

DATA AND STRUCTURE CHARACTERISTICS ANALYSIS FOR A SCIENTIFIC RESEARCH E-MANAGEMENT PLATFORM IN THE HUMANITIES AND SOCIAL SCIENCES

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ABSTRACT

This article first discusses the characteristics of scientific research in the humanities and social sciences (HSS), and then lays out its basic e-management demands. In building a scientific research e-management platform (SREMP), attention must be paid to the characteristics of its data and structure. The data in the SREMP of HSS domains have multiformity. That is, their structure should be an integrative multi-functioned information subsystem with a clearly graded data management mode, flexible user jurisdiction management functions, accurate and common retrieval systems, reliable security design, and flexibility to improve its operations, and ease in maintenance and amelioration. The article also describes the development tendencies of a SREMP.

Keywords: Scientific research management, Information system, Humanities, Social sciences, Data, System structure

1 PREFACE

E-management is the process that, according to an organization's objective, uses information and communications technology (ICT) to build information systems for the organization, to open up, accumulate, and utilize all kinds of information and knowledge with a systematic, all-sided knowledge management system, in order to improve the scientific research environment and to raise the efficiency of decision making and other operations. The scientific research e-management platform (SREMP) discussed in this article is one of the information subsystems run on an organization's interior network to fulfill the organization's management information targets. It is an important subsystem in an organization's information system.

Along with the development of ICT, e-management system construction proceeds from computerized data processing and storage to the digitized knowledge management. It goes from the simple to the complex and from unsophisticated database construction and utilization to the sophisticated using and discovering the organizations' resources. Generally speaking, the level of e-management scientific research in the humanities and social sciences is low in comparison with that in the natural sciences. In recent years, although the e-management practices in HSS in China have developed rapidly, most are still limited to building databases in accordance with business operations and lack the systematic study and practice necessary for an organization's integrated e-resources utilization. Worldwide, research and development statistics for HSS and studies on the impact of this research on society have not yet been sufficiently explored. On the other hand, this also reflects on the deficiencies of e-management in HSS. The question is how to expand the development of the scientific research e-management (SREM) for HSS, especially under tight budgets and low ICT infrastructure. Another problem is how to start small in building SREM systems for HSS according to the characteristics of scientific research management. Finally, we ask how to avoid isolated information islands during SREM platform

construction. This paper tries to give answers to these questions based on the experience of SREM platform building in the Chinese Academy of Social Sciences (CASS), which will benefit the organization's total e-science planning and use of e-science resources.

2 FROM THE CHARACTERISTICS OF SCIENTIFIC RESEARCH IN HSS TO THE BASIC E-MANAGEMENT DEMANDS

2.1 Characteristics of Research in Humanities and Social Sciences

To build information systems for humanities and social sciences research, it is first necessary to analyze the characteristics of HSS research as well as its research management. Although HSS research and natural science research are both considered to be scientific research, their research concepts and methods are quite different. Many scholars have discussed this, for example Ouyang Kang (2001), Zhou Lai-xiang (2003), Chen Xian-da (2003), and Lu Gao (2005). Below is a discussion of these researchers' ideas:

First, the relationship between research subject and object in natural sciences research is relatively clear. Natural sciences show the truth and law of the objective world, excluding subjective ideas that may disturb the objective studies. In humanities and social sciences research, however, the relationship between research subject and object is more complex. HSS scholars attempt to explain objective social phenomena through cumulative knowledge and to characterize, analyze, and explain this knowledge, in order to discover objective laws. HSS research results inevitably reflect the researcher's ideology; therefore, HSS research is relatively subjective.

Second, the methods used in natural science research must be based on strict mathematical deduction and analysis of substantial evidence, using tests and experiments. However, in HSS research, it is hard to follow suit. Though social science research has borrowed quantitative analysis methods from the natural sciences and developed its own quantitative paradigm, still, quantitative analysis cannot explain all social questions. Zhou Lai-xiang (2003), a famous esthetician, pointed out in his article *Characteristic and Law of Humanities and Social Sciences Research*: "What the humanities and social sciences research comprehend of the phenomenon of society and history is not as exact in quantity as the natural science research; on the other hand, it allows scholars of HSS research to express their own ideas, views, volition, wish and evaluation..." One important paradigm of HSS research is based on the process of analyzing and explaining human phenomena and historical and social realities, discovering new concepts, exploiting new laws, and gradually achieving an objective understanding of human and social phenomena through the debates of different schools of thought. According to Ouyang Kang (2001), it has characteristics of non-quantification, irreversibility, individuality, and non-repeatability.

