Discussion on influencing factors and countermeasures of traffic safety in locomotive system of China National Railway Group Co., Ltd.

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Abstract: The purpose of this paper is to deeply analyze the influencing factors of the traffic safety of the locomotive system of China National Railway Group Co., Ltd., and put forward effective countermeasures. In order to achieve this goal, this paper comprehensively analyzes the influence of personnel, equipment, environment, management and technology on driving safety. Through systematic analysis, the complexity and comprehensiveness of traffic safety of locomotive system are revealed, and the interaction between various influencing factors is clarified. The research shows that the quality of employees, training status, equipment maintenance, working environment, rules and regulations and the application of new technologies are the key factors affecting the driving safety of locomotive system. In view of these factors, this paper puts forward a series of targeted coping strategies, including improving the quality of employees, strengthening training, optimizing equipment maintenance, improving the working environment, perfecting rules and regulations and promoting technological innovation. The implementation of these strategies is expected to comprehensively improve the driving safety level of the locomotive system and reduce the occurrence of safety accidents.

1. Introduction

With the rapid development of China's economy, railway transportation, as the main artery of the national economy, plays an irreplaceable role in safeguarding national economic security, promoting regional coordinated development and serving people's livelihood [1]. China National Railway Group Co., Ltd. (hereinafter referred to as "China Railway Group") is the core enterprise of national railway transportation, and its locomotive system, as an important part of railway transportation, bears the heavy responsibility of ensuring the safe and punctual operation of trains [2]. However, with the continuous growth of railway transportation volume and the continuous application of new technologies and equipment, the driving safety of locomotive system is facing many challenges [3]. Therefore, it is of great significance to deeply study the influencing factors and coping strategies of the locomotive system of China Railway Group for improving the safety level of railway transportation and ensuring the safety of people's lives and property [4].

The purpose of this study is to comprehensively analyze the factors affecting the traffic safety of the locomotive system of China Railway Group, including personnel, equipment, environment, management and technology, and to explore effective coping strategies on this basis. The specific research purposes include: defining the key factors of driving safety of locomotive system; Analyze the influence mechanism of various factors on driving safety; Put forward targeted traffic safety coping strategies; It provides theoretical basis and practical guidance for the traffic safety management of the locomotive system of China Railway Group.

2. Overview of locomotive system of China National Railway Group Co., Ltd.

2.1. Definition and function of maintenance system

Locomotive system is an important part of railway transportation, which is mainly responsible

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for the operation, maintenance and servicing of railway locomotives [5]. It includes locomotive operation, locomotive overhaul, locomotive servicing and other links, and is the key department to ensure the safe and punctual operation of trains [6]. The main functions of the locomotive system include: providing locomotives that meet safety standards; Ensure the good technical condition of the locomotive; Ensure the timely supply and rational use of locomotives; Responsible for the maintenance and repair of locomotives.

2.2. The position and role of locomotive system in railway transportation

Locomotive system plays an important role in railway transportation and is an important guarantee for the safe and efficient operation of railway transportation [7]. It is not only the power source of train operation, but also bears the important responsibility of ensuring the safe and punctual arrival of trains. The working quality of locomotive system directly affects the order and efficiency of railway transportation, which is of great significance for improving the overall service level of railway transportation.

2.3. Development history and present situation of locomotive system

The locomotive system of China Railway Group has experienced years of development. From the initial era of steam locomotives to the era of coexistence of electric power and diesel locomotives, the locomotive system has continuously adapted to the development needs of railway transportation and carried out many technological innovations and equipment upgrades [8]. At present, the locomotive maintenance system of China Railway Group has formed a relatively perfect management system and operation mechanism, with advanced locomotive maintenance equipment and technical force, which provides a strong guarantee for the safe and efficient operation of railway transportation [9]. However, with the continuous growth of railway transportation volume and the continuous application of new technologies and equipment, the locomotive system is also facing many challenges, such as aging equipment, insufficient personnel training, imperfect management system and so on, as shown in Figure 1.

