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Applications and Challenges of Big Data Auditing in the Health Insurance Industry

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Abstract: *With the rapid development of technology, audit work can refer to new data collection and analysis technology to collect and analyze the data generated by the audit unit at a deeper level. The application of big data has brought unprecedented changes to auditing, from data collection, and selection to data analysis, and then to the formation of audit papers, every link has the participation of big data technology. Secondly, medical insurance is responsible for ensuring the personal safety of Chinese citizens, which generally refers to basic medical insurance, which is used to compensate workers for economic losses caused by disease risks, and is an important part of China's social insurance system. It can be seen that the audit of medical insurance is an essential type of audit object in the audit task, and ensuring the safety and reliability of the medical insurance fund is to ensure the well-being of the people. In addition, the basic conditions for big data audit to be embedded in medical insurance audit have also been met, big data technology plays a positive role in improving the audit efficiency of medical insurance, reducing the cost of insurance companies, and promoting the practical application of big data audit in medical insurance audit is of great significance, providing important help for the development of China's national livelihood.*

Keywords: *Big Data, Audit, Edical Insurance*

1. Introduction

With the rapid development of the economy, material life continues to improve, and people's disposable income is also increasing, so it gives the insurance industry space for development, so the analysis of the market and user demand can be found, now China's insurance business presents a very typical diversification and intelligent characteristics. Article 19 of the Opinions on Strengthening Audit Work puts forward: exploring ways to use big data technology in auditing practice, increasing the comprehensive use of data, and improving the ability to use information technology to check problems, evaluate judgments, and make macro analyses. This is the first time that the state has included big data auditing in the audit informatization work focus in the document. The use of big data to audit health insurance has become a mainstream development direction, and at present, there are many kinds of big data-based health insurance fund audit models, and many new technologies are still emerging as people's research continues to deepen. Most of the references are from the last three years about the development of the health insurance industry in recent years, the development of big data auditing and the application of big data auditing in health insurance, and the application of big data auditing in the health insurance industry, and the challenges from the aspects of auditing, management, and economics.

More domestic and foreign research literature on big data audit, put forward the use of big data audit needs to face the difficulties and solutions, most of which are focused on the training of talents and data processing, but few people proposed that the existing policy should be improved, and China's health care business is faced with a huge size of the group, complex structure, diverse needs, health insurance fund has a wide coverage, more types of large impact, and other characteristics of the objective need to constantly strengthen its supervision level. The health insurance fund is characterized by wide coverage, many types, and great influence, which objectively requires continuous strengthening of supervision and improving governance. In addition, domestic insurance companies also have certain problems, many insurance companies have not set up internal audit departments, or the independence of the internal audit department can not be guaranteed, at present, there are more studies on the establishment of internal audit departments in China, China's insurance companies are often under the management of the internal audit department, from the point of view of the design of

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the institution is not completely independent, and will face new difficulties in the establishment of a separate internal audit department in the future. The internal audit department of insurance companies in China is often subordinate to the management and is not fully independent in terms of institutional design.

Foreign research on big data auditing is characterized by technology-driven and multi-disciplinary integration, focusing on solving complex problems in auditing practice through cutting-edge methods. On the one hand, countries are actively exploring the innovative application of big data auditing in finance, smart cities, and other fields, relying on blockchain, artificial intelligence, and other technologies to improve the efficiency and precision of auditing; on the other hand, the research focuses on the optimization of the audit model and the construction of the risk assessment system to adapt to the challenges of the massive growth and diversification of data.Alomari Sara et al. (2018)[1] pointed out in their study that with the increase in data scale and complexity, enhanced big data auditing needs to rely on efficient technical tools and analysis methods, emphasizing the core position of data integrity and security in the auditing process.In terms of audit model design and method innovation, Jiang Sai et al. (2021)[2] introduced Fuzzy AHP into big data auditing under the financial shared service model, which provides a quantitative tool for risk assessment in complex business scenarios by dealing with the uncertainty of auditing metrics through multi-criteria decision-making methods.Li Linghan's team (2020)[3] conducted a study on the shared service model of finance, proposing that big data auditing needs to integrate process data in depth, and real-time monitoring of cross-region and multi-object business is achieved by constructing standardized auditing modules, with the viewpoint of emphasizing the synergistic effect of the application of technology and business process re-engineering.