Third, natural science research results have provided humanity with tools to understand and reconstruct nature, and therefore, they can be widely applied in various social environments. However, humanities and social science research cannot rid itself of regional, spatial, epochal, and social influences. A scholar's concepts of social values and truth will inevitably be restricted by his social context. Therefore, HSS research results have much more relativity than those of the natural sciences.

Fourth, natural science research projects generally need extensive experimental instruments and group cooperation. However, HSS research relies greatly on individual researchers' accumulation of knowledge and has a certain degree of reliance on the individual. It relies less on working units and needs flexible external

management based on scholars' personal academic activities. Meanwhile, quite a lot of HSS research is not directly the result of research grant projects.

In other words, in the HSS research, mastering historical and realistic issues and building theoretical systems for scholars require a great deal of academic accumulation. Moreover, HSS scholars' subjective initiatives and innovation abilities are key factors influencing their academic research.

2.2 Characteristics of Scientific Research Management in HSS

HSS scientific research management needs to pay more attention to the characteristics of HSS research and its special demands.

First, it is important to create a relatively flexible research environment for scholars, so they are able to systematically integrate their own scientific research plan into their formal research duties. For example, a flexible system of working arrangements in the office or at home is an important feature.

Second, it is important to provide scientific researchers with various resources for their work as well as to direct scientific research according to the national demand and to do basic research adequately link with applied research and hot topic research with "the lost body of knowledge." For example, to organize various research projects and scientific research activities in institutes and academies.

Third, in a scientific research evaluation system, the same value should be given to both project research results and individual research production. Also, equal value should be given to scholars' short-term output, degree of participation in scientific research activities, and long-term scientific research targets and schemes.

Fourth, it is important to understand comprehensively both the present situation and the future development of the research.

Under the establishment of the SREM system, it is important to consider fully the characteristics of HSS research and management. It is essential not to set up independent database systems according to the contents of scientific research work but to build an e-management system that comprehensively reflects the organization's entire research circumstances, such as human resources, research investment, output, evaluation, etc., and records important information and clear spots of knowledge during the scientific research management procedure.

2.3 The Basic Demands of an HSS Scientific Research E-Management (SREM)

When building HSS SREM systems, constructors should pay more attention to the human-oriented management mode. Interior scientific research business can be administered through an integrated information management platform, i.e. the scientific research e-management platform (SREMP). The platform can join data collection, storage, information publishing, diversified retrieving, and mutual communication functions, making for better business expansion and maintenance.

First, scientific research management data such as information from researchers, projects, research activities and results, etc. will be collected, stored systematically, and well managed so that they become important data resources for construction of the scientific research management knowledge systems. The data will be entered

into the SREMP using a well-defined process. For example, following the research project management progress, the project application data will be submitted to the SREMP by the project applicant and approval information will be managed and communicated by the project manager and the project researcher. The application and approval manner will be the same during the annual examination and research results evaluation process. Meanwhile, the platform will provide the user with real time systematic information about the project research and statistics, which can be used by authorized multilevel users of management and research.

Second, various data in the platform will become an important part of the knowledge management system. They will be the main resource for scholars in exploring the work of other researchers and for managers to understand the management experience, so they can understand the research topic's status and its main development.

Third, the SREMP will provide expansive services for scientific research, for example, supporting the establishment of virtual research groups, real time or live communication, a coordinated work mode, etc.

Fourth, through networking and digital operations, managers of different levels will have a better view of the scientific research progress as a whole, so they can comprehend the research direction. Meanwhile, the platform will enable them to communicate with the researchers.

Fifth, according to the scientific research index, the platform will provide real time statistical data, which can be the basis of the managers' summaries of their work experience. The SREM will make the management procedure more transparent, scientific, and efficient.

