

Development trend and challenges of communication equipment maintenance industry under 5G Internet

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Abstract: With the wide application of 5G Internet technology, the communication equipment maintenance industry is facing unprecedented changes. This article will delve into the impact of 5G technology on the communication equipment maintenance industry, analyze the industry's development trends and challenges, and propose response strategies to provide reference for the sustainable development of the industry.

Keywords: 5G Internet; Communication equipment maintenance; Development trend; Challenges

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1 The impact of 5G technology on the communication equipment maintenance industry

1.1 Positive impact

Remote maintenance becomes possible: The high-speed and low latency characteristics of 5G enable maintenance personnel to connect to faulty equipment through the network for remote diagnosis and maintenance. This can not only shorten maintenance time and improve efficiency, but also reduce the travel costs of maintenance personnel and the risks of on-site operations. For example, the maintenance of communication base stations and other equipment can be completed through remote operation for preliminary diagnosis and some simple repair work^[1].

The development of intelligent diagnosis and predictive maintenance is accelerating: With the high bandwidth and low latency of 5G networks, communication devices can transmit large amounts of operational data in real time to cloud platforms. Through big data analysis and artificial

intelligence technology, the status of equipment can be monitored and analyzed in real time, potential failures can be predicted, and maintenance can be carried out in advance to reduce the occurrence rate of equipment failures. This will change the traditional post maintenance mode and improve the reliability and availability of equipment.

Maintenance training and technical exchange are more convenient: 5G supports high-definition video transmission and low latency interaction, providing maintenance personnel with a higher quality remote training and technical exchange platform. Maintenance personnel can use virtual reality (VR) or augmented reality (AR) technology to engage in immersive learning and simulated operations, improving training effectiveness and skill levels. At the same time, maintenance personnel from different regions can exchange experiences and technologies in real time, promoting the dissemination and innovation of technology.

Promoting optimized allocation of maintenance resources: 5G technology can integrate and share

maintenance resources distributed in different regions. Maintenance companies can use IoT technology to real-time monitor the inventory and usage of maintenance tools and spare parts, achieve rational allocation and sharing of resources, improve resource utilization, and reduce maintenance costs.

1.2 Negative impacts (challenges)

Rapid technological updates and increased maintenance difficulty: 5G communication equipment has higher technical complexity, more precise internal structure, and higher requirements for the technical level and professional knowledge of maintenance personnel. Maintenance personnel need to constantly learn and master new technologies and maintenance methods to adapt to the maintenance needs of 5G equipment, which increases the learning cost and work pressure of maintenance personnel^[2].

The issues of data security and privacy are highlighted: there are numerous devices connected to 5G networks, and the maintenance process of communication equipment involves a large amount of user data and device information. If data security and privacy protection measures are not in place, it may lead to data breaches and information security issues, causing serious losses to users and businesses. Therefore, maintenance companies need to strengthen data security management and improve their data protection capabilities.

High demand for maintenance tools and equipment upgrades: The maintenance of 5G communication equipment requires specialized tools and equipment to meet high-precision and high-efficiency maintenance requirements. Maintenance enterprises need to invest a large amount of funds in upgrading and updating tools and equipment, which puts higher demands on their financial strength and technological capabilities.

2 The development trend of communication equipment maintenance industry

2.1 Intelligence

Intelligent diagnostic systems are widely used: by

utilizing technologies such as artificial intelligence and machine learning, intelligent diagnostic systems can be developed to quickly and accurately identify the types and causes of communication equipment failures, and provide corresponding maintenance plans. This will greatly improve maintenance efficiency and accuracy, and reduce maintenance costs.

The emergence of automated maintenance equipment: With the development of robotics and automation technology, automated maintenance equipment will gradually be applied to the communication equipment maintenance industry^[3]. These devices can perform repetitive and high-precision maintenance tasks, such as chip soldering, circuit board inspection, etc., to improve the quality and efficiency of maintenance.