In the field of big data auditing, Gu Juan (2020)[4] mentioned that the data structure in big data auditing is more complex and of many types. The focus of this type of research is more concentrated on auditing in the broader environment, and the conclusions drawn have a wider range of application areas and do not highlight the application of big data auditing in different industries among different industries, and the processing aspects of data will be handled differently according to different industries. Sun Yuan (2021)[5] pointed out that in the context of the big data era, the work mode of the audit institution has undergone a fundamental change, and the audit efficiency and audit quality have been effectively improved. In the relevant literature on the use of big data to audit medical insurance, Xu Linjing (2022)[6] Ping An Insurance Company, for example, proposed that customer information can be shared to establish a closer customer relationship. Wu Hengliang and Yu Benhai (2019)[7] proposed a ‘top-down’ implementation path for the construction of big data auditing in three dimensions: technology, management, and modeling. Hu Zhiqiang and Zhang Wenxiu (2020)[8] proposed to increase the use of audit results of various types of health insurance funds. Data processing is the key to the use of big data audit, Ji Xiaoting (2024)[9] solve the key to the use of big data audit of health insurance is the need for abundant big data audit base resources, around the health insurance fund-raising and the use of management, analyze and find possible problems to improve the efficiency of the health insurance audit, but how to implement the specific implementation is still a problem. Guo Dandan et al. (2021)[10] analyzed the latest release of China Life's recruitment requirements for the audit post, which shows that the structure of the internal audit staff is developing in a diversified direction.

Based on the existing auditing theory and the impact of big data on it, scholars start from the impact of the industry as a whole, put forward the implementation of the cost problem, the quality of practitioners, and the application of the methodological model of big data auditing, and then focus on the practical issues of auditing practice. However, the above research is still deficient in two aspects: firstly, the collection mode and method of big data information still lacks results; secondly, the processing method of the acquired big data is still in the exploration stage, and a clear data processing method has not been proposed yet.

2. Theoretical foundations related to big data auditing

Big data auditing is an auditing institution adhering to the concept of big data, with the help of big data technology methods and means, the use of a large number of economic and social operation data from scattered sources, in a variety of forms for auditing, to carry out cross-level, cross-regional, cross-system, cross-departmental and cross-business in-depth excavation and analysis, and to enhance the audit of the problem, assessment and judgment, and the ability to conduct macro-analysis. Big data is the inevitable development trend of information technology at a certain stage, and it is the inevitable

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choice for audit institutions to adapt to the changes of the times.

2.1 Key elements of a big data audit system

Big data has gradually become the mainstream of development in the current era, and under the premise of attaching importance to the construction of big data systems, China has also attached importance to training a number of professionals. Compared with other developed countries, the time for domestic big data research is still relatively short, but some technical activities have been incorporated into the big data environment. In addition, the increasing level of economic and social informatization, as well as the development of accounting informatization and network technology, is changing rapidly, big data technology processing has become an important content and technical support in corporate governance, internal control, and risk management systems.

In 2014, the Audit Commission set up the Electronic Data Audit Division, and successively issued regulations on the management of electronic data for auditing business, remote networking management of electronic data for auditing business, construction of data analysis network of the Special Commission Office, and sharing of electronic data for auditing business, etc., defining the requirements for each link of data collection, management, use and security, and initially establishing a relatively complete and standard big data audit system; local audit authorities at all levels have also constructed big data audit systems according to the actual situation. Institutions have also built big data audits according to the actual situation, and have received good results.[11]

