MAINTENANCE INFORMATION SSTEM

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ABSTRACT

This paper analyses the dilemma of the management of a rail transit company from different considerations. Due to the closed nature of the industry, it is necessary to understand the actual difficulties of rail transit operation management. In the analysis, the report and analysis solution focuses on the difficulties of the rail transit industry. It illustrates the dilemma of the actual data processing human resources shortage of rail transit operators, so that similar companies can understand themselves well. It describes the relationship between the actual data accumulation of the rail transit industry and the lagging capability of data analysis and processing; the contradiction between the short of human resource and the rapid growth of business demand. Under this situation, an analytical solution will be proposed according to the current status.

Keywords:

1. BACKGROUND

At present, the maintenance records of facilities and equipment are supplemented by the original paper records and archives as the main computer storage. The data analysis mainly relies on the manual statistical analysis of EXCEL forms. The information transmission is mainly transmitted by telephone. The methods are inefficient and the information data is easy to lose. It is increasingly unable to meet the data analysis, transmission and storage of big data, high intensity and large information volume. Therefore, Maintenance System urgently needs information system to support the following problems:

(1) The number of subway facilities and equipment is increasing day by day, with various types, different performances, scattered distribution points, and obvious differences in maintenance procedures and processes. It is necessary to support the benign economic operation of the subway with reasonable facilities and equipment maintenance mode;

(2) The maintenance and construction operation points lead to more difficult resource allocation and distribution. There is a high degree of coordination between technical professional departments, technical departments and functional departments, technical departments and transportation departments. It is necessary to quickly and reasonably allocate production factors such as manpower, technology, materials and tools;

(3) The development of rail transit technology is changing with each passing day. There are many contradictions between the new technology and the coordinated operation of existing old equipment and systems. The software and hardware compatibility issues of the equipment need to be solved to better carry out maintenance and maintenance basic data collection and equipment status judgment.

2. OBJECTIVES

At present, the maintenance records of the equipment are supplemented by the original paper records. The analysis data mainly relies on the manual statistical analysis of the EXCEL form. The information mainly transmitted by telephone. Such methods are inefficient and easy to be lost. This situation cannot meet the requests of big data, high intensity, and large amount of data analysis, delivery and storage. It became the best choice for technical support and quality through accumulating equipment state data through information system, establishing proper technical support maintenance information system, supporting maintenance management, quality analysis and control.
Here is our deliverable:
1.   Manage related work of equipment's maintenance through the information system.
2.   Provide information support to analysis the reliability, efficiency of the equipments. Then send the e-mail to related users automatically.
3.   Key the maintenance procedures into the system then able to track and control the status of each equipment and record all the data automatically.

3. PESTEL ANALYSIS

The quality of the subway equipment has directly effect to the quality of the operational services. Only with the support of technical security management and big data base, then we can guarantee the operational needs. With the

increasing of the accumulation of various technical data of the equipment, and the difficulty of data analysis and statistics is constantly increasing. In addition, the variety of equipment and facilities, the different performances, the scattered distribution, the repair process and the process are far apart, giving technical support, brought serious challenges.

3.1 Politics

The rail transit industry is mainly a relatively closed field dominated by government investment and using out-dated management styles. The process management involves paper form management, which is inefficient and wastes resources. The data is very difficult to master and the statistics are very difficult. At the same time, due to the fast expansion of the past 20 years, human resources are very tight. The rail transit industry is a huge linkage system with multiple disciplines. It takes a long process for the involved personnel to go from training to entering the work site. In the short term, it is impossible to realize the gap in the human resources of the industry through the students who have graduated from the current expansion of rail transit. Therefore, we propose an automated rail transit information system to replaces manpower.