2.2 Greening

Promotion of green maintenance technology: Adopting green maintenance technology and processes to reduce energy consumption and pollutant emissions during the maintenance process. For example, using environmentally friendly cleaning agents, welding materials, etc. to reduce the impact on the environment. At the same time, strengthen the recycling and reuse of waste communication equipment to achieve the circular utilization of resources.

The maintenance demand for energy-saving communication equipment is increasing: With the continuous improvement of energy-saving and emission reduction requirements, the market share of energy-saving communication equipment will gradually increase. Correspondingly, the demand for maintenance of energy-saving communication equipment will continue to increase, and maintenance companies need to master relevant maintenance techniques and capabilities.

2.3 Service oriented

The rise of the full lifecycle service model: shifting from traditional equipment fault repair to full lifecycle services such as equipment installation, commissioning, maintenance, upkeep, and renovation. Repair companies will

provide one-stop service solutions to meet the diverse needs of customers, improve customer satisfaction and loyalty.

The development of customized services: providing customized maintenance services based on the needs and equipment characteristics of different customers. For example, providing exclusive repair solutions and emergency plans for corporate customers, and offering personalized equipment maintenance advice and services for individual users.

2.4 Collaboration

Strengthening collaboration between upstream and downstream of the industry chain: The communication equipment maintenance industry will strengthen cooperation with upstream and downstream enterprises in the industry chain, such as communication equipment manufacturers, operators, and suppliers, to form a close collaborative relationship. By sharing information and complementing resources, we can jointly improve the maintenance efficiency and quality of communication equipment, and reduce maintenance costs.

Multi technology fusion collaborative maintenance: Integrating multiple technologies such as the Internet of Things, big data, and artificial intelligence to achieve a multi technology collaborative maintenance mode. For example, using IoT technology to achieve remote monitoring and management of devices, using big data analysis technology to predict device failures, and using artificial intelligence technology to provide maintenance decision support.

3 Challenges and coping strategies faced

3.1 Challenges faced

Rapid technological updates: The communication industry is experiencing rapid technological development, with communication equipment constantly being updated and replaced, and maintenance technology also requiring constant follow-up. This requires maintenance personnel to continuously learn new knowledge and skills, and maintenance enterprises to constantly invest in R&D

and training resources to maintain the progressiveness of technology.

Intense market competition: The communication equipment maintenance market is becoming increasingly competitive, with competition from both original equipment manufacturers for after-sales service and third-party maintenance companies. Maintenance companies need to continuously improve service quality, reduce costs, and expand their markets in order to stand out in competition.

Talent shortage: The communication equipment maintenance industry needs composite talents who understand both communication technology and maintenance skills, but currently there is a shortage of such talents. In addition, the industry lacks attractiveness for high-end technical talents, and the phenomenon of talent loss is also quite serious.

The difficulty of supply chain management is high: the maintenance of communication equipment requires a large amount of components and raw materials, and the stability and timeliness of the supply chain are crucial for the development of maintenance business. However, there are certain difficulties and risks in the management of suppliers, procurement of components, and inventory control.

Network security threats: With the increasing intelligence and networking of communication devices, network security threats are also on the rise. The maintenance process may involve the security of user data and device information, and maintenance companies need to strengthen network security management to prevent data leakage and network attacks.

3.2 Response strategies

Strengthen technology research and development and talent cultivation: Maintenance enterprises should increase investment in technology research and development, cooperate with universities and research institutions, carry out industry university research projects, and jointly overcome technical difficulties. At the same time, we will strengthen the construction of internal training systems,

provide regular technical training and career development plans for employees, and attract and retain outstanding talents.

Improving service quality and brand building: Establishing a customer-centric service philosophy, optimizing maintenance processes, and enhancing maintenance efficiency and quality. Establish a comprehensive service quality management system, strengthen customer feedback and satisfaction surveys, and continuously improve services. Establish a good brand image and enhance market competitiveness through high-quality services.

Optimize supply chain management: Establish long-term and stable cooperative relationships with suppliers, strengthen supplier evaluation and management, and ensure the quality of components and timely supply. Adopting advanced inventory management systems, based on the needs of maintenance business and market forecasts, to reasonably control inventory levels and reduce inventory costs.