2.2 Characteristics of auditing in a big data environment

With the application of big data, innovation in the thinking of auditors and auditing methods has been achieved, and full coverage of auditing work in the true sense of the word has been realized. Firstly, in the planning stage of the audit, the auditors provided a reference for the preparation of the audit work program by establishing a data collection module. Secondly, during the audit process, auditors compare and analyze the collected data to provide clues for quickly finding the focus of the audit work, to accurately obtain the focus of the audit, clarify the objectives, reduce the risks, and improve efficiency. Thirdly, in the audit report stage, through modeling, a comprehensive analysis of audit conclusions is carried out to improve the level of audit results, summarize and analyze the completion of the project, identify shortcomings, and accumulate experience.

2.2.1 Increased efficiency of audit staff in analysing data

In the audit work, the auditors will be faced with a huge amount of data and information, and to complete the audit task with high standards within the limited audit time. Therefore, the auditor should be familiar with the database of the audited unit in advance to use the situation, and specifically formulate a practical data collection program so that the auditor from the massive database to find the data helpful to the audit work, to enhance the quality and efficiency of the audit work.

2.2.2 Optimised audit procedures

As shown in Figure 1, the concept of big data is always present in the auditing process, which is better than traditional auditing as far as the auditing procedure is concerned. Taking Jiaxing as an example, in recent years, the construction of Jiaxing's health insurance information system has been gradually improved, mainly including the core platform version 3 business system and Jiaxing's telemedicine coordination platform system. The third version of the core platform business processing system mainly realizes the whole process of the health insurance business, including insurance registration, payment approval, fund collection, medical treatment payment, financial payment, and other business links.[12] The medical care coordination platform system realizes the function of auditing, settlement, and clearing of Jiaxing's business data, and is also the core platform of Jiaxing's remote medical care channel. Jiaxing medical insurance big data audit relies on these two systems to obtain the city's medical insurance data in real-time, use big data technology for querying, validation, and predictive analysis, optimize the audit process, achieve data first, and play the role of audit supervision more effectively.

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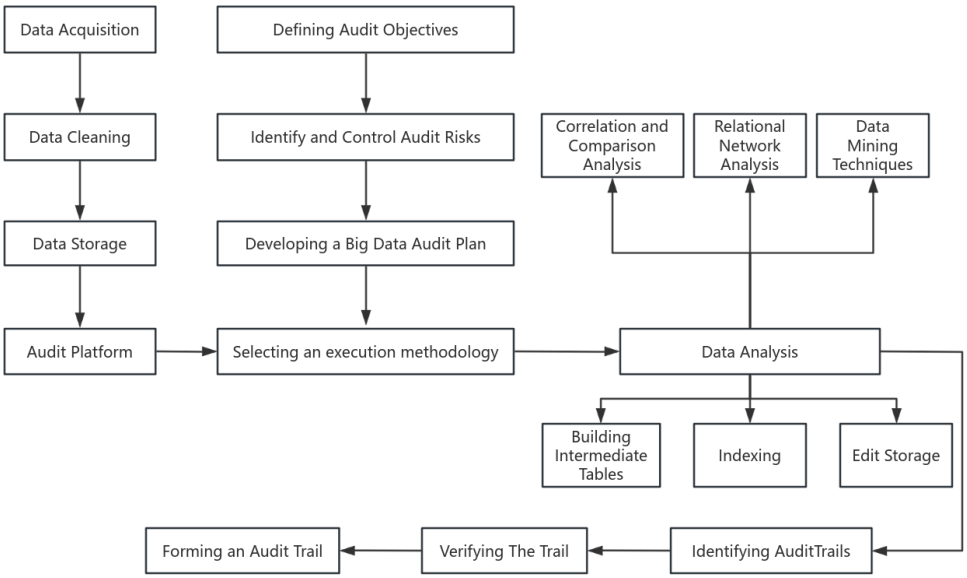

