



# Bibliographic database as a support tool for knowledge management

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## Introduction

Knowledge management is a relatively broad concept. In the milieu of universities and research institutions it includes - among others - the presentation and evaluation of the results of scientific activities. Publication activity and participation at scientific conferences, symposiums and congresses are both very important when it comes to the presentation of scientific results of university teachers and researchers. Via these activities we can follow the directions of research and development on the level of individual scientists, institutions, scientific communities and the state as well. Information about these activities, however, is scattered at many different places around the world. The registration of publication activity is being done at various levels and with a different degree of detail and standardization. It is often required when the evaluation of individual researchers (habilitations, inaugurations, grant applications) or institutions (accreditations) is necessary. Scientific results of researchers are also being recorded in various bibliographic, factual and full-text databases. These databases are, however, created on the principle of a specialization or of a type. So if we want to follow the scientific activities of individuals, groups or nations, we have to search the data at various locations while the completeness of the selection is always a question of luck.

## Complexly defined bibliographic database

All the data which is needed for the registration and evaluation of scientific activities from the perspective of published outputs and of the participation at scientific conferences can be stored and processed in a special bibliographic database. A complexly defined bibliographic database contains files and records on 3 levels of distinction:

1. Bibliographic level, for which the records about publications in master file are dominant. Other types of records are derived from them - records about authors



(name authorities), records of references, records of source documents (a catalogue of periodicals).

2. Biographic level, where the record of creator (author) in the name authority file is dominant,

3. Scientometric level, where files of periodicals and of scientific actions are important.

The bibliographic database of publication activity must be built upon the appropriate library-information standards, mostly UNIMARC and ISO 2709 (the structure of records for the interchange), AACR2 cataloguing rules and the presentation standards and recommendations of ISBD, STN ISO 690 and Z39.50. Besides that it is necessary to use the authority files and encoding tables to enable the creation of nation-wide registrations and to exchange the records among universities. For having an opportunity of a complex information exploitation of this database it is necessary to create mutual links among individual types of records and files - as it can be seen in fig. 1. These are the links between the records of publications, name authority file, catalogue of periodicals and the authority file - scientific actions. For example the item described in the record no. 11241 has been written by the author registered in the name authority file under no. 061. The article is from a conference - the link to the authorities - scientific actions, record no. 121, and it has been published in the conference proceedings no. 272 (a link to the catalogue of periodicals, record no. 272). Some other articles (Makulova, Kimlicka) are linked to the record no. 121 in the authority file - scientific actions as well. Similarly the links to authority files and references are shown in the record no. 11242. As a result, it is possible to execute various operations and scientometric calculations over this database to produce outputs necessary for the support of scientific activities management. To ensure the highest possible level of completeness in recording the development of a researcher or of a scientific discipline it is also necessary to keep eye on qualification works which quite rarely get listed in the databases but which can contain valuable information. Well-processed and accessible databases of publication activity and of references offer a good picture of the profile and effectiveness of a research institute or university but mainly of individual scientists. Registration and presentation of publication activity and of qualification works on a national level is even more important as a part of the national bibliography system. Its importance here is multiple:

- It presents scientific community on a concentrated national platform within a world-wide system of national bibliographies.
- Processing the „domestic“ researchers' publications published abroad, the database of national bibliography is complemented with the records that are often otherwise unavailable and hence very valuable. It is necessary to mention here the project of national bibliographic registration of qualification works and of grey literature within the internationally recognized and - in the framework of global information environment - implemented system of universal bibliographic control (programmes of UBC and UBCIM).
- Complexly defined bibliographic database may serve as a basis for the biographic research as it can contain the publication activity of a researcher starting with his/her study years.

- It is possible to use this type of a bibliographic database - with the help of appropriate software systems - for various types of bibliometric and scientometric calculations.

