished at the level of government, i.e. its ministries of science, education and telecommunications, as responsible for R&D, or between them and institutions in their jurisdiction. Only recently such integration appeared in some public projections in creating e-government.

What obstacles lie on the way of integration and thus a higher level of functionality of RTD ISs in Serbia? A reliable answer to that question requires appropriate research. In the absence of findings, some judgments on the subject based on observations might be of help to RTD ISs planners, both local and international.

(1) Real needs for scientific information of domestic origin has still not been fully recognized within the academic community of Serbia. Consequently there is no requests, at any level, for S&T information integration. The official system of evaluation strongly encourages productivity, not necessarily followed by the quality. And only orientation on the quality would ask for higher impact which, in turn, would ask for higher visibility. Since the quality is not a must, researchers are not sufficiently motivated to urge for better representation of their products. To the contrary, various groups, formal and informal, still exert resistance to the use of impact (citation) data in the process of evaluation. Developers also are not very much interested in integration. Groups that exist within academic community and (in the absence of the real software industry) are engaged in the development of ISs are in mutual relationships typical of competition. The competition is severe, since they share the same scarce development funds. Business strategies of Serbian RTD ISs producers are characterized by closed, secret plans and individual rather than collective application for funding. To change this model of behavior in which all lose including MSTD as the financier, it is necessary to create a climate in which competition remains the ruling principle, but there is a room for co-operation as well. Such a relationship is described in the literature as a cooperative competition – cooptation. Cooptation would definitely be more fruitful model for functioning of software engineering industry in Serbia, since it is operating on a small market and works for a small community of clients. Cooptation as an ambient can only be created by the MSTD as the main sponsor of S&T in the country.

(2) The parts of the Serbian government in whose jurisdiction are higher education, research and development have still not recognized the need for decision-making based on valid information. There is a strong impression that the ministries responsible for implementation of e-government have not accepted the task with sincere enthusiasm. There are also evidences that the level of cooperation of the respective governmental institutions in working on common long-term objectives of this kind is relatively low or even non-existent. At the top levels of administration, e.g. in MSTD and SSTD, there are clear doctrinaire differences. There is no sign of mutual devotion to common goals, as in some good examples of so called joined-up government or citizen-cantered government.

3.6. Conclusion

Access to current scientific information and their sharing is an essential requirement in the process of creating the European Research Area [3]. The best way to achieve it is through integration of resources. In this process interoperability is a crucial tool, change organizational culture is a

necessary condition, and policy makers must have a central role [4]. It is evident that Serbian academic community is late in joining European integration. It is also evident that conditions for fulfilling this historic task can only be created by the government, i.e. MSTD which has to overtake full responsibility for the process .

4. Further Developments

4.1. Prospects for National Integration: Policy Context

Political and social integrations are permanent items on agenda of all post-2000 Serbian governments. In draft version of the new strategy of scientific and technological development of the Republic of Serbia various integrations are set as priority research area for social sciences and humanities. In a separate chapter (4:10) it was stated that "MSTD will develop methods for better monitoring of developments in science and research in the country, as well as the most successful experiences in the world in the domain of scientific and technological policy. Only in this way, based on real and accurate information, valid management decisions can be made. Firstly, work on a database of researchers in Serbia and our researchers in the Diaspora will be completed, as well as work on a database of scientific projects and institutions. Also, by working with the Institute for Statistics, and by modelling after international statistical surveys and analyses (OECD, Eurostat, EC DG for Research Report), the statistical binding forms closely related to the final financial report (final accounts) will be introduced for all the companies. In this way, the next three years (up to 2012t), MSTD will conduct a separate project and appropriate activities, and thus try to map the situation in Serbia and indicators necessary in the process of the Lisbon agenda" [5]. Also, in his introductory presentation of the Strategy, the Minister of science explicitly stated that one of the tasks to be launched was integrated database of researchers, their products, projects and research institutions.

Another strategic governmental document is also dealing with integration processes. "Starting from the analysis of existing situation in all public sectors and considering the objectives and vision of e-government, the aim ... is formation of logical and physical architecture of integrated information system of state bodies of Serbia and creation a detailed resource and time of the annual plans of development activities, including requirements of budget funds. All authorities and public sector organizations will adopt their own more detailed development plans based on this development plan. Established institutional mechanisms will be regularly monitored, evaluated and accordingly modified these development plans at the national and local level [6].

It seems that the strategy of building information society in Serbia is offering even better prospects for ISs developers in Serbia. Although there is a traditional gap between intentions and actions of the scientific state administration in Serbia, the above declarations can be judged as encouraging for all working on RTD ISs development and utilization. More detailed analysis of other recent governmental documents also paint generally favourable picture of the situation. Of course, financing new ISs projects by the government will probably have to wait until the global financial crisis which also severely affected Serbia starts to vanish.

4.2. Prospects for Regional Integration

Regional integration of the national information systems seems to be first natural step in integration of WBC countries R&D sectors in ERA. In spite of some political reasons against such an orientation, this appear to be the winning solution when discussed with field experts. Efforts in this direction would be easier and should bring immediate effects. The reached level of cooperation and citation exchange among the scientist of WBC countries is a guarantee that common information resources will be accepted as useful. SCIndeks usability statistics clearly indicate that the vast majority of its international persistent visitors come from the region. Official interests in joining SCIndeks, which is purely national database, were surprisingly expressed by journal publishers from Bosnia, Montenegro, Macedonia, Bulgaria and even Turkey.

However, there are also some reasons for caution. In the recent years there were too many trials to make various regional ISs which failed. Some of them build for the purpose of partnering heavily relied on the work of interested users whose expectations had not been fulfilled. Most of such resources are not maintained at all.

To start a new project on regional RTD IS one has to learn from the past bad experiences. It seems that step-by-step development approach with reasonable ambitions but insisting on sustainability is

the most promiseable strategy. Such a project can start with building a regional directory of organizations, ongoing projects, and most particularly on local journals. If filled with shallow data extensible to full CERIF, it would have better chances to be accepted and supported by all.

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