Figure 1 Big data audit process

3. The use of big data technology in health care audits

Medical insurance audit covers a wide range of levels, including health government agencies, fund regulators, management agencies, etc., involving the collection, supervision, and application of medical insurance funds, and the pre-audit research to determine the audit field and depth, correctly construct the main scope of the audit, and determine the audit objectives are the necessary basis for the audit of medical insurance big data analysis.[13]

3.1 Improved quality of health insurance audits

In recent years, industries have made great progress in modernizing their work, especially in health insurance, which has benefited from the strong support given by our country. What's more, the health insurance business can operate with the help of network technology, which lays the foundation for big data auditing. At the same time, thanks to the continuous improvement of information technology, the level of automation and intelligence of big data audit is getting higher and higher, especially in information collection, data mining and statistical analysis, and other technology updates put forward higher requirements, resulting in higher and higher quality of data, so that the quality of health insurance audits greatly improved. Moreover, with the use of big data information technology medical insurance companies can implement the audit of the comprehensive data chain, which is very important to improve the efficiency of medical insurance audits, but also to overcome the phenomenon of information blindness in the traditional audit, thus improving the accuracy and precision of the audit. In short, the application of big data analysis technology can promote the effectiveness of health insurance audit work and improve the quality of service.

3.2 Promoted standardisation of health insurance audits

Medical insurance funds' reasonable use of big data audit methods must ensure the informatization and standardization of big data statistical analysis, to promote the development of this work, China's government puts forward, all relevant authorities have clear requirements and the promulgation of many regulations. Along with the further implementation of the above policies and measures, the degree of intelligence of China's health insurance has been greatly improved, the standardized operation of information big data has been effectively implemented, and the transformation of big data standards has laid a solid foundation for the standardized operation of China's health insurance. At the same time, the big data audit is more stable than the traditional method, and the calculation method is more reasonable, which can significantly reduce the interference of human factors, and thus can also greatly reduce cheating and other illegal behaviors. Therefore, both from the technical level and the practical operation level, big data audits can promote the standardization of China's health insurance

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audit.

3.3 Improved early warning capacity for the health insurance fund

Big data audit also helps to enhance the government's health insurance fund early warning capability, this is because the smooth operation of the health insurance fund is related to the lives of the general public and the stable development of the national society, therefore, it is necessary to use big data audit to achieve the government for the health insurance fund for dynamic supervision of the use of funds, but also able to detect potential risks and hidden dangers promptly to facilitate the government to carry out timely early warning. Another advantage of big data audit is its accuracy because the level of economic development of China's regions varies, many regions with high levels of economic development and strong funds, but there is a lack of funds utilization, in the level of economic development of the backward regions can also be detected through the big data audit of the health insurance fund shortages.

3.4 Enhanced application of evidence of correlation

Big data audits are useful for maximizing the scope of the data chain and facilitating the use of relevant relational information. Currently, the increasing number of documents printed electronically and the growing variety of evidence make the review process extremely difficult. The use of big data for auditing can effectively identify the links between various types of data, and then based on these links for follow-up audit research, the unknown data can be ignored, and direct examination of the correlation and reduce the previous purely causal relationship to find information caused by too much information. In short, big data auditing can use cause and effect relationship logic to transform the search for data into an in-depth analysis of the links between the data and examination, and then enhance the reliability of the audit conclusions.

4. Challenges of applying big data in health care audits

The wide scope of China's health insurance fund and the large number of responsible departments involved have put forward higher requirements for the collection of health insurance information. At present, most of China's health insurance audits are based on provincial and regional audits. In the future, if this ‘branch office’ audit organizational model is still used, the lack of information exchange between regions, the lack of relevant health insurance data sharing and dynamic analysis, will make the health insurance audit more difficult, will inevitably reduce the efficiency of the audit, how to obtain the data information is also the difficulty of China's commercial insurance must be. In addition, the various disputes that may arise during the implementation of big data audits can not be fully considered and handled, and it is difficult to make sense of them. Therefore, how to effectively control the cost of big data auditing and improve the efficiency of auditing has become an important topic that needs to be studied and explored urgently at present.