3.2 Economics

The contradiction between the rapid growth of the rail transit industry and the shortage of human resource and data processing：
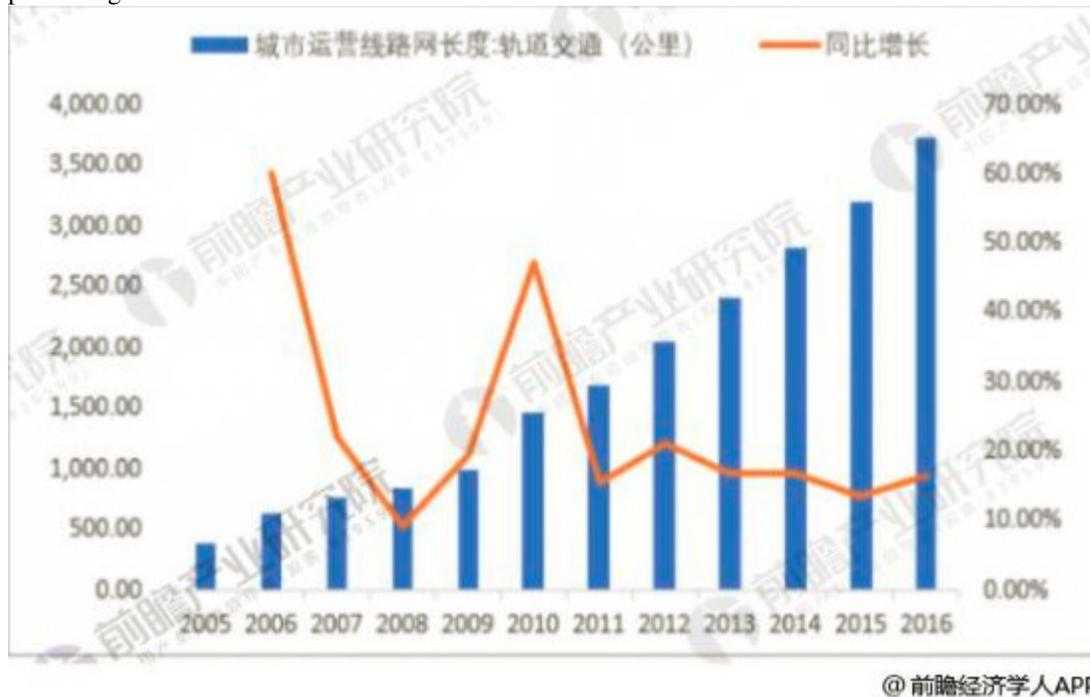

Figure 1: High-speed growth and talent gap (320,000 talent gaps)

In the foreseeable future, in the economic field, the investment in rail transit is basically in the production of hardware equipment and rail transit facilities, but the lack of continuity in the human resources investment in the rail transit industry and the supply will be serious. The main reason is the lack of prior education investment and the current speed of training dedicated talents. The root cause is the lack of attention to the cultivation of talents in the economy. Because the investment in rail transit is a long period in the economic field and this kind of investment has a big risk. But missing this piece can lead to serious operational problems. Therefore, this paper proposes to replace manpower with information system, and at the same time transform the information currently collected into products with economic value in the form of information system.

3.3 Social

In the current social environment in China, rail transit will continue to increase due to its special economic pull, but there is a long period of training for talents in rail transit, which may last for 10 years. At the same time, rail transit information system is also out-dated. Although such automation system projects have a short life time but

development this system input and output still take time. From a social point of view, it is actually an upgrade to the current rail transit industry.

3.4 Technology
At present, the relevant information technology related to rail transit has matured, and the key lies in the excellent architecture and the extension of high scalability. At present, the main reason is that the investment is not strong enough and the adaptability of the structure is not strong. No company is willing to invest in a information system that cannot be copied at one time, because the structure of the national rail transit operators is different, or the similarity is very poor. The complete development is a customized system, the development cost of the system, and the operating cost will be an unacceptably high price. Nonetheless, this project considers modular development. Integrate various application scenarios. The parallel development mode of small input and multi-module hopes to perfect the application scenario in a small step. The existing technology and mainstream interface can be involved in the track information system.

3.5 Environmental
Using the rail transit information system is good news for the current environment. The system uses a paperless office and information is delivered using a data link. Save energy, save manpower and increase production efficiency. Relative information technology is mature in other directions (such as power monitoring), and there are relatively inexpensive solutions and measures.

3.6 Legal/Regulations
Chinese laws have higher requirements for information security. This has advantages and disadvantages for the track information system. The advantage is that the user can obtain a safer system. The disadvantage is that the producer is more difficult to develop and meet the relevant requirements. About the rail transit production management system is establishing a national standard system. At the national level, the establishment of relevant rail transit production management systems is encouraged. The laws of related patents are relatively sound. Special analysis algorithms and related software can be smoothly applied to the corresponding patent and software copyrights.

4. FIVE FORCES ANALYSIS
Five forces analysis is a way to realize organizational situation; it helps organization to identify the sources of competition in an industry or sector, in order to gain advantage over competitors. (Johnson & Scholes 2002)

4.1 Threat of entry

a) Same properties phenomenon
At present, the project team itself has project leaders who are the information systems of the relevant rail transit operators. The rail transit industry is relatively closed, and the relevant rail transit enterprises are closely linked horizontally. As long as the layout is completed in some key rail transit management companies and with the demand then a relatively rich return will be obtained. The difficulty lies in custom development, which requires long-term multi-level communication. The current situation of the project is actually jointly developed by a joint rail transit operation company. The development results are directly applied to the actual production of the company, and the relevant data is also taken from the first-line production data of the relevant companies.

b) Society political character exist with market capitalism
In China, the rail transit industry is a special industry with state policy guidance, and the main investment in the industry comes from the state. A small part of the PPP project, the funds come from private capital. In general, rail transit as a tool to improve urban transport is also a tool for population migration. It is generally understood that rail transit will lead to efficient growth of real estate.

