

# The Practice and Application of E-science in University's Scientific Research Management

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**Abstract:** In the 21st century, human society has entered into the information age. Along with the development and application of modern information technology which characterized by multimedia and information superhighway, scientific management mode takes place great changes. It brings the unprecedented development opportunities and challenges to university scientific research work. E-science is a significant measure in the process of higher education informatization. Based on analyzing the content of scientific research management in university, this paper presents the thought and related problems. It also discusses the means to implement the informatization of the work to improve the efficiency of scientific research management in college.

**Keywords:** E-science; scientific research management; management in university; scientific research in higher education

## 1. Related Concept Definition

### 1.1 Scientific Management Informatization

The emergence of E-science roots in pursuing modernization of information of several generations of scientific researchers. At the higher stage of human research development, the pursuit of information modernization is lower costs, sharing and cooperation, and improvement of efficiency. In general, scientific management information refers to a process of building scientific information management network system, optimizing the scientific management model, and constantly improving the management efficiency and level of scientific research. Its characteristic is making full use of modern information technology, information resources and the environment in every link of scientific management.

### 1.2 Scientific Research Management in University

Currently, the university's function does not only complete the teaching task simply, but deal with the links among teaching, research and service. Scientific research management in university should finish two tasks: one is supplying accurate, timely and effective research information to science research in order to serve the control and decision making in science management; the other is organizing the research team to participate social compe-

tion, strive for research projects, output scientific research achievements to society and promoting the development of science and economy. The level of scientific management exits direct impact on scientific research development in university. A high level of scientific research management is the base of innovation.

### 1.3 E-science in Higher Education

E-science is the direction of the development of scientific research management in colleges and universities. E-science is the specific implementation of social informatization concept in the specific area of colleges. The information resources and information network are the core content of the E-science. Both information collection and information analysis are the base of scientific research decision-making and implement. The information resources in the scientific management can be used by staff of scientific research administration, scientific research, policy decision and market. It can also break the limitations of time and space and realize diversified cross configuration. Therefore informatization and network have significant position in colleges and universities, and they are the key factors of E-science.

Now, with the in-depth development of E-science in university, informatization has been applied to the scientific research of the stages, as shown in **Figure 1**.

From **Figure 1**, we can find that informatization of

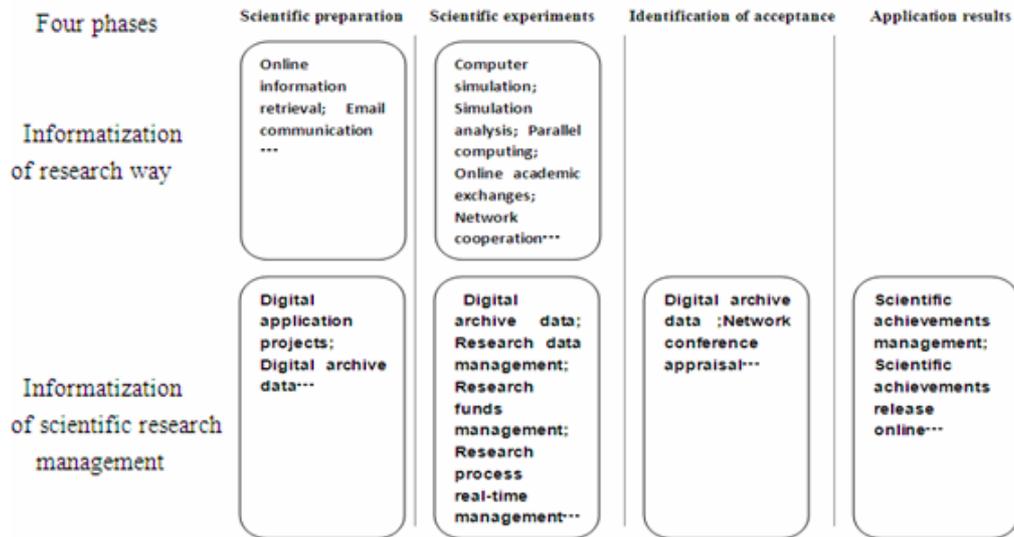


Figure 1. Scientific research stages of informatization

research way and informatization of scientific research management as the direct factors in this model have influence on every phase of science research. The informatization of research way mainly applies in the phases of preparation and experiments, while informatization of scientific research management throughout all phases of the scientific research.

### 1.4 Features of E-science in University

- The remote and universality  
Information transmission on the network is almost instantaneous, and distance is no longer the obstacle to information communication. So scientific research management can take advantage of these features to strengthen the information exchanges among the management department, the administration department and the scientific research personnel.

After universities finish building E-science and network, a lot of science research data can be consulted on internet and browsed in other print media that advertises for universities and improves school's reputation and benefits.

- Normalization and Dynamic

Information technology requires standardization of data. The technology processing of man-machine interface can effectively regulate data and make scientific management data which submit through the network accord with the design requirements. This feature not

only ensures the quality of data and enhances the efficiency of processing and analysis data, but creates an environment of standardization for science research management.