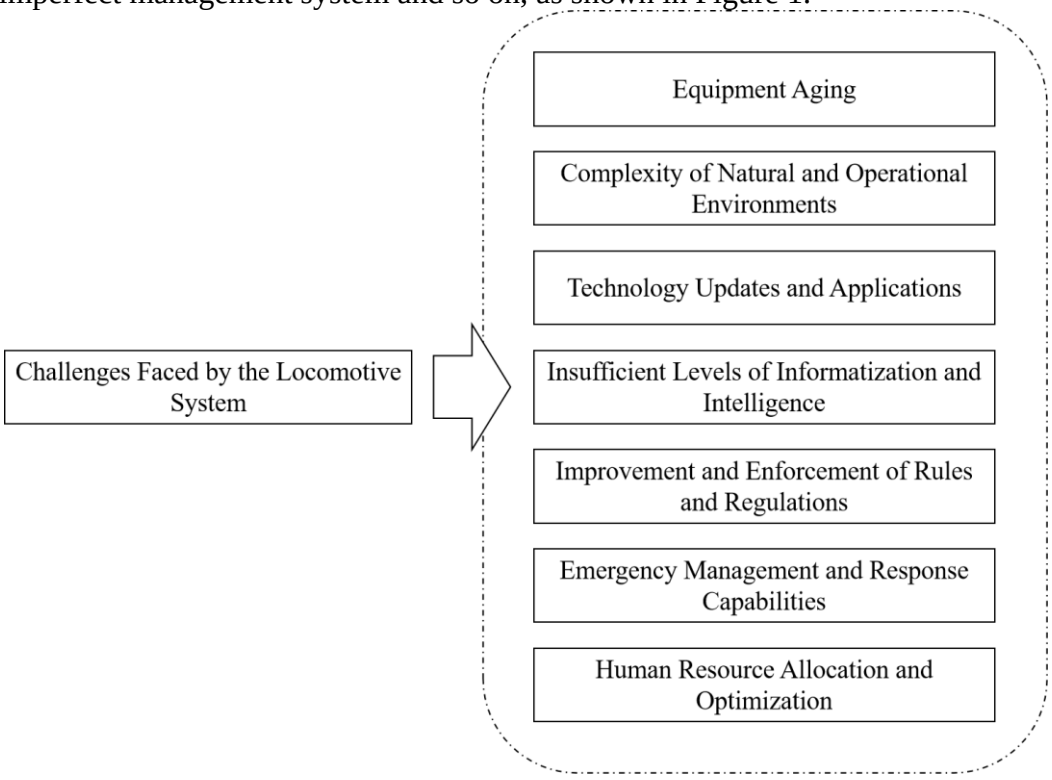

Figure 1 Challenges faced by locomotive system

2.4. Management system and mechanism of traffic safety in locomotive system

After years of practice and improvement, China Railway Group's locomotive safety management

system and mechanism have formed a relatively mature management system [10]. The system includes traffic safety rules and regulations, safety supervision and inspection, accident emergency treatment and other aspects, aiming at ensuring the safety and controllability of locomotive operation, maintenance and servicing. At the same time, China Railway Group also pays attention to strengthening the safety education and training of the crew, improving the safety awareness and operational skills of the crew, and providing strong personnel protection for driving safety. However, with the rapid development of railway transportation and the continuous application of new technologies and equipment, the existing traffic safety management system and mechanism also need to constantly adapt to the new development needs and make continuous improvement and perfection.

3. Analysis of influencing factors

The influencing factors of driving safety of locomotive system of China National Railway Group Co., Ltd. are shown in Figure 2, which will be discussed later.

