Research and Application of Analysis System in Material Field by Digital Audit and Artificial Intelligence

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Abstract. In the material management process of large power companies, there are frequent withdrawals from the library to modify the age of the warehouse, resulting in a substantial backlog of materials. In view of the huge amount of data and multiple analysis dimensions in the process of auditing and screening such problems, the research and development is based on digitalization. The automatic analysis system in the field of audit materials, through the comprehensive cross-analysis of engineering information, financial data, and material data, can quickly determine the data of the false profit pool, and significantly improve the quality and efficiency of the audit. According to the screening results, the material management department is urged to deploy the stockpiled materials in the library to promote the efficient turnover of materials.

Keywords: digital audit, artificial intelligence, intelligent analysis

1. Introduction

In the actual material management process of large power companies, in order to complete the benchmarking indicators of the same industry, branch companies at all levels do not work hard on their own internal management, do not pay attention to the construction of long-term management mechanisms, and only pay attention to immediate benefits. Pursuing the ostensible benchmarking data by performing false warehouse-in, profit-making, and out-of-warehousing operations in the SG-ERP system resulted in serious distortion of the data in the SG-ERP system, inconsistent accounts, and chaotic material management, which brought companies larger production and operation risks and capital loss risks. When auditing such problems, there are numerous systems and huge amounts of data involved, and traditional human audits are time-consuming and labor-intensive. This paper uses digital audit thinking, applies big data, computer-assisted decision-making and other technologies to establish digital audit models, develops automatic analysis systems in the field of materials, and greatly reduces the time for the false withdrawal of audit materials from the library, and effectively improves the quality and efficiency of audits.

1.1. Work process

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In the face of thousands of power grid engineering projects every year, there are dozens of millions of items in all aspects of material management. The amount of data, through the establishment of a digital audit model, using database SQL statements, to compare the collected SG-ERP system data with the relevant data in the project management system and PMS system, automatically judge according to the set data logic rules, and filter out the suspects Data, and then conduct empirical analysis on the suspicious point data to find audit trails. The specific process is shown in Figure 1.

**Figure 1.** The specific process of auditing false profitability issues

1.2. Basic database for material analysis

Focusing on the data of each management link of the SG-ERP system, combining the PMS system, infrastructure management system, reimbursement and capital payment/BW analysis system to obtain materials, project management, project finance and other related data, and the key links and information system function points one by one Correspondingly, the systems have the same key data, forming a basic database for data analysis.
1.3. Element location method to obtain standard material information of engineering approval documents

The element positioning method is used to obtain project approval documents, which are mostly scanned documents, project standard material information in CEB format files, in order to judge whether the materials are used in the actual needs of the project, the specific method is shown in Figure 2.

The element positioning method is adopted to quickly convert the form in the project approval file into a form file to facilitate subsequent processing of the form file; this method does not require manual copying of the form in the project approval file, which can save manpower and improve efficiency. Preset vertical edge lines and horizontal edge lines, and determine the attribute information of the extracted line elements and text elements based on the edge lines. The size relationship of the attribute information can uniquely characterize the relative positions between elements, not only with less information, but also the attribute information can be used directly in the subsequent processing without other conversion or calculation, which effectively improves the processing efficiency. The specific method is shown in Figure 2.

![Figure 2. Using element positioning method to obtain standard material information in engineering approval documents](image)

2. Intelligent analysis system in the field of materials

The intelligent analysis system in the field of materials mainly includes four modules: information acquisition module, latest time determination module, project information determination module, and analysis module (Figure 3).
Figure 3. Four modules of intelligent analysis system in the field of materials

2.1. Information acquisition module
It is used to obtain material data of multiple units of materials from the enterprise resource planning system, obtain project detailed information from the project financial system, and extract the project material information in the unit of project name from the project approval document; the material data includes each One or more pieces of basic information corresponding to a unit material, and each of the basic information includes: the movement type, batch number, material code, input time, and WBS elements of the corresponding material; the project detailed information includes: project Name, project creation date, actual commissioning date, and project completion date; the engineering material information includes the project name and the corresponding project material code;

2.2. The latest time determination module
It is used to select one or more units of materials as target materials according to the movement type, batch number, and material code, and determine the target material code corresponding to the target material; The input time of the target material determines the latest withdrawal time of the target material, and the latest profitability time of the target material is determined according to the input time of the target material whose movement type is the outbound type;

2.3. Project information determination module
It is used to determine the latest target project code of the target material according to the Liku WBS element, and determine the target project name corresponding to the target project code according to the correspondence between the project code and the project name; according to the project The project information determines the target project creation date, the target actual commissioning date and the target project completion date corresponding to the target project name; the material consistency of the target material is determined according to the target project name, and the material consistency is used To indicate whether there is a project material code consistent with the target material code in the engineering material information corresponding to the target project name;

2.4. Analysis module
If the target material meets one or more of the first condition, the second condition, the third condition, and the fourth condition, it is used to determine that the target material has a problem of false withdrawal from the library.