4.2 Substitutes
Traditional production order management
There is no substitute, only the possibility of downgrade use. Its downgrade use refers to an original command mode, which is done through paper forms and voice calls. This method is currently used by a large number of rail transit companies or used locally. The information carrier in this manner is a paper or voice call, and the data information command is transmitted through a paper or telephone signal.

4.3 Customers
Each city has one rail transit company and totally we have almost 50 companies' exist, they all could be the customer.

Figure 1: rail transit operation management companies of the whole China

4.4 Suppliers
The supplier of this project is a user-specified supplier who wants to acquire ownership of the system software. Therefore, we are willing to invest in development. As far as the number of domestic software development companies is concerned, in the case of all kinds of data in place, most of the domestic software vendors who have developed system monitoring are no less than 100. Even so, the rail transit industry is relatively closed. It is difficult for software vendors that are not in the industry to enter the Chinese rail transit industry. Development capabilities not only to write code, to understand industry needs, to understand the development architecture, but also to be able to guide customers to achieve information. This is a development company that rarely has such capabilities in the industry.

4.5 Competitive rivals
In the Chinese rail transit industry, the rail transit information system (production part) is a blank in the segmentation industry. There are sporadic manufacturers who have tried to enter these industries, but the market reaction is dull. The main reason is that the architecture is not suitable for applications in multiple scenarios. The main competition is mainly generated by the operating companies in each city, with sufficient power and capital investment and first-line practice data as development support. This will be the biggest competitive force in this industry. Instead, software contractors are profitable and cannot afford the consequences of development failure. In contrast, rail transit operators have their first users and have developed software with test platforms. All, this industry may not be very competitive, because the development of the first-run enterprise rail transit information system has a demonstration effect, which monopolizes a large market.

	Shanghai	Guangzhou	Shenzhen	Beijing	Nanjing
Software development capability	80％（100％）	85％（100％）	90％（100％）	70％（100％）	60％（100％）
Scale	2	3	4	1	5
Development desire	4	2	1	5	
Financial strength	4	3	2	1	5

Table 2: Source: China rail transit magazine2015

5. INFORMATION SYSTEM DESCRIPTION

The technical ideas for equipment technology assurance and information management system construction are as follows:

a) **The first** is to manage a series of related work related to maintenance and maintenance of equipment and facilities through the information system.

b) **The secon**d is to provide information support and business data archiving analysis for the reliability of equipment and facilities, comprehensive efficiency level, and operational behavior, and automatically generate reports. Automatically distribute to the appropriate users in the form of emails.

c) **The third** is to solidify the maintenance procedures into the information system through information technology. Through the introduction of Internet of Things technology, information terminal technology, two-dimensional code technology and other real-time collection of equipment status data, the facility equipment technical support business "management has standards, operation has guidelines; plans have overall planning, implementation has monitoring; after the trace back, data can be Analysis; easy to store information, report self-generation "automated and refined management objectives can be achieved.

5.1 System structure

The system is divided into a system setting module, information recording module, a data management module, analysis data module, an information deliver module, and an information report generation module, as below:
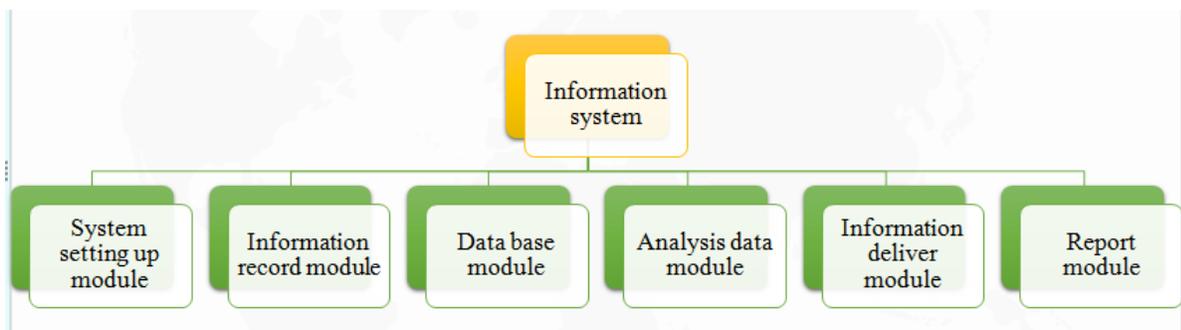

