On the Innovation of Refined Scientific Research Management in Application-Oriented Universities in the Context of Big Data

Xingqiang Wu(✉) and Li Wang

College of Electronic Information Engineering, Han Kou University, Wuhan, Hubei, China
4501153@qq.com

Abstract. With development over the past few years, application-oriented universities have achieved a preliminary improvement in innovation with entrepreneurial characteristics, and have set relatively systematic goals for the management of scientific research. Given the current era of big data, application-oriented universities must keep pace with the times and achieve refined management of scientific research work through data mining, data analysis, and other means, based on their status quo of scientific research management and big data.

Keywords: big data · application-oriented universities · scientific research management

1 Introduction

Currently, due to the rapid development of the Internet, cloud computing, artificial intelligence, and other technologies, the scale of data in the cloud is increasing at an exponential rate, and the enormous flow of data is gradually driving the continual innovation of data development and application technology, and the era of big data has arrived. In an era of big data, the scientific research of application-oriented universities plays a critical role in strengthening academic influence and the strength of faculty, and the level of management and service of the university scientific research management department will have a direct bearing on the development of scientific research work. Information systems building has been used extensively in university management, and the management information systems of each academic department have greatly improved the efficiency of business processing, but for the most part, each system operates independently and the data cannot be shared, forming an information island, which brings inconveniences to scientific research management. Following the application of effective data collection, cleaning, mining, and analysis technologies to the management of scientific research will greatly enhance the level and capacity of scientific research management and promote the healthy development of scientific research in the university.

N. Akhtar et al. (Eds.): PMIS 2023, AHIS 8, pp. 1296–1303, 2023.
https://doi.org/10.2991/978-94-6463-200-2_138

2 The Status Quo of Scientific Research Management in Application-Oriented Universities

2.1 The Lack of Scientificity of the Chosen Topic

Application-oriented universities in the early stages of construction inevitably focus on teaching and learning, and scientific research volume is low and conceptually lagging. Teaching far outweighs scientific research, scientific research results are more salient in key sessions involving teachers' interests such as the assessment of titles. Scientific research work is highly utilitarian, and most teachers treat it as a task to be completed, leading to a lack of effective long-term training in scientific research, an inability to understand the demand for scientific knowledge and application at the social level, and grasp the hotspots of the frontier and review preliminary concepts in the process of choosing topics for particular scientific research projects, which ultimately results in the disconnect between university scientific research and social development [1].

2.2 The Lack of Research Innovation

As part of the management of scientific research in application-oriented universities, duplication of the approval of scientific research projects occurs from time to time, which not only departs from the spirit of innovation in scientific research in colleges and universities but also results in the wastage of scientific research resources existing in small numbers. There are multiple levels of funding for the same or similar projects of scientific research, such as the provincial and ministerial level, the departmental and bureau level, or the school level; or for some hot scientific research information, different levels and types of funding projects fund the same project multiple times, forming a clumsy research situation in which teachers research the sake of research and there are no innovation points in research.

2.3 The Practicality of the Results is not Strong

Since most scientific researchers in application-oriented universities take their existing research interest or research bases as an entry point, they do not pay sufficient attention to the demands of external firms and institutions and the results of individual scientific research, which leads to a low conversion rate and slow conversion rate of scientific research results in colleges and universities. Moreover, university scientific researchers can't have access to enough external information and are unable to connect effectively with external demand data, which also constrains the effective conversion of scientific research results in application-oriented universities.

2.4 Lax Regulatory Constraint

While the academic integrity of papers can be verified by checker software as part of the current academic research process, the declaration stage of specific research projects does not include a targeted mechanism for oversight of academic integrity, causing a few scientific researchers to take improper ends as a starting point, and malicious behavior

such as forgery and plagiarism, at the project declaration stage [2]. The project evaluation experts in the letter evaluation, meeting evaluation, and other evaluation stages, pay more attention to the feasibility of the technical route of the project and project innovation, and there is also a lack of review supporting data and preliminary results of the project declaration of, etc. These two deficiencies indirectly lead to the repeated occurrence of academic misconduct.