Ping An Insurance (Group) Company of China, Ltd. was founded in Shenzhen in 1988 and is a financial company listed on the Hong Kong Stock Exchange. Its main business is to provide diversified financial services and products with insurance business as the core. In response to the problems faced by big data auditing in health insurance auditing, this paper takes Ping An Insurance Company as an example and makes corresponding suggestions for using big data to audit health insurance.

4.1 Inadequate policies for using big data to audit Medicare

At present, big data auditing technology has been widely used in many fields, but because China's legislation on this point is not yet sound, although the relevant agencies have issued Framework Opinions on Several Major Issues on Improving the Audit System, the opinions are only directional and do not have legislative binding force. The lack of laws and regulations makes the boundaries of auditors' rights after applying the method ambiguous, causing some unnecessary troubles to the audit work. In addition, big data auditing requires the regulation and guarantee of laws and regulations at the national level from data collection, storage, and analysis to the determination of results.[14]

To better meet the requirements of big data auditing, for big data auditing standards, ISACA has stipulated the relevant norms to be complied with in the auditing process, etc., which facilitates the auditing department to provide a more comprehensive description of the relevant information and

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ensure the authenticity of the data. At present, in China's big data auditing work, the relevant legislation and auditing norms are not yet sound, and cannot specifically guide the details of auditing, as there is no corresponding basis for auditing work, and the implementation of the standards is not clear enough, which makes it difficult to solve some difficult problems in big data auditing, and unable to better avoid some systemic risks.

4.2 Quality of audit staff needs to be improved

Big data audits of health insurance require auditors with high professional qualities and sufficient experience to conduct audits. Even though the application of big data technology has put forward higher requirements for auditors, for a long time, the demand for auditors in all government departments has been more in favor of professionalism and neglected the understanding of high and new technology. In Fujian Province, for example, less than 30 percent of the total number of people who passed the computer intermediate examination entered the Audit Department, and many local audit departments focus only on auditing when recruiting personnel, rarely recruiting talents in data mining and data analysis. In addition, while it is true that big data technology has greatly improved the efficiency of auditing and the quality of service, it has also raised higher standards for the ethical qualities of personnel due to the issue of data security, which must therefore be taken into account in future work. Although the development of big data is in full swing, the audit is still practical work, the need for auditors to keep pace with the development of the times at the same time not to forget to learn the theoretical knowledge of auditing, and the combination of the two into the actual work. Only in this way can truly keep pace with the times, better serve the social and economic construction, to meet the growing needs of the people for a better life. With the continuous integration of information technology and auditing, auditing methods and approaches are more diversified and complex.

4.3 Inadequate internal audit mechanisms

Internal auditing is based on the enterprise's internal affairs and provides testing and evaluation services for the entire enterprise. Compared with external auditing, internal auditing is more reflective of the enterprise's business risks and requires less time and simpler procedures. This is because the internal audit department itself is part of the enterprise, can participate in the enterprise's major decisions, and has more real access to the enterprise's daily activities in the data.

In the modern digital audit environment, the business processing process includes manual processing, computer system processing, and human-computer interaction processing, the focus of unit management has become the human business and its processing, human-computer interaction processing, computer system business processing and the process of information transfer between different systems, the focus of the internal control and the link has changed greatly.

4.3.1 Lack of assurance of audit independence

At present, many domestic insurance companies have positioned internal auditing as financial risk assessment, after finding problems and correcting deficiencies, as the internal audit work can not yet be completely independent, the audit concept also needs further improvement, the audit will not play an effective preventive function, and can not provide value strategic advice for business managers. The overall health of internal controls can only be known through a comprehensive audit of controls over the entire information system, thus clarifying the points for future substantive testing and audit procedures.