Sixth, the platform will provide users with background knowledge and a users' manual for platform operations.

In addition, although ICT utilization in institutes of humanities and social sciences in China started late compared with that in institutes of natural sciences, the scholars in HSS still often have a chance to deal with e-work although some still lack knowledge about it. Most institutes still lack of experts with a comprehensive knowledge of ICT utilization and scientific research management. Therefore, e-management planning will first consider management demands for the whole organization and the data shared among the organization and its sub-organizations and then chose the appropriate technical arrangements. The e-management platform will first facilitate use for scholars, administrators, and maintainers and then give attention to management demands at different grades and the demands of data exchange. For example, at the beginning of the scientific research information management system establishment at CASS in China, the construction guidelines that were brought forward stated that the e-management platform would satisfy the basic demands for scientific research management of both the academy and its institutes, with the consideration that people with ICT abilities and e-practice levels were quite different among the institutes.

Finally, under the conditions of a tight budget and low e-practice levels, key tasks with clear management procedures and operational flows will be chosen as the start of the e-management system establishment. In this way, the small start will provide easy and clear e-experience to users; basic data will be accumulated for fulfillment of the master plan of scientific research e-management, and therefore, a better foundation will be laid to push forward the integrative utilization of scientific resources in the academy and its institutes.

3 DATA CHARACTERISTICS OF THE HSS SREMP

What are the characteristics of the HSS SREMP?

1. Data forms include structured data, semi-structured data and non-structured data. For example, research project application information, research results registration information, etc. are structured data; notices in various forms, regulations, communication information, etc. are semi-structured data; varieties of application forms, project research reports, the full text of a research result in a word processing document, picture information, etc. are non-structured data.
2. Data features include dynamic data, such as information about personnel, project approval and progress, project funds management, project evaluation, some scientific activities, etc., which need to be updated along with the research progress; and static data, such as data of scientific productions, finished projects, activities, etc., which are archived data for storage and usage.
3. Communication modes include immediate or live information, bulletin information, virtual group alternative communication information, etc. The knowledge base of information will be established gradually to provide a variety of information and knowledge for scientific researchers, managers, and other related users.
4. Utilization means include original data, secondary data, automatic statistical data, etc. Using the project management sub-system as example, according to the scientific research statistical indexes set up at the beginning of the SREMP establishment, the platform can provide real time statistical data including indexes of scientific research personnel and an analysis of the project make up, the research direction analysis, the research project budget and utilization analysis, the project's output make up analysis, etc. These data can be used for in-depth searching and statistics analysis.
5. The SREMP system management includes system security accounts for graded management demands, database structure codes and common codes, etc., which are needed for the system's operation and maintenance.

As illustrated above, the data in an HSS SREMP has the feature of multiformity. The relationships among modules are rather complex. To maintain integrity and consistency in the subsystems, the data-source singularity principle must be used. The elementary metadata system should also be built for standardized data structure and usage. The data recorded into the SREMP follows an even-driven mode, therefore an understanding of the human-oriented management mode, data collection, and use relationships will help form integrated systematic data resources (Figure 1).