3 Implementing Principles of Big Data Technology in the Refined Management of Scientific Research in Application-Oriented Universities

3.1 Big Data Technology Promotes Scientific Research Topic Selection

Scientific research begins with the selection of the topic of scientific research projects, and the scientificity of the topic has a direct bearing on the feasibility and innovation of project implementation. In an era of big data, the application of big data technology, scientific research managers can gather the current hot issues in the scientific community, the natural sciences theories, and technical research problems that need to be solved for national development and people's livelihoods, and then further gather relevant information domestically and internationally with the direction of academic discipline classification and organize them into scientific research topics in the form of school level projects to be posted in the university. Depending on the actual school situation, a pre-research team of major topics can be formed to get fully prepared for the topics to be proposed and declared at the next stage. Big data technology can also play an extremely important role as a bridging platform for the selection of the topic of scientific research in horizontal scientific research projects entrusted by companies and institutions [2]. Some companies do not currently know the research expertise, strength, and achievements of different universities, nor can they find their own trusted research team or researchers to take on the assigned project to help them overcome technical challenges. Actually, they often search for the entrusted units and the trustees through acquaintances. Big data technology has an extremely important value and role to play in resolving the inefficiency brought about by such information asymmetry.

3.2 Big Data Technologies to Prevent Duplication of Research Efforts

The core value of scientific research is innovation-discovering new problems, proposing new methods, solving new problems, or completing new inventions, etc., which is the foothold of all scientific research. Based on big data technology, scientific research management can integrate and mine the declared and approved scientific research projects across different levels, categories, and regions, by combining the strengths and research characteristics of universities and their research teams, they can also monitor the risk of duplication of the approval scientific research projects, avoid duplication of research, save scientific research funds, and reduce wasteful use of resources. When the university scientific researchers are organized to declare various projects at all levels, the university scientific research management department should make full use of big data technology to gatekeep the declaration of scientific research topics, avoid duplication of research, reduce the cost of scientific research, and save resources.

3.3 Big Data Technology Oversees the Standardization of Academic Integrity

Information asymmetry between researchers and review experts as well as scientific research managers is a major cause of problems in academic ethics and integrity. Through technologies such as scientific and technological verification of information, verification services can be provided for tasks such as approving and appraising scientific and technological projects and applying for awards, but the declaration text of the project is excluded from verification. The application of big data technology allows scientific research managers to oversee academic ethics and integrity at the declaration stage, further forming an all-round, multilevel, and wide-ranging supervisory standard.

3.4 Big Data Technologies Promote the Commercialization of Research Results

The ultimate goal of scientific research is to add to and extend scientific knowledge or to achieve breakthroughs in technological innovation and to make due contributions to the exploration of human knowledge or technological progress. Research results once completed, should be transformed and applied to society in time or widely disseminated to achieve the goal of promoting social progress. Science and technology management departments and university scientific research management departments can promote the establishment of that meet the databases of external entities, and university scientific research results database, use big data technology to achieve matching and docking between them, promote the rapid and timely conversion of research results, and effectively bring into play the market economic benefits of university scientific research results.

4 The Implementation Path of Big Data Technology in the Refined Management of Scientific Research in Application-Oriented Universities

Big data technology has the potential to make data knowledge-generating and upgrade prior data management work to analysis and prediction. Figure 1 is a flowchart showing how university scientific research management data generate knowledge. As shown in Fig. 1, the three main categories of data each fall into two parts: people and data [3]. Interval resources include the university scientific research staff database and the information about school-level projects, funds, and equipment; external data include the experts and talents database established by the government, universities, and the scientific research data from relevant departments of provinces, cities, and autonomous regions; the network data include the talent database of major recruitment and job-hunting websites and the database of literature, patents, and scientific research results from major public database platforms. Based on the originally collected internal and external data, useful information is extracted, converted, rebuilt, and put into the data warehouse, and then the data is compared and mined through suitable query and analysis tools to finally achieve the scientific selection of the topics, the sharing and re-use of scientific research data, the supervision of academic integrity, the acceleration in the conversion of results, the recruitment of scientific research talents that are much needed, the optimization of the paths to establish research teams across disciplines and majors.