### **Organizing the creation of virtual bibliographic database of science in Slovakia**

Registration of scientific, pedagogical and other professional activity via publication output seems to be very unpopular among research workers and university professors. Various kinds of publication activity and references listings are quite regularly or even randomly required by universities and colleges administrations, academy of sciences or research institutes headquarters, ministries, accreditation and grant commissions. Very often these requirements vary in the structure of records and in criteria for evaluation of different types of documents, citations or other kinds of references. These are particularly the categories of document types and their evaluation criteria that are interpreted differently depending on individual evaluation commission. The situation changes according to the orientation of commission members - some of them are only willing to accept the publications in „serious“ scientific journals ranked in Current Contents service meanwhile some of them are able to respect essayistic and popular articles even from the local press. There are some ambiguities in defining the document types and their scientific level as well as in distinguishing types of references. Nevertheless there is no universally valid objective way of evaluating the publication activity and the references. Each scientific branch, each discipline has its own specific features. In spite of all the objections the registration of publication activity and of references represents a meaningful and relatively objective tool of evaluating scientific and pedagogical activity. It is necessary to mention, however, that the data on publication activity itself does not replace the evaluation and, on the other hand, wrong data cannot serve as a basis for a reliable evaluation.

Qualification works are a very special type of documents - habilitation, dissertation, doctoral and diploma theses are the most significant among them and they are usually produced at colleges, universities and institutes of Slovak academy of sciences (SAS). These works are processed and collected very sporadically. Access to them is practically impossible with the exception of nation-widely registered dissertation works that are collected and processed by Univerzitná knižnica (University Library) in Bratislava. These documents are part of the system registering the grey literature. Registration and availability of these works has predominantly a historical importance, but their information and managerial functions are equally important. Historical importance of qualification works' registration lies - besides the documentation of qualification progress - also in the fact that it enables to complete crucial data in biographic researches of well-known personalities. Information function is evident mostly in connection with the role of grey literature. Managerial function consists in orientation and help with the selection of new dissertation topics and with the evaluation of qualification works.

From the point of view of a complete registration of both types of documents it is important to register and to process all of them, without any respect to their category. After a qualified selection of records from this complex database it is possible to create a virtual bibliographic database of publication activity of

scientists and researchers in Slovakia, which can be called SCIENTIA-SK. Potential organizational-functional model of the nation-wide system of processing data on scientific activities is described in fig. 2.

Organizational-functional model has 4 levels and represents the hierarchy of system elements, information flow and locations of providing the outputs and delivering document copies on demand:

- Level I. processing locations of registration and of recording data on qualification works - departments, resp. faculties, where only qualification works are processed, publication activity is processed on a university level
- Level II. processing locations of registration and of recording data on publication activity, scientific actions and qualification works, local databases and locations of document copy distribution on the level of faculty libraries where a central library exists
- Level III. processing locations of registration and of recording data on publication activity, scientific actions and qualification works, local databases and locations of document copy distribution on the level of central libraries
- Level IV. nation-wide www servers, resp. locations of central databases.

Local databases of publication activity and qualification works are created on the local level (universities, colleges, faculties, research institutes). These databases can be linked to the databases of electronic copies of documents (full-texts). At this level all categories and types of documents are being registered. The categories of documents express their scientific and professional level, their type specification and territorial impact, resp. importance. Registration databases are created on the nation-wide level as a part of SNB and the records contain a reference to the location databases where the links to electronic copies of documents could be found. On the highest level, the virtual database is compiled by selecting from lower level of nation-wide registration. Hence, virtuality of the bibliographic database SCIENTIA-SK is given by the opportunity of having access from one place to the filtered records from a complex SNB database with consequent links (references) to the records in local databases, their call-numbers, resp. electronic copies in local files, then by linking to the scientific and research actions in local databases and also by having direct links to the references on publications. Registration of all documents of this type without any respect to their present categorization gives us an opportunity to complement or to update the SCIENTIA-SK virtual database in the future.

Virtual view of these databases is also possible from the level of university, resp. college, which has local databases on the faculty level, or from the SAS level when looking at individual institutes. This is also the way to create specialized virtual databases for individual scientific branches or disciplines. The basic precondition for the creation of the system of nation-wide registration of publication activity and of qualification works is the foundation of a cooperative system that would be capable to register and to process bibliographically all these types of documents. For this purpose it is necessary:

- to select on optimal number of fields and subfields in UNIMARC format for the description of publication activity (references to it) and of qualification works,
- to prepare a working methodology for the creation of the above mentioned records in accordance with AACR2 cataloguing rules,
- to prepare a mechanism of interlinking the local databases into central databases on the level of universities and SNB, to ensure the duplicity check-up and the selection of their records to the SCIENTIA-SK virtual database,
- to provide access and maintenance of the SCIENTIA-SK virtual database on the Internet,
- to prepare the competition strategy for the selection of software suitable for the cooperative processing of publication activity (+ references) and qualification works registration,
- to prepare the methodology for the application of STN 01 0195, ISBD and STN-ISO 690 recommendations in the process of editorial preparation of scientific and professional publications in publishing houses,
- to prepare the methodology for the application of STN 01 0195, ISBD and STN-ISO 690 recommendations in the presentation of the records and listings in printed form as well as on the computer and terminal screens within the Internet and Intranet networks.