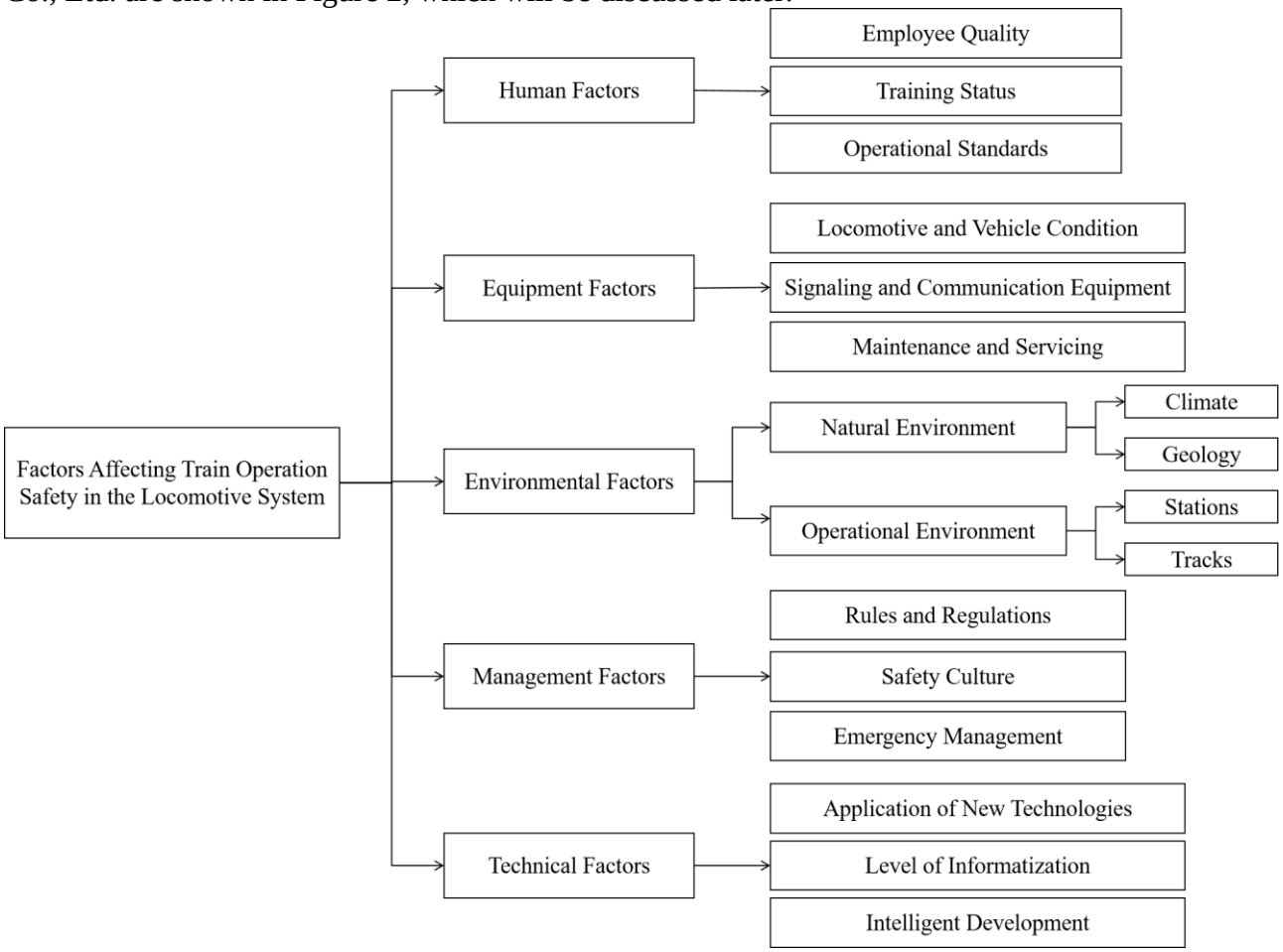

Figure 2 Influencing factor

(1) Personnel factors

The quality of employees is one of the key factors for the safety of locomotive system. Employees' professional ability, work experience, sense of responsibility and safety awareness will directly affect driving safety. High-quality employees can accurately judge and deal with various complex situations and effectively avoid accidents. In addition, the training status of employees also has an important impact on driving safety. Regular and systematic training can improve employees' professional skills and emergency response ability, and make them better adapt to job requirements. At the same time, the implementation of operating specifications is also an important guarantee for driving safety. Employees must strictly abide by the operating procedures to ensure that every step of operation meets the safety standards.