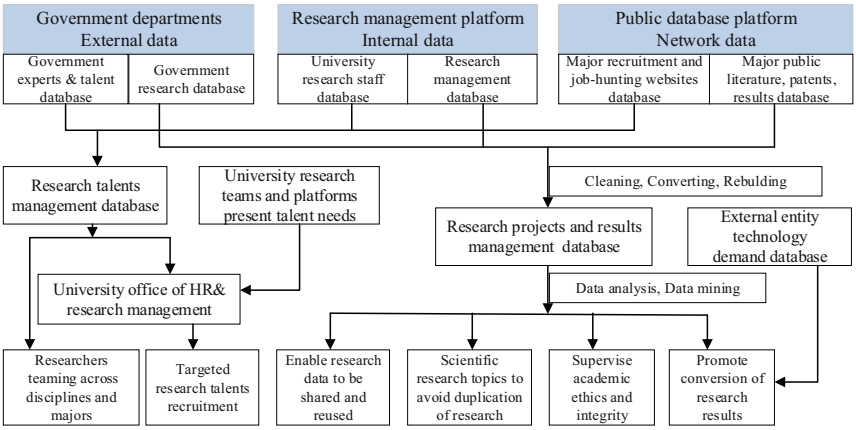

Fig. 1. Schematic of the derivation process for scientific research data.

4.1 The System Formulation Refinement

Apart from data collecting and mining, scientific research managers should also have some interpretation of the results, which reflects relationships among variables in the data. Schönberg, the author of The Age of Big Data, argues that the interpretation of data in the age of big data should be aimed at correlations among variables rather than at causal relationships. It is easy to derive "what happened" from the data, but “why it happened” and “what we should do in the future” are usually left ignored [4]. Big data technology should be used by scientific research managers to delve deeper into the information behind the raw data to provide a basis for management to make scientific, rational, and refined decisions and systems in the future.

4.2 Information Management Refinement

As noted above, all the departments in the university have each built their own commercial information management data platforms, but most operate separately and scientific research data and information resources cannot be interlinked and shared in real time. The realization of big data scientific research management services requires the establishment of a big data information platform to achieve the refined management of scientific research information (as shown in Fig. 2). Firstly, all kinds of scientific research management information platforms that work independently within the departments should be optimized and integrated to make the information interconnected for the sake of the establishment of a scientific research management data platform system with all the data interconnected and shared. The system can achieve not only in-depth mining of the academic data and the enhancement of the functions of re-using and sharing, but also the eradication of repetitive scientific research, the effective supervision of academic integrity, and the successful combating against various scientific research corruption and academic misconduct to ultimately bring into full play the big data technology applied in university scientific research management. Secondly, a data and information platform for converting scientific research results should be established to help put the results

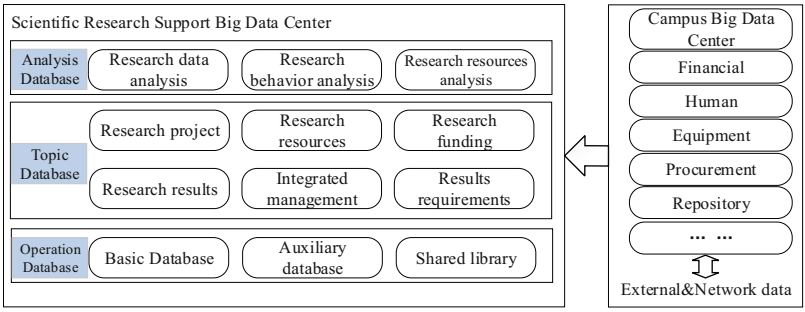

Fig. 2. Data framework of scientific research information big data platform.

into practice. Drawing on the scientific research management department, the university should actively set up a platform for exchanging data and information about the conversion of scientific research results, gather the demands of society, industries, and enterprises for the conversion and application of the scientific research results, create the database of demands for results, and carry out the matching and docking between scientific research results and social demands with the help of the existing scientific research database in the university. These measures can largely improve the asymmetry of the information about the conversion of the scientific results and speed up the achievement of a win-win situation in which scientific research results are converted into the market and social benefits [5]. Thirdly, based on the scientific research management platform with data interconnected and shared, the university should establish a database of scientific research information resources, containing information about the approved projects of different levels over the past years, such as the topics the leaders, keywords, research contact research results, and research teams, and create a standardized and data-driven service platform of scientific research data resources, on which the data can be collected, stored, sorted, analyzed, applied, promoted and dealt with.