4.3.2 Audit risk exists

In the big data environment, to obtain complete and credible audit evidence, one not only must access the audited organization's financial reports, documents, and other information, but also must access other organizations' data and information, and even need to access public data on the network. For example, the Ping An Insurance Company audit, not only needs to be collected from the company's insurance information but also be supplemented by the public security organs on the death of personnel and other information, to reflect the audit issues more comprehensively and truly. However, these data resources are often sensitive and confidential, and should not be made public. By renting storage management from ordinary cloud platforms, malicious attacks on the network will cause serious consequences. Therefore, it is necessary to design a sharing and authority management mechanism for the specific needs of big data auditing, to effectively manage and protect the security and availability of audit data collection, transmission, storage, use, maintenance, updating, and destruction, and to reduce

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audit risks.

China's experience in big data auditing is still relatively scarce, and very often internal auditors make judgements based only on their own experience when carrying out their work, which may also lead to more risky loopholes and thus create audit risks.

4.4 Increased risk inherent in data

Health insurance audit data involves several government departments, such as the finance department, the public security department, small and medium-sized enterprises, and public hospitals, which will selectively provide data to safeguard their interests, and once the integrity of the data has been compromised, the fairness and objectivity of the audit results will be affected. In addition, although all departments have established information systems, the lack of unified interface technology increases the difficulty of data sharing. Therefore, the application of big data analysis must first be designed from the top and improve the data-sharing mechanism.

In the case of Ping An Insurance Company, it has some value-added commercial medical services such as medical beauty and dental care, and it can obtain reliable data from medical institutions through risk prevention and assessment of these items. However, because customer information involves telephone numbers and diagnostic information, it faces the risk of data leakage when collecting information.

5. Strategies to address the challenges

The introduction of big data technology into the audit of China's health insurance fund is relatively late, and the audit mechanism has many unsound points, which is also the root cause of the loopholes in the information system. In the future, the relevant regulatory authorities will strengthen supervision and continuously improve the construction of the big data audit mechanism. In the design, not only the audit needs but also the actual needs of the National Health Insurance Fund should be taken into account. In addition, full attention should be paid to the issue of data security during the design of the information system, and data security standards, including personal and corporate security as well as national security, should be improved to avoid the leakage of information in the application process.

5.1 Enhanced policy support

Big data auditing is a brand new auditing method, so China should improve the relevant legislative system as soon as possible. First of all, for data collection, storage of power and rights must be determined by law, to produce a strong deterrent to illegal behavior. Then, the results of data analysis also require the recognition of laws and regulations, the only way to promote the orderly development of big data audits. Finally, through the legislation on big data analysis of the normative scope, operational standards, and implementation of the way to be clear, so that the audit of big data analysis can achieve a chapter to follow, there is a law to follow, in the country to introduce the corresponding laws of local people's governments at all levels should respond positively, the introduction of relevant local regulations, the only way to form a more sound legal system can be carried out for the development of big data auditing to create more favorable conditions. The only way to create more favorable conditions for the development of big data audits is to form a more sound regulatory system.

Specifically, big data audits can be implemented in the following three important aspects: first, pay attention to the reimbursement of medicines for the treatment of chronic diseases and medicines for major diseases, review whether there are patients who are unable to purchase medicines in the medical insurance catalog, and review whether there are unreasonable reimbursement situations. The second is to focus on the medical protection of groups in difficulty and to review whether there are people in difficulty who are not covered by major disease insurance by using big data to compare the data of people in difficulty with the data on contributions made by insured people. Third, focusing on reform promotion plans such as the pilot drug use scheme, the national centralized purchasing catalog can be used to compare with the health insurance data system to review whether there are problems such as drugs being falsely prescribed and sold.

5.2 Strengthening vocational skills training

To give full play to the role of big data auditing first of all, it is necessary to cultivate a group of

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excellent talent teams, to conduct professional skills training at the same time as the training of professional knowledge in big data analysis, and in the recruitment and selection of talents, the ability to analyze big data must be regarded as one of the recruitment criteria. In addition, the provincial and municipal auditing authorities should also do a good job of cultivating the professional skills of the talents and may take the form of selection and other forms to form a group of backbone troops, which will undertake the technical work of big data auditing in the province and city and complete the cultivation of the relevant talents.