(2) Equipment factors

The condition of locomotive and rolling stock directly affects the driving safety. The performance of key components such as braking system, running gear and electrical system of the vehicle must be kept in good condition to ensure the stability and reliability of the train during operation. At the same time, the normal operation of signal and communication equipment is also an important guarantee for driving safety. These devices are responsible for the dispatch, command and communication of trains. Once a fault occurs, it may lead to chaotic train operation and even accidents. In addition, maintenance work is very important to ensure the state of the equipment. Regular maintenance can find and deal with hidden dangers of equipment in time and prevent them from developing into safety accidents.

(3) Environmental factors

The influence of natural environment on the driving safety of locomotive system can not be ignored. Climate factors, such as rain, snow and smog, may affect the normal operation of the train and the driver's sight, and increase the driving risk. Geological conditions such as earthquakes and landslides may also cause damage to railway lines and affect traffic safety. In addition, the working environment also has an important impact on driving safety. The layout of the station, the direction of the line and the setting of the turnout will all affect the safety and efficiency of the train operation. Therefore, we must comprehensively consider the influence of environmental factors on driving safety and take corresponding countermeasures.

(4) Management factors

Rules and regulations are the basic guarantee for driving safety of locomotive system. Perfect rules and regulations can clarify the responsibilities and authority of personnel at all levels, standardize the operation process, and ensure the safe and orderly driving. At the same time, the construction of safety culture is also very important. By creating a "safety first" cultural atmosphere, employees' safety awareness and sense of responsibility can be enhanced, and they can consciously abide by rules and regulations and operating procedures. In addition, emergency management is also an important link to ensure traffic safety. Establishing a sound emergency management system can ensure that emergencies are handled quickly and effectively and minimize losses.

(5) Technical factors

The application of new technology is of great significance for improving the driving safety of locomotive system. With the continuous progress of science and technology, more and more new technologies are applied to the railway field, such as intelligent driving and remote monitoring. The application of these technologies can improve the running efficiency and safety of trains and reduce safety accidents caused by human factors. At the same time, the improvement of informatization level can also provide better support for driving safety. Real-time monitoring and data analysis of train operation status by means of information technology can find and deal with potential safety hazards in time. In addition, intelligent development is also an important trend of locomotive safety. Through the application of intelligent technology, the autonomous operation and intelligent dispatching of trains can be realized, and the driving safety level can be further improved.

4. Discussion on coping strategies

The traffic safety coping strategies of the locomotive system of China National Railway Group Co., Ltd. are shown in Figure 3, which will be discussed later.

(1) Personnel management strategy

In view of personnel factors, the following strategies should be adopted: first, improve the quality of employees, and encourage employees to improve their business ability, work experience and sense of responsibility through regular assessment and selection mechanism; Second, strengthen training and formulate a systematic training plan to ensure that employees master the latest professional skills and emergency response capabilities; The third is to optimize the allocation of human resources, and make reasonable allocation according to job requirements and employee characteristics to ensure that there are suitable candidates for each position.

(2) Equipment management strategy

In view of equipment factors, the following strategies should be adopted: first, strengthen equipment maintenance, establish a perfect maintenance system, and ensure that equipment is always in good condition; The second is to update and transform the old equipment to improve the performance and safety of the equipment; The third is to adopt advanced technology, actively introduce and apply new technologies and equipment, and improve the overall technical level of the locomotive system.

(3) Environmental adaptation strategy

In view of environmental factors, the following strategies should be adopted: first, improve the working environment, rationally arrange and optimize the design of stations, lines and other working areas, and improve the working efficiency and safety; The second is to enhance the ability to cope with natural disasters, establish a sound early warning and emergency response mechanism for natural disasters, and ensure that they can respond quickly and take effective measures when natural disasters occur.

(4) Management innovation strategy

In view of the management factors, the following strategies should be adopted: first, improve the rules and regulations, and constantly revise and improve the relevant rules and regulations according to the traffic safety requirements; The second is to build a safety culture and create a "safety first" cultural atmosphere through publicity, education and training; The third is to improve the level of emergency management, establish a sound emergency management system and plan database, and improve the ability to respond to emergencies.

(5) Technology application strategy

In view of technical factors, the following strategies should be adopted: first, promote technological innovation, encourage and support the research and development and application of new technologies and methods; The second is to improve the level of informatization, and use informatization means to monitor and analyze traffic safety in real time; The third is to develop intelligent technology and actively explore and apply the application prospect of intelligent technology in the field of locomotive system driving safety.