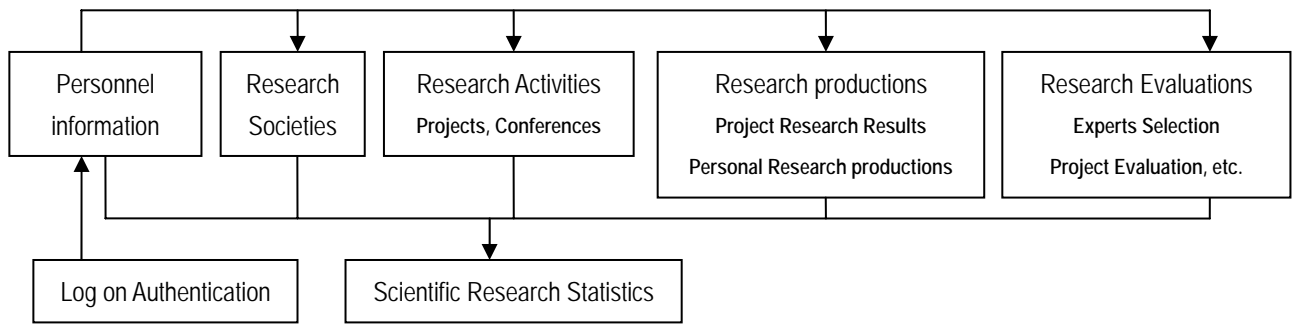


Figure 1. Research data relationship in SREMP

As shown in Figure 1, any one who enters the SREMP will first get a logon authentication with proper data operating permission and the correct menu with which to do the work. The data in modules of scientific research activities, products, evaluations etc. have relationships with the personnel information. Searching personnel information can find not only personal information and what working unit he or she belongs to but also the research activities he/she has taken part in and his or her research results. In the same way, we can find all kinds of information about a particular institute, research society, or the whole academy. This design pattern guarantees data source integrity, reduces data redundancy, and avoids isolated information islands. It also benefits management decision making by providing real time data about the whole organization’s scientific research input, activities, output, evaluations, etc. as well as other services.

4 DATA STRUCTURE OF THE HSS SREMP

According to the SREMP development experience, the SREMP data structure can be shown in Figure 2.

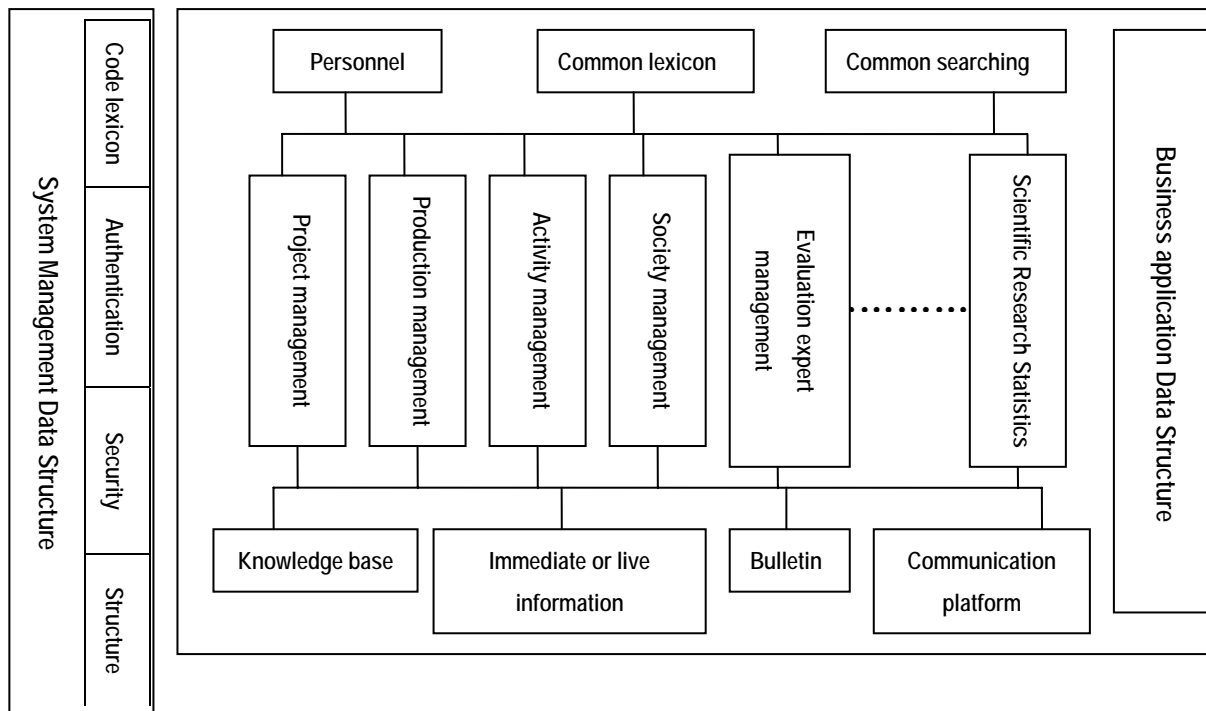


Figure 2. SREMP data structure

The SREMP data structure contains two parts. The system management data structure contains modules of code, terminology management, authentication management, security management, and structure management, which guarantee that the SREMP has good expansibility and maintainability. The business application data structure contains various business subsystems. Among them, the modules on personnel, common terminology, and common searching are public data modules, used by other business modules such as research project management, research production management, research activities management, etc. The modules of the knowledge base, immediate or live communication, bulleting information, and mutual communication platform make it easy for users to communicate with each other and learn how to use the system. This structure also guarantees that the SREMP has scientific and systematic qualities and sustainability.