Creation of a cooperative system of (relatively complete) registration, processing and presentation of publication activity, references, scientific activities and of qualification works at universities and research institutes in Slovak republic represents the principal goal of the Pro Scientia project (Kimlicka 1998). The project is based on the application of international standards and recommendations, esp. UNIMARC, ISO 2709, ISBD, AACR2 and Z39.50. It is a part of a larger project of national bibliographic registration of qualification works and publication activity within the Slovak national bibliography in the framework of UBC and UBCIM programmes. Due to the fact that academic libraries involved in the project do not have any personal, financial or coordinative capacities for the solution of problems and tasks of this type, the association of information specialists for the support of science - Pro Scientia - has been founded. Its main activity will consist in concentrating the expertise, obtaining financial resources and creating a pilot project that will be gradually extended to all academic libraries and libraries of research institutes.

### **The role of libraries in building SCIENTIA-SK virtual database**

It is necessary to admit that a frequent need to submit the listings of publication activity and of references, often in various forms and layouts and prepared according to various criteria, is not a pleasant job and usually it takes a lot of time. Registration and processing of qualification works seems to be even more demanding, mostly from the point of view of time and capacity. The solution does not lie, of course, in cancelling the registration of all these documents but in making their processing easier. It is a task for librarians and information specialists working in academic libraries as well as for the preparation team of Slovak national

bibliography to find the ways how to do it and how to make the process for the researchers and professors more straightforward.

The complexity of registration and presentation of publication activity and of references can be partially shifted on the librarians' shoulders - after all, they have a qualification for this type of work. It is mostly the question of the basic know-how of a simple document description according to the appropriate standards and the preparation of listings and of other outputs that are also standardized. In order for the librarians to succeed it is important:

- to know the appropriate standards for the document description and the creation of listings and outputs,
- to have a suitable software for the registration of publication activity,
- to divide the competencies and duties among researchers and professors on one side and the librarians on the other, resp. among departments/institutes and the library,
- to create a well-functioning system linked to the library system and the Internet.

The collection of entry data and their proper and reliable input seem to be the most fragile part of the system of publication activity registration (EPC). There are a lot of problems with the complexity of data (to ensure that the documents can be precisely identified) and with the ranking of individual publications, references or scientific activities into categories. If the collection and input of the data is left up to the authors, in most cases the completeness and correctness of data is at stake. This phase should be done by experts - the librarians. On the other hand it is quite natural that the librarians cannot objectively rank the documents into categories of publication activity. This is the domain of authors themselves and the control function can be fulfilled by the scientific community of the discipline represented by e.g. the commission of the scientific board.

Registration and processing of qualification works represents a special problem. A present practice on the academic ground varies enormously. Somewhere the publications are registered and preserved at individual departments, in some cases in the framework of the faculty, in other cases they are just stored without any registration and processing. Reasons of this status quo can be found in the shortage of the storage room for qualification works and in the lack of workforce or of a software suitable for their processing. This problem can be solved only with financial support from outside of the system and with understanding of its importance from the side of leading figures at the academic institutions.

### **Software solution for the publication activity and qualification works registration**

Based on the experience from the routine run of EPC system at 12 faculties of Comenius University and some other faculties and universities in Slovakia, as well as from the need to approach the international standards it is possible to formulate principal requirements for a good software system for the publication activity and qualification works registration as follows:

- a comfortable input of entry data with the support of authority files (authors, periodicals, scientific and professional actions) and tables (categories of publication activity, categories of references, categories of scientific and professional activities, codes of languages, codes of countries, codes of authors' roles, codes of workplaces, codes of scientific disciplines, codes of document types etc.),
- possibility of conversion of data about employees from the personal module of the faculty/university/institution information system into the name authority file,
- selection of data entry worksheets according to the type of document,
- formal check-up of data during input,
- automatic generation of selected data (date, record number etc.),
- import and export of records in ISO 2709 UNIMARC structure,
- possibility of conversions of databases from other systems of publication activity registration including the conversion of categories (e.g. from the EPC - CDS/ISIS system),
- interlinking of EPC database to the modules of cataloguing, serials management and authorities,
- interlinking of records of publication activity with the appropriate references and with the records of scientific and professional activities (participation at conferences, seminars etc.),
- creation of listings of publication activity, references and participation at scientific, professional and artistic activities sorted according to various aspects (workplace, authors, categories etc.) in accordance with the ISBD rules and the standard ISO 690 as well as according to the requirements of grant agencies, accreditation and evaluation commissions,
- possibility of linking pictures or electronic copies of documents to the records,
- processing of statistical surveys for individual employees as well as the whole institutions,
- application of Z39.50 recommendation to the online catalogue accessible on the WWW-server via Internet with the possibility of searching under a variety of fields and criteria with the help of boolean operators,
- possibility to build a union catalogue of publication activity on the WWW-server (applying Z39.50) on a nation-wide Slovak level and in the network of cooperating bodies (faculties of universities and colleges, scientific institutes of the academy of sciences) and institutions.

System RL-EPCA<sup>1</sup> (Rapid Library - Evidencia publikacnej cinnosti a aktivit) has been tried out in practice and it proved to be a suitable software for the implementation of this type of bibliographic database. This software module can work independently (stand-alone) or as a part of integrated library-information software system Rapid Library. It is based upon the utilization of the UNIMARC structure and of the links that enable to create a relational database and to interlink the records in individual files as it can be seen in fig. 1. Besides a whole range of publication activity and references listings (9 presentation formats and 10 standard outputs) the system provides even the outputs applicable for the support

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<sup>1</sup> RL EPCA software has been developed and distributed by Cosmotron Systems, Ltd.

of the scientific activity management. With these functions the software system RL-EPCA ranks beyond the frame of common library-information systems. Provided outputs are as follows:

1. listings of scientific activities of an author or of an institute;
2. listings of articles in periodicals that reach certain threshold of the impact factor for the individuals and for the institutes;
3. an average number of publications per 1 employee (with the possibility of defining the categories of publications for which the calculation applies);
4. impact factor of an author or of an institute for a certain period of time (with the possibility of defining the categories of publications for which the calculation applies);
5. processing of statistical tables for the Accreditation commission (regular evaluations of colleges and universities).

Several tables and encoding tables are built into the software which facilitate and check the input of coded data. Tables of categories were prepared the way so that it would be possible to make the conversions of categories in the whole file even retrospectively, e.g. when the categorization of the Accreditation commission changes. It is also possible - in all of the outputs - to preselect the type of categorization, selection of years' range, threshold of publication categories, authors and institutes, for which the output is produced.