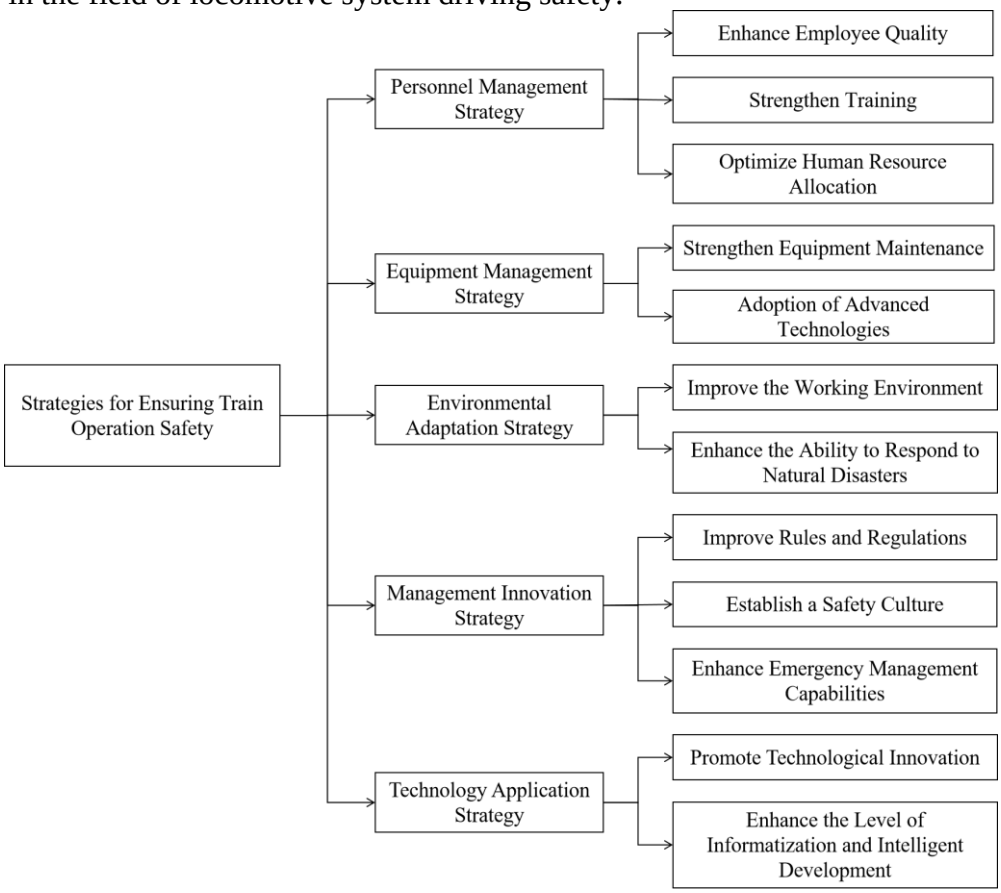

Figure 3 Coping strategy

5. Conclusions

This study makes a comprehensive and in-depth analysis of the factors affecting the traffic safety of the locomotive system of China National Railway Group Co., Ltd., discusses many factors such as personnel, equipment, environment, management and technology, and puts forward corresponding countermeasures. It is found that the driving safety of locomotive system is a complex system engineering, which needs to comprehensively consider the influence of various factors and take comprehensive measures to ensure it. Among them, personnel quality and training status, equipment maintenance and renovation, working environment and natural disaster response ability, improvement and implementation of rules and regulations, and application of new technology and information level are all key factors affecting driving safety.

In view of the above factors, this study puts forward a series of targeted coping strategies. The implementation of these coping strategies will help to comprehensively improve the safety level of locomotive system, reduce the occurrence of safety accidents, and ensure the smooth railway transportation and the safety of people's lives and property. It is expected that after the implementation of these coping strategies, the overall safety performance of the locomotive system will be significantly improved, the traffic accident rate will be reduced, and the safety and reliability of railway transportation will be further enhanced.

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