5 STRUCTURAL CHARACTERISTICS OF THE HSS SREMP

According to the characteristics of HSS management demands and its e-management platform, the structural characteristics of the SREMP can be easily sketched.

1. The HSS SREMP will be an integrated multi-functioned information subsystem capable of data publishing, multi-styled communication, data collection, storage, analysis, diversified retrieval, etc. It will be a part of the e-science information system, specializing in e-management functions and will be able to systematically organize the management information by study, section, activity category, etc. according to users' demands.
2. The SREMP will have a clear graded management mode, especially in multi-level large organizations. It is necessary to give institutes or various sub-units independent data management rights so they can deal with their own data. They must also be provided with basic e-management functions that will make centralized data management and usage convenient as well as demonstrate e-management practices and increase data collection, e-storage, and management, especially when different institutions require different information system building practice levels.
3. The SREMP will have flexible user jurisdiction for management functions. The setup and update for a user's data processing permission will be easy to operate. When scholars change their work units, modification of their jurisdiction will be given in a timely fashion. To make the operation convenient, authorized users will give permission for transferring their data processing to other persons.
4. The SREMP will be the center for various data. Thus it uses various techniques to combine and display information according to users' demands. For example, during different project management phases, data of different types and structures will be collected and displayed according to users' needs.
5. The SREMP will have accurate and common retrieval systems, so that users can search over multi-modules or search topics in more than one module. Retrieval system designers will understand users' needs and make sure that needed retrieval fields for a common search exist. A full text search can provide maximum retrieval results but with lower accuracy. With it, however, users spend more time and energy finding what they want. Precise fulfillment of retrieval demands will also be provided.
6. The SREMP will have a good data interface. Along with the information digitizing process, the individualized management demands of institutes or sub-units will increase and, therefore, will need

more information exchange. Building an appropriate interface for data exchange among different systems in or out of the platform will benefit the system's performance.

7. The SREMP will pay attention to security design both for the security system and for data application systems. The non-updatable principle for verified data according to their origin is essential, and non-structured documents can be encrypted for transmission. Only the authenticated user will be able to download documents through a decrypted mode.
8. Because management is a process of innovation and reform, its information system, i.e. the SREMP, will be a platform system with the flexibility to open up and improve operations and allow users to maintain and enhance easily.

6 THE DEVELOPMENT TENDENCIES OF THE SCIENTIFIC RESEARCH E-MANAGEMENT PLATFORM (SREMP)

The SREMP is only one part of an e-management system for research institutes and academies. Along with the in-depth development of e-management, information on layers of management, such as departments of scientific research management, personnel, international cooperation, financial capital construction and planning, etc. must also be integrated and used. Functional departments of the academy and their subunits in institutes also must mutually adjust and carry out their integrated management information usage accordingly. Otherwise, respective information systems of these units or departments will not be linked and will become isolated information islands, bringing serious burdens on data input and data maintenance and forming a low efficiency mode in the e-management application. Therefore, data integration is an inevitable trend in the development of the SREMP. Moreover, scientific research management itself is a process with dynamic innovation, and its SREMP will also be unceasingly improved and perfected.

6.1 Integrated Data Usage

As mentioned above, the integrated data usage will be analyzed from two aspects.

First is the integrated use of data on the transversal management layer of the research institute or academy. Through integrated management, the data of various departments can virtually or actually become one entity, which will comprehensively and accurately reflect the situation of the research institute or academy. On the one hand, this will eliminate duplication of data and reduce the data maintenance load; on the other hand, it will guarantee the accuracy and consistency of the data. It is necessary to standardize the elementary metadata and build a metadata database system for e-management. By building an exchange platform, data of various institutes or academies can be integrated, filtered, and exchanged according to demand. Generally speaking, in the case of a small start, it is difficult to completely integrate the system as the integration is so dependent upon the data interfaces of the subsystems, especially in academies, large-scaled institutes, or in environments with complex information systems or unceasingly innovative management.