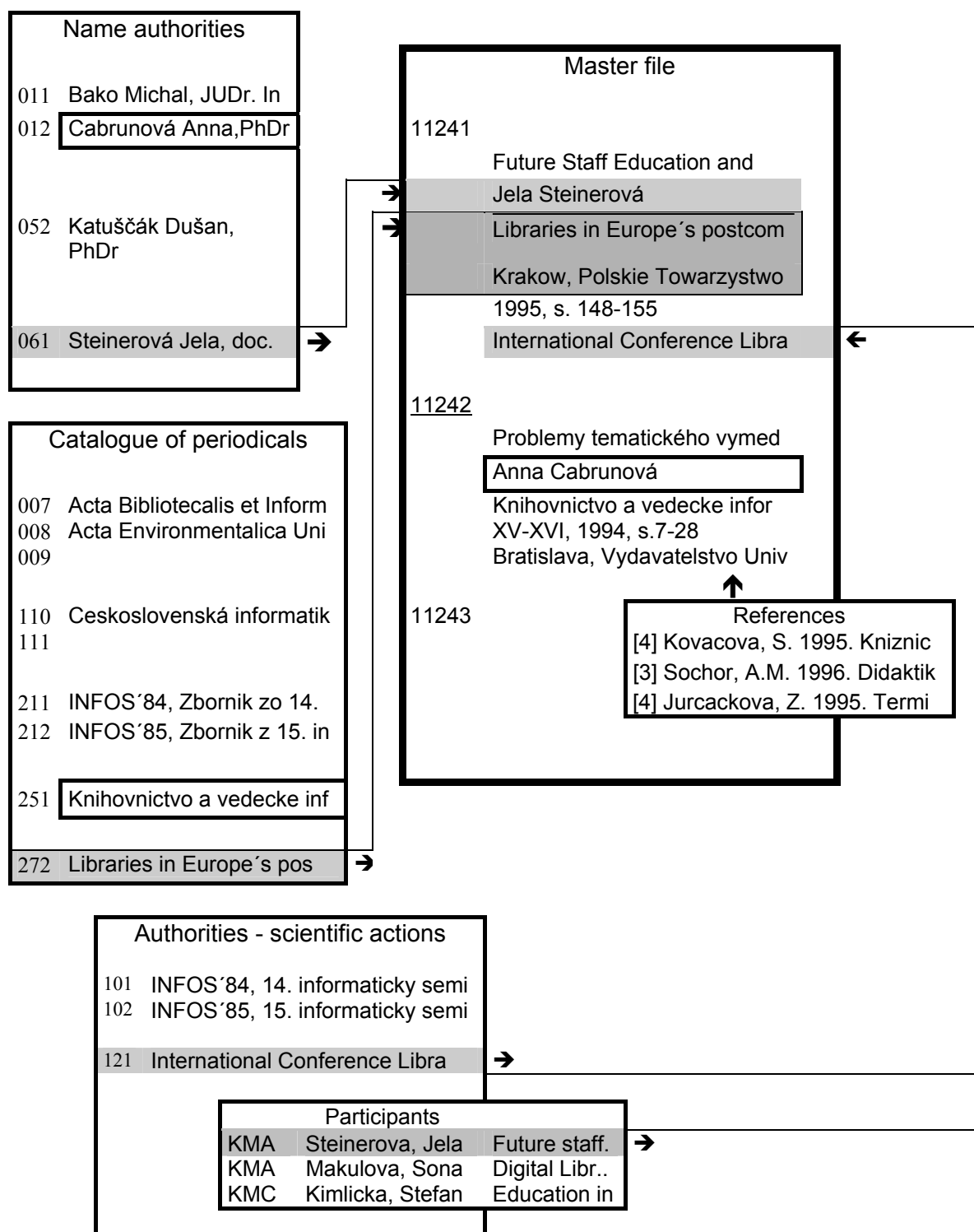


Fig. 1

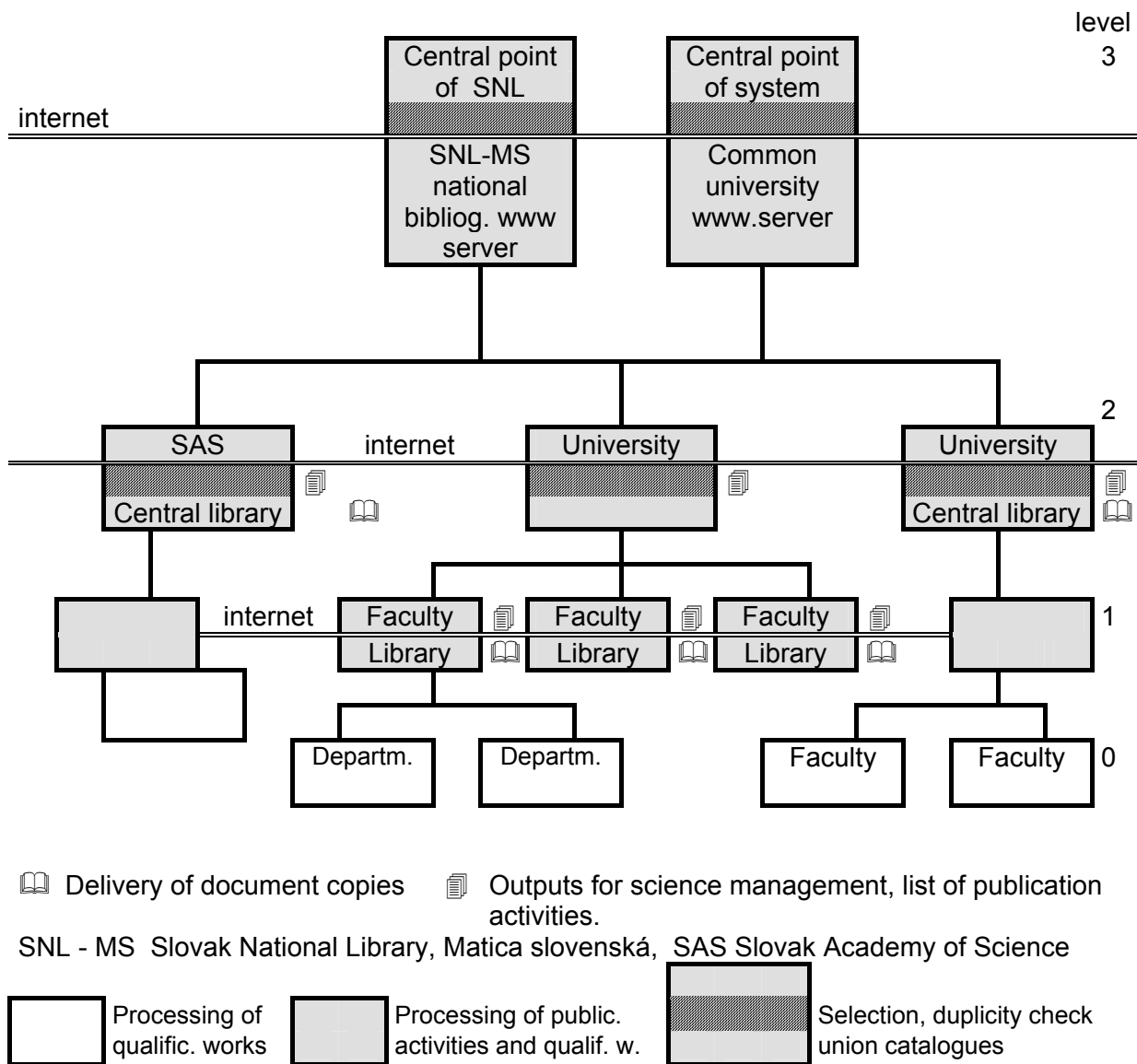


Fig. 2

## **Summary**

Publication activity and participation at scientific conferences, symposiums and congresses are both very important when it comes to the presentation of scientific results of university teachers and researchers. Via these activities we can follow the directions of research and development on the level of individual scientists, institutions, scientific communities and the state as well. Information about these activities, however, is scattered at many different places around the world. The registration of publication activities is being done at various levels and with a different degree of detail and standardization. It is often required when the evaluation of individual researchers (habilitations, inaugurations, grant applications) or institutions (accreditations) is necessary. Scientific results of researchers are also being recorded in different bibliographic, factual and full-text databases. These databases are, however, created on the principle of a specialization or of a type. So if we want to follow the scientific activities of individuals, groups or nations, we have to search the data at various locations while the completeness of the selection is always a question of luck.

All the data which is needed for the registration and evaluation of scientific activities from the perspective of published outputs and participation at scientific conferences can be stored and processed in a special bibliographic database. A complexly defined bibliographic database contains files and records on 3 levels of distinction. 1. Bibliographic level, for which the records about publication in master file are dominant. Other types of records are derived from them - records about authors (name authorities), records of references, records of source documents (a catalogue of serials). 2. Biographic level, where the record of creator (author) in the name authority file is dominant, 3. Scientometric level, where files of serials and scientific actions are important.

To ensure the highest possible level of completeness in recording the development of a researcher or of a scientific discipline, it is also necessary to keep eye on qualification works which quite rarely get listed in the databases but which can contain valuable information. Well-processed and accessible databases of publication activities and references offer a good picture of the profile and effectiveness of a research institute or university, but mainly of individual scientists. Registration and presentation of publication activities and qualification works on a national level is even more important as a part of the national bibliography system. Its importance here is multiple:

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Complexly defined bibliographic database may serve as a base for the biographic research as it can contain the publication activity of a researcher starting with his/her study years.

With the help of appropriate software systems it is possible to use this type of a bibliographic database for different types of bibliometric and scientometric calculations.

The structure and links within a complex bibliographic database and the Rapid Library - EPCA (Evidencia publikačnej činnosti a aktivít - Registration of publication activities) software are discussed in this study. The main function of this software is the processing of the data for the purposes of research activities management at universities and research institutions. Beside standard types of library-information outputs it provides the possibility to create various bibliometric and scientometric outputs. This software is being implemented within Pro Scientia project, main task of which is to build up a cooperative registration system of scientific publication activities on a national level in Slovakia.

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