The first condition is: the latest withdrawal time is greater than the latest profitability time;

The second condition is: the latest profitability time is after the target actual commissioning date and/or the target project completion date;
The third condition is: the latest profitable time is before the creation date of the target project;
The fourth condition is: the consistency of the materials is no.

3. System operation test

3.1. Traditional method test

The common methods for auditing long-term material backlogs and false profit retreat pools include four steps, including data export, material overdue backlog analysis, false profit pool analysis, and audit doubtful point verification summary. Choose 6 groups of people, and test the same group of data (Table 1).

| Test staff | export data | Long-term backlog analysis of materials | False profit analysis | Summing up audit doubts | Total time |
|------------|-------------|----------------------------------------|-----------------------|-------------------------|------------|
| 1          | 4.51        | 46.78                                  | 131.05                | 6.69                    | 189.03     |
| 2          | 4.18        | 55.12                                  | 147.41                | 6.03                    | 212.74     |
| 3          | 4.07        | 70.07                                  | 170.74                | 7.70                    | 252.58     |
| 4          | 4.07        | 51.82                                  | 182.40                | 7.70                    | 245.99     |
| 5          | 4.40        | 72.15                                  | 157.52                | 6.93                    | 241.00     |
| 6          | 4.07        | 47.65                                  | 168.40                | 6.03                    | 226.15     |
| average value | 4.22      | 57.27                                  | 159.59                | 6.85                    | 227.92     |

The average duration and sample variance analysis of the data show that the two-analysis links of long-term material backlog analysis and false profit analysis are time-consuming and fluctuating (Figure 4 and Figure 5).

![Figure 4](image-url)  
**Figure 4.** The average time consumed by traditional methods of auditing each link
3.2. Intelligent analysis system test in material field
For the same set of data, use the researched and developed intelligent analysis system in the field of materials to test (Table 2).

| Test staff | export data | Long-term backlog analysis of materials | False profit analysis | Summing up audit doubts | Total time |
|------------|-------------|----------------------------------------|-----------------------|--------------------------|------------|
| 1          | 5           | 1.7                                    | 5.3                   | 13                       | 27         |
| 2          | 4           | 2.0                                    | 5.6                   | 12                       | 23.6       |
| 3          | 5           | 1.9                                    | 6.0                   | 11                       | 24.9       |
| 4          | 4           | 2.6                                    | 5.1                   | 14                       | 25.7       |
| 5          | 4           | 2.4                                    | 4.9                   | 12                       | 23.3       |
| 6          | 4           | 2.3                                    | 5.6                   | 11                       | 23.9       |
| average    | 4.3         | 2.3                                    | 5.9                   | 12.2                     | 24.7       |

Using the intelligent analysis system in the field of materials to test the average time is 24.7 minutes, which is 89.2% less time-consuming than traditional audit methods (Figure 6), and the audit efficiency is greatly improved.
4. Conclusion
Through the corresponding relationship between the project code of the project and the project name, the material data, project detailed information and project material information of the materials are gathered together, so as to realize the cross-comparative analysis of the three kinds of data, and the corresponding materials can be extracted. The time parameters of the project and the actual situation of the investment in the project, and then realize the intelligent analysis of the phenomenon of false withdrawal of materials.

The advent of the "big data" era has brought new opportunities and challenges to corporate audit work. As an important task of supervising economic activities, auditing is inevitable and necessary in combination with "big data". Faced with the huge amount of data and information, only through the establishment of digital audit modules and continuous improvement and innovation can the audit work be comprehensive and continuous, and the efficiency and effectiveness of the audit work can be improved, so as to accurately discover and solve problems. Reduce the possibility of audit work risk issues, provide important information reference for the operation and development of power grid companies, corporate decision-making, etc., so as to promote the continuous progress and development of power grid companies.

References
[1] J. van der Geer, J. A. J. Hanraads, R. A. Lupton, The art of writing a scientific article, J. Sci. Commun. 163 (2000) 51 - 59.
[2] W. Strunk Jr., E. B. White, The Elements of Style, third ed., Macmillan, New York, 1979.
[3] G. R. Mettam, How to prepare an electronic version of your article, in: B.S. Jones, R. Z. Smith (Eds.), Introduction to the Electronic Age, E-Publishing Inc., New York, 1999, pp. 281 - 304.
[4] C. D. Smith and E. F. Jones, “Load-cycling in cubic press,” in Shock Compression of Condensed Matter-2001, AIP Conference Proceedings 620, edited by M. D. Furnish et al. American Institute of Physics, Melville, NY, 2002, pp. 651 – 654.
[5] P. G. Clem, M. Rodriguez, J.A. Voigt and C.S. Ashley, U.S. Patent 6, 231, 666. (2001).
[6] Information on http://www.weld.labs.gov.cn

Figure 6. Comparison of time-consuming work between traditional audit methods and R&D systems