With the help of computer network technology, scientific research management can realize the dynamic way, obtain and provide necessary information and grasp the latest data at all times and understand scientific dynamic timely. Consequently, the decision-making ability is improved and the cycle of decision-making is shorten.

- Intensivism

Information processing must consider economic and social benefits. Scientific information management requires to acquire more valuable data at the expense of lowest cost. The establishment of economic and efficient information processing system has greatly increased management efficiency and saved a lot of time, manpower and material resources.

- Timeliness

The timeliness requests that information must be processed at the fastest speed. On one hand, it needs information management personnel to record and collect all kinds of information timely. On the other hand, it demands to process and transmit information to the relevant departments at the highest speed. Due to its effectiveness, it presents inversely proportional between information's value and the time of providing it. If we delay the time, the science research achievements will lose

its value possibility.

- Authenticity

Information shall truthfully reflect the objective situation. Information management personnel must prevent and reduce interference to assure information authenticity. False information and information distortion are more dangerous than no information.

## **2. E-science Brings New Vitality to Scientific Research Management in University**

### **2.1 The Influence on Scientific Research Project Management**

- Shortening working cycle of organizing and declaring projects

In the past, a series of science research project works such as plan giving and results registration need a sort of links and department to transmit. It easily presents error, long circle and low efficiency. E-science not only realizes file transfer, information release and communication but transmits the latest research information timely. It realizes the paperless office, reduces the waste of manpower and resources, eliminates unnecessary intermediate links and shortens project circle of organization and reporting. This improvement advances quality of project management and fair rationality of project organization.

- Improving the level of scientific management decision-making

Only if obtain a substantial amount and accurate information, can we grasp the research direction and make a right choose of scientific research to improve the efficiency of the scientific research work and make a scientific decision. Universities are an important base which produces amount of talents and knowledge, and generates discipline integration across. Their dependence of the information is strengthening constantly. E-science provides dynamic, accurate and comprehensive information through online retrieval for people of research and management so as to achieve project evaluation and reduce the blindness and hysteresis of decision-making. It provides a powerful support for assisting university scientific research management decision-making and formulating scientific policy.

- University research institutes realize scientific flat-

ting management

E-science based on network changes the traditional vertical management model to flatting management model in radial horizontal direction. In this mode, scientific research personnel can apply project, search on line release research information and achievements and download various material. In universities E-science not only promotes the management division of labor intensive and accelerates the process of transfer and feedback of information management, but improves the working efficiency and management level.

### **2.2 Improvement of Sharing Level**

Due to the E-science, research management realizes network management and improves online office file transfer function. All resources in the environment can be shared, such as the latest science technology information, experiment data, the latest research achievement and scientific research workers in the world. The sharing based on network overcomes the obstacles of time and space and maximizes resources efficiency. Scientific research workers can obtain research subject knowledge to improve their professional qualities. We can apply the E-science to build digital platform of scientific research in our own country even in the world. On the platform, research workers can do cooperative work efficiently and conveniently, discuss the work of scientific research, exchange academic and share scientific research achievements.

### **2.3 The Influence on Technology Statistics**

E-science improves the accuracy and scientificity of the information statistics data. Information network can interconnect scientific management department with all the other departments, help workers to quickly finish the work of research data acquisition and summary. It rationalizes original data, thus ensures the scientificity of data statistics of scientific research at any time. Scientific management department tracks management processes of project execution and completion, identification and award through the design of the reasonable data report.

### **2.4 Promotion of Scientific and Technological Achievements**

Transformation of scientific and technological achievements in universities is a concern topic in today's world governments, industry and academia. It is also successful experience of combining the world economy with science, technology and education. The informatization construction prompts scientific research management mode and management standards to become internationalization. The scientific management model and advanced management method help to enhance competitiveness of colleges and universities, promoting research and international standards. Research information is released, displayed vividly timely through the network media and built the bridge for colleges and the enterprise which develops and applies technology innovation to realize commercialization.

### **2.5 Realization of Global Collaborative Research Work**

In university E-science environment, the scientific research personnel who disperse over the universities, enterprises and other scientific research institutions can easily work cooperatively and hire the experts and scholars in all over the world that work dispersedly to solve complicated problems together. Virtual research institutions such as "virtual institute" and "virtual academy of sciences" can be formed in a nationwide and worldwide. This mode can make full use of domestic and foreign universities or other technological talents and take advantage of the equipments, and can reduce the investment of scientific research colleges and universities so as to save science and technology research funds in colleges and universities.

Besides, the real-time dynamic management in project management, workload management and fund management based on network will increase the transparency of scientific management. Scientific research project adopts expert evaluation. So experts meet each other online in order to reflect fairness and impartiality, then scientific research project level will enhance unceasingly.