Figure 2: system structure

5.2 Interface rendering

Figure 3: Main Deskinterfac

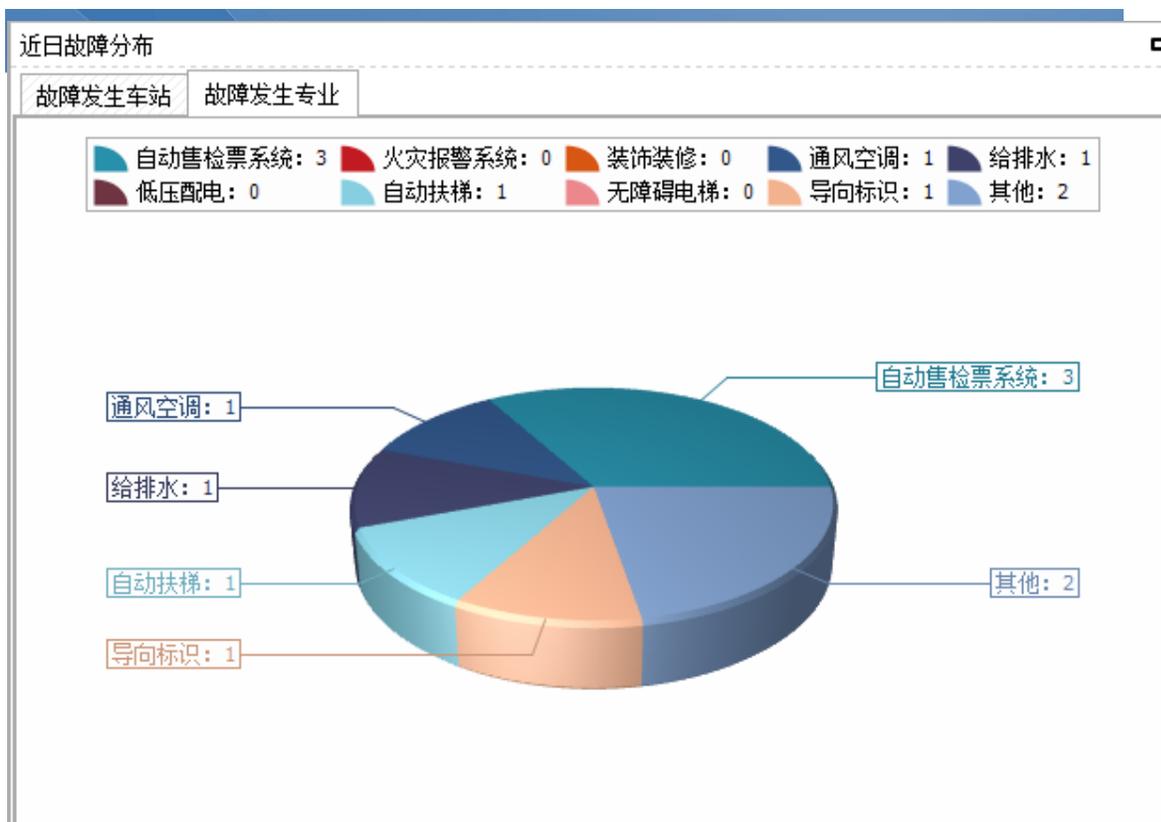Figure 4: Desk of equipment failure information

Figure 5: Desk of data analysis

6. STEPS OF IMPLEMENT THE INFORMATION SYSTEM

Equipment technical support mainly includes four parts: organization planning, plan management, field operation execution and data analysis of maintenance operations. They will be implemented in three phases, described below:

Phase	Objective	Achievement
First phase	Using information system for daily management.	1. Breakdown maintenance planning. 2. Data storage of equipments status。 3. Management of work shift. 4. The formatting of the data and standardization. 5. Data analysis, automatic report generation. 6. Data distribution.
Second phase	Running the system under internet data base.	1. The hardware and network deployment. 2. Management of maintenance plan. 3. Refined management of equipments status data 4. On-site data monitoring 5. Short the update cycle of data.
Third phase	Automated management under IoT conditions	1. Direct application of the Internet of Things program.

Table3: Implementation phases

In the future, through three stages of hierarchical implementation of technical support for refined management and information management, through the big data information management to sort out a large number of infrastructure data of facilities and equipment, the status of field equipment facilities and job execution will be visualized as equipment The establishment and improvement of the resume, the state analysis of the equipment provides good technical support.

Establishing an computerized, networked, and digital management platform is a mature practice for all metro enterprises. In the future, we will rely on the field equipment maintenance data repository accumulated by the technical support fine management. The technical support can be further extended to a single unit (The key equipment dynamic evaluation direction promotes business development, monitors and monitors equipment failure changes in real time, forms an instant equipment evaluation tool, sets equipment quality warning and maintenance plan start mechanism, and gradually transitions from planned repair to state repair and equipment modification for system equipment. And updates provide effective underlying support. At the same time, it also explores and paves the way for the technical support of other lines in the future.

7. REFERENCES
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