Strengthen network security management: Establish a sound network security management system, enhance network security training for maintenance personnel, and improve employees' security awareness. Adopting encryption technology, identity authentication technology and other security measures to ensure the security of user data and device information.

4 Standardize market order and strengthen supervision

4.1 In terms of regulating market order

Establish industry standards and norms: Relevant departments and industry associations should develop unified communication equipment maintenance industry standards and norms, including maintenance technology standards, service quality standards, charging standards, etc. This will help improve the overall level of the industry, reduce non-standard market behavior, and protect the legitimate rights and interests of consumers.

Strengthen industry self-discipline: Industry associations should play an active role in guiding maintenance enterprises to strengthen self-discipline, comply with industry norms and ethical standards. Establish an industry credit system, evaluate and publicize the credit status of enterprises, punish non-compliant enterprises, and create a favorable market competition environment.

Promote market information transparency: Establish a communication equipment maintenance market information platform, publicly disclose the qualifications, service projects, charging standards, and other information of maintenance enterprises, so that consumers can easily understand the market situation and choose suitable maintenance service providers. At the same time, maintenance companies can also showcase their advantages and characteristics through information platforms to increase market awareness.

4.2 Strengthening supervision

Clarify regulatory responsibilities: Relevant government departments should clarify the regulatory responsibilities of the communication equipment maintenance industry and establish a sound regulatory mechanism. Strengthen the qualification review and daily supervision of maintenance enterprises, and severely crack down on illegal and irregular behaviors such as unlicensed operation, false advertising, and price fraud.

Strengthen quality supervision: Establish a communication equipment maintenance quality supervision system, regularly inspect and evaluate the service quality of maintenance enterprises. Conduct quality inspection on the repaired equipment to ensure that its performance and safety meet the standard requirements.

Protecting consumer rights: Strengthen the protection of consumer rights and establish a sound complaint handling mechanism. Timely accept consumer complaints and reports, handle consumer disputes in accordance with the law, and safeguard the legitimate rights and interests of consumers.

5 Opportunities and challenges coexist in the communication equipment maintenance industry under 5G Internet

5.1 Opportunities

Market demand growth: The construction and popularization of 5G networks will drive the deployment of a large number of communication equipment, which will inevitably increase the demand for communication equipment maintenance services. Whether it is base station equipment, terminal equipment, or network equipment, professional maintenance services are needed to ensure their normal operation, bringing broad market space to the maintenance industry.

Technological innovation drives industry development: The development of 5G technology has brought new technologies and methods to the communication equipment maintenance industry, such as remote maintenance, intelligent diagnosis, big data analysis, etc. The application of these technologies will improve maintenance efficiency and quality, and promote technological innovation and upgrading in the industry.

Industrial integration brings new business models: 5G technology will promote the integration of the communication industry with other industries, such as industrial Internet, intelligent transportation, smart city, etc. The communication equipment maintenance industry can cooperate with these industries to expand business areas, provide cross-border integrated maintenance services, and create new profit growth points.

5.2 Challenge

The technological threshold has been raised: The technical complexity and integration of 5G communication

equipment are relatively high, which requires higher technical level and professional knowledge from maintenance personnel. Maintenance companies need to invest more resources in technology research and talent development to meet the maintenance needs of 5G equipment, which puts higher demands on their technical and financial capabilities.

The pressure of data security and privacy protection has increased: there are numerous devices connected to 5G networks, and the maintenance process of communication equipment involves a large amount of user data and device information. Data security and privacy protection have become important challenges facing the industry. Maintenance companies need to strengthen data security management, establish a sound data protection system, and ensure the security of user data and device information.

Market competition intensifies: The potential of the 5G communication equipment maintenance market has attracted the participation of many enterprises, and market competition will become even more intense. Maintenance companies need to continuously improve service quality, reduce costs, and enhance brand influence in order to gain a competitive advantage in the market.

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