## **3. The Problems Of E-science During Practice In University**

### **3.1 Incompatible Information**

University's scientific research management informa-

tionization is to realize the sharing of the information resources of university's scientific research and excavate application efficiency of scientific research management so as to reduce duplication of scientific management personnel. The unity of data in the information system is very important, but the scientific research management system in colleges and universities is scattered, disordered, repeated data etc. Consequently realizing scientific research management standardization and normalization are the first step.

### **3.2 Deficiency Necessary Training for Scientific Research Personnel**

Along with the development of E-science, scientific research management system promotes the personnel to increase capabilities of information processing. But many managers take the research system as the most important thing and ignore the quality of scientific research personnel and training.

### **3.3 The Restriction of College Management System Organization**

Currently, most universities have good hardware resources and different levels of management information system, but they lack unified planning and integrated E-science system. Because of the relatively loose scientific research management systems in university, the relative independence in each department and college gives rise to that deficient sharing of resources and difficult integration in application and non-uniform interface. It is difficult to process information in a higher level in such system, information mining and decision support for example, and realize order services.

### **3.4 The Benefits of E-science and Sustainable Development**

Many colleges in developed countries imitate the ERP mode in E-science construction resulting in implementing system with difficulty, and having higher costs. In the process of E-science construction, although colleges invest a lot, the results can not be achieved as expected, and then the investment falls down. In addition, it is difficult to upgrade the system because of the higher integration of system.

## 4. Practical Approaches of E-science in University

### 4.1 To Strengthen Overall Planning and Implement Step by Step

E-science must be assured senior management to participate so as to conform to the requirements of the university development. In order to guarantee the unity of planning and IT technical development, we need senior experts to take part in. It is necessary to organize the personnel of information technology and scientific research management to investigate adequately before implementation. Only by understanding the real need of management correctly, can we make a scientific and rational research project management informatization integrated planning and adopt effective ways to implement step by step.

### 4.2 To Establish the Management Mode Adapted to Information

Scientific research department in traditional scientific management structure is only the research center which collects all information from downstream and supports cleared up information to upstream. With the wide use of IT, network management mode of the distributed structure turns up, and achieves the purpose of reducing management level, cutting workers scale and making the organization structure flat and elastic. To solve the problem of disjunction between implementing information system and operation management, universities should accelerate the transformation of scientific management mode.

### 4.3 To Establish a Management System of Clear Responsibility and Division of Cooperation

Network management is a whole work that involves many different departments. So problems in the operation which can not be solved by one department require each department to strengthen mutual cooperation and enhance communication. As the openness of network system results in the complication of data quality, it is easy to cause the information disorder and network management work normal operation. Therefore, colleges must establish a management system of clear responsi-

bility and guard a pass step by-step to prevent the management from passing the buck to each other through the requirements of signing by superintendent in every program.

### 4.4 To Establish and Popularize Information System

With the application of MIS and DSS and OAS which as the three representatives of information system, the future developing trend of scientific research work in colleges and universities is presented. These three branch systems are independent and interdependent as a whole. They play irreplaceable role that can not be replaced by other human resources in management and decision-making and operation.

### 4.5 To Pay Attention to the Training of Personnel and Team Construction

Currently, the basic work which can not be neglected is to popularize information technology and train personnel and improve the level and consciousness of E-science application in university. Colleges should arrange related scientific research personnel to study theoretical and train techniques according to the different positions and functions. In university's E-science, we should build three teams: The first is the Information research team. Scientific research personnel should master modern information technology commonly and make good use of technological information resource in information environment. The second is the information research management team. Improving the ability of information

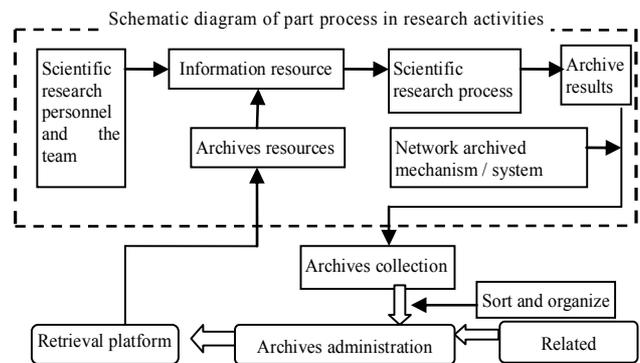


Figure 2. Scientific research archive management in the environment of E-science

management which is related to their functions is benefit for making decision-making more scientific and democratic. The third is the information technology maintenance team. These engineering and technical personnel can provide high quality technical support and technical services for research and management of university. Only we establish a scientific mechanism of talents training in, can the colleges and universities obtain greater development in the tide of E-science.

Finally, there is an example of E-science application in scientific research management.

## 5. Conclusions

E-science enhances human abilities of dealing with problems in research analysis and cooperation crossing regional exchange. It urges new scientific research work mode and advanced scientific research thinking to generate, thus it improves the scientific innovation ability greatly. If universities could pay attention to combine the scientific research management with modern science

technology and accelerate the development step of E-science, there will be a great-leap-forward development in colleges.

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