Second is the integrated use of information on the longitudinal management layer, which stands for the data from varied levels of management information systems, such as that from an academy, its administrative departments, and its research institutes. This is another form of integrated data application among different levels of information systems, which also necessitates building an exchange platform. Here, establishing the standardized elementary metadata database system is still necessary. In addition, it is also very important to

build a unified logon authentication system, so that the seamless transfer can take place among business modules in different systems according to users' jurisdictions. This system will also provide a possibility to expand its application functions according to demands of different levels of management data.

6.2 Functions of the SREMP Expansion Tendency

Whether with the reform following the management process, or with the development of ICT, the SREMP needs continuous improvement and development of its service functions. This growth can be explained as follows.

First, it is essential to develop gradually from general services to individualized and intelligent services according to users' requirements. "Individualization" means letting all levels of authenticated users make their choice of configurations and definitions to their interfaces in accordance with their own demands. "Intelligence" refers to the permission of all levels of users to take various formats of data input and output according to their own demands.

Second, it is essential to increase prompt facilities, besides the immediate help information service. It is essential also to permit announcements by mobile-phone short messages, email, or taskbars when work needs to be done. Management activities will be gradually deployed in the direction of live interaction.

Moreover, the SREMP must strengthen its data analysis functions. Besides the data download according to user's jurisdiction, the real time data analytical function will also be improved. To realize functions of diverse statistical analysis and statistical data storage, an instant transfer procedure for statistical analysis may be used to provide individualized services to support management decision-making and scientific research management study.

7 REFERENCES

Chen, Xian-da. (2003) In Search of the Harmonization in Science and Value – About the Nature of humanities and the Innovation Issues, *Social Science in China*, 2003(6).

Deng, Wen-biao. (2004) Future Development of Chinese Management Application Software, 2004-3-15. Retrieved from the WWW September 12, 2007: <http://manage.org.cn>

Du, Yi-hua. (2005) Discussion on Integration of the Websites of China Academy of Sciences, *ICT Application and Communication Workshop of Three Academies of Both Sides of the Coast, 2005-5.*, Beijing, China.

He, Wei. (2004) The Characteristics and Management measures of Recessive Knowledge in Research Institutes, 2004-7-7. Retrieved from the WWW September 12, 2007: <http://manage.org.cn>

Li, Xue-rong. & Li, Sa. (2005) Integration System Design of Heterogeneous Data Sources on Metadata, *ICT Application and Communication Workshop of Three Academies of Both Sides of the Coast, 2005-5.*, Beijing, China.

Li, Zhang-yin. (2005) The Hermeneutical Study on Natural Sciences and the Hermeneutics of Natural

Sciences. From: *The Chinese Hermeneutics, Volume 3, Shandong People's Publishing House, 2006-3, p287-296.*

Lu, Gao. (2005) In Search of a Second Einstein -- Unification of Natural Sciences and Humanities and Social Sciences. Cosmos' blog, 2005-10-12. Retrieved from the WWW September 12, 2007: <http://www.lsty.cn>

Ouyang, Kang. (2001) Outline of the Philosophy on Humanities and Social Sciences. *Jianghai Study Journal 4.*

Qin, Bo-yi. (2005) Integrated sciences with liberal arts, flourishing multi-studies. *The Sixth Section Key Report, China Sciences and Humanities Forum, 2005-11-18.* Retrieved from the WWW September 12, 2007: <http://www.sina.com.cn>

Zhongnan University *Management Information System.* Beijing: The Higher Education E-Audiovisual Press. Retrieved from the WWW, September 12, 2007: <http://neu-nec.sy.ln.cn/ncourse/glxxxt/chapter1/1index.htm>

Zhou, Lai-xiang. (2003) Characteristic and Law of Humanities and Social Sciences Research. *Literature, History and Philosophy 1, 5-7.*