4.3 Refinement of Talent Recruitment

Talent recruitment falls into two categories: external recruitment and internal teaming. A research team or research platform, according to their research expertise, proposes to the university personnel department the request for talents with specific research directions to be recruited. Big data can integrate data from the government, academic experts and talents databases, major professional recruitment and job-hunting websites, and relevant departments in provinces, cities, and autonomous regions to establish a targeted scientific research talents database, and achieve the targeted recruitment of external talents in line with personnel needs. Big data can also realize the evaluation of the score based on the scientific research activity and scientific research contribution of the scientific researchers in the university, and form the scientific research groups or friend zones proposed by the management system according to the scientific research directions and interests, so as to achieve internal teaming of scientific research projects across disciplines and specialties.

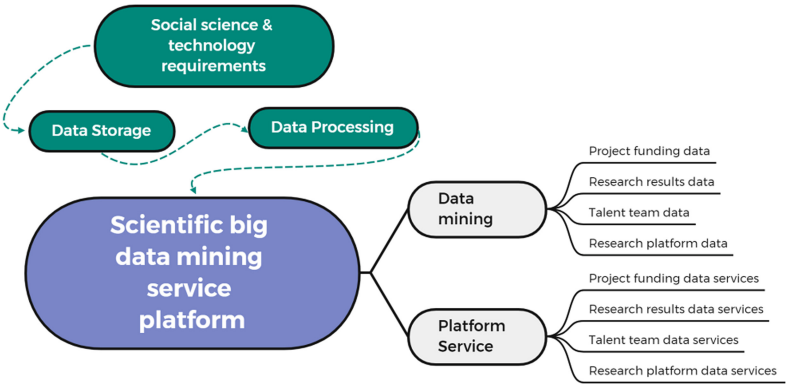

Fig. 3. Schematic of big data mining service platform functions.

4.4 Service Guarantee Refinement

The big data environment will certainly enhance the service consciousness of all departments within colleges and universities. The traditional concept of managing scientific research cannot guarantee the healthy development of scientific research in colleges and universities, which demands that scientific research management make some changes. First, under the big data condition, information mining should be started ahead of time to analyze the social and technological demands from the data, which makes the goal of scientific research more valid and focused. Secondly, in the context of big data, management departments should be forward-looking. They should not wait for researchers to come and demand data and results. Instead, they should make full use of the data, analyze and mine it to capture what data or findings researchers may need, and offer door-to-door service [6], as shown in Fig. 3.

5 Conclusion

In summary, the management of scientific research in application-oriented universities is a complex and challenging task, which has a lot to do with whether scientific research can be done smoothly and efficiently. In the context of big data, the scientific research service mode of application-oriented universities is constantly changing, which brings in more stringent requirements for scientific research management. Consequently, in the process of managing scientific research, management should use big data technology according to the current situation to discover hidden information from various aspects such as scientific research topics selection, research team, research projects, research integrity, and conversion of research results, with a review to provide support for the level of management and decision making of application-oriented universities to be boosted.

Acknowledgments. This work is partially supported by Science and technology research project of Hubei Provincial Department of Education ("Research on the implementation path of fine scientific research management in application-oriented universities from the perspective of big data", No. B2021568).

References

1. Song P 2017 A New Approach to scientific research management in application-oriented universities *Chinese University Science and Technology* (vol 12) pp 25–28
2. Yang W 2015 Innovation in Research Management in Universities in the Age of Big Data *Science and Technology Management Research* (vol 14) pp 1–4
3. Zhang C, Wu L, Zhang G. 2022 Research on informatization of scientific research management in colleges and universities under big data *Journal of Nanjing Open University* (vol 4) pp 64–69
4. Mayer-Schoenberg C 2013 *Big Data Age: A Big Change in Life, Work and Thinking* ed. Sheng Y, Zhou T Zhejiang People's Press Hangzhou
5. Liang Z 2018 Research management in universities under the big data threshold *Journal of Chongqing Jiaotong University* (Social Science Edition, vol 4) pp 127–131
6. Zhang Y 2015 Some Explorations on Improving the Management of Scientific Research in Colleges and Universities in the Context of Big Data *Journal of Northwestern University of Technology* (Social Sciences vol 2) pp 112–116