Audit staff should make timely preparations for information collection. The first is to determine the purpose of the audit by understanding and investigating the audited organizations, especially to make timely preparations for the scale and time of data collection. The second is to grasp the information technology platform and database structure of the audited organization through telephone calls and in-person on-site inspections, to provide a basis for collecting audit information. Third, the demand for collecting audit information is put forward to the audited enterprise by the audit implementation program. In short, upgrading the quality of audit personnel is the basis for promoting the implementation of big data auditing.

In addition to the training of professional auditors, it is also necessary to strengthen the training of audit students in various colleges and universities, the theory and practical operation of big data auditing for the course is arranged in the teaching task, which can be audited by a group as a unit of a certain enterprise, to enrich the hands-on experience of the students at the same time, but also to deepen the idea of big data auditing into the ideological aspects of the students.

5.3 Sound internal audit system

In a digital audit environment, where business processes include manual processing, computer system processing, and human-computer interaction, the focus and aspects of internal control have changed significantly. Only through a comprehensive audit of internal controls over the entire information system can the status of internal controls be captured and the elements of future substantive testing and audit procedures be established accordingly.

There are three specific implementation methods to build a perfect enterprise internal audit system: integrating the auditing organ with the legal department; setting up an audit department under the enterprise's disciplinary committee; and setting up an independent audit department. However, it is worth paying attention to the fact that, regardless of how the department is set up, the auditor should be independent and should neither carry out matters related to the use of the health insurance fund nor engage in financial management activities, which is an important prerequisite for reasonable audit supervision.

Establish an effective corporate governance structure and risk prevention system. For Ping An of China, to achieve long-term sustainable development, it must improve its competitiveness in three aspects: firstly, to continuously improve its corporate governance capacity to ensure that the company can develop steadily; secondly, to strengthen its awareness of risk management to take precautionary measures; and thirdly, to enhance its resilience to deal with unforeseen events, to enable the company to better create value for its shareholders.

5.4 Building a data analytics platform

In the context of big data auditing, audit authorities have more basic data from government departments, building a data and information cornerstone for full audit coverage. Audit institutions must continue to improve the construction of a network platform for big data analysis and review, increase the frequency of data collection and analysis, update the data promptly, and make objective analyses and judgments of the current economic situation and social risk conditions, to give full play to the important role of auditing in the Party and state supervision system, and to help promote the establishment of a unified, all-rounded, authoritative and effective audit supervision system. For example, ‘Internet +’ technology can be used to build a Web-based online monitoring system. The system is based on the enterprise's existing financial, business, and office software and integrated with the ERP system, CRM management system, remote video conferencing, and other functions to achieve real-time viewing of various types of reports, querying a variety of data, and providing Financial management and business decision-making.

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6. Conclusions

The National Audit Office has put forward clear requirements for the introduction of big data technology in auditing, and provinces and municipalities should gradually set up audit data centers and continuously improve their capacity for data mining and data analysis. The medical insurance fund is related to the life safety of hundreds of millions of people in China, and is the ballast of China's medical system reform, especially after the outbreak of the new crown epidemic, the importance of the medical insurance fund is more and more prominent. The use of big data technology to audit medical insurance is the mainstream development direction, but there are still many problems in the development process, mainly focusing on the imperfections of the relevant policies, imperfections in the internal audit mechanism, and other aspects. This paper takes Ping An Insurance Company as an example and puts forward four suggestions for the problems that need to be solved urgently.

In summary, China's big data audit has not yet matured, and health insurance audit still has a broader upside. Therefore, it is hoped that through the joint efforts of all walks of life, the new auditing organization mode and auditing method that relies on the improvement of big data technology will play a role in the field of social medical insurance and commercial health insurance as soon as possible, solving the dilemmas and contradictions at this stage, to promote the long-term development of the people's livelihood project in China.

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