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Analysis of the Development Status of Mobile Communication Engineering Managemen

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Abstract

Purpose: This study aims to reveal the current global overview of the development of mobile communication engineering management. Method: The research team started from reality, adopted scientific and reasonable research methods, and conducted analysis by reviewing a large number of literature in CNKI and WEB OF SCIENCE, and combining bibliometric techniques. Conclusion: It has been proven that the relevant methods have a good supportive effect on research. Based on effective research results, the current global development of mobile communication engineering management has been effectively revealed.

Keywords

Mobile Communication, Engineering Management, Development, Statistics

1. Introduction

With the continuous optimization of technologies such as the Internet of Things, artificial intelligence, and big data, higher requirements have been put forward for communication technology, requiring an improvement in the efficiency of communication infrastructure construction (Gharghan & Hashim, 2024). The continuous development of the communication industry and communication engineering will attract more enterprises to join the development and construction of the communication industry in the future, intensifying market competition and promoting technological and service upgrades. Mobile communication engineering can meet people's higher requirements for telephones and make up for the shortcomings of fixed communication. However,

the composition and frequency configuration of its system are also relatively complex, and there are many classifications. From the perspective of usage, mobile communication systems mainly include public mobile communication systems, dedicated business mobile communication systems, wireless paging systems, centerless multi-channel automatic location selection systems, cordless telephone systems, and satellite mobile communication systems (Patel & Baz, 2024).

2. Tools and Methods

At present, CNKI is the database with the most indexed papers in the Chinese scientific research community; On a global scale, WOS is one of the most influential databases. Therefore, selecting the above tools in this study will have significant convenience and probative power. The results of the tools used to support this study are of great significance.

2.1. China National Knowledge Infrastructure

Founded in June 1999 by Tsinghua University and Tongfang Co., LTD., CNKI is an information construction project aimed at realizing the dissemination, sharing, and value-added utilization of knowledge resources in the whole society. After years of efforts, the project has adopted self-developed and internationally advanced digital library technology to build the world's largest digital library with full-text information and officially started the construction of the China Knowledge Resources Database and China Knowledge Network grid resource sharing platform. To provide the most abundant knowledge information resources and the most effective knowledge dissemination and digital learning platform for the efficient sharing of knowledge resources in the whole society (Hu et al., 2023).

2.2. Web of Science

Web of Science is a large comprehensive, multidisciplinary, core journal citation index database, including three major citation databases: The Science Citation Index (SCI), the Social Sciences Citation Index (SSCI), and the Arts & Humanities Citation Index (A & HCI) and two databases of factual information about chemistry (Current chemical Reactions, CCR and Index Chemicus, IC). Its powerful analysis function can help researchers better grasp relevant topics and seek research breakthroughs and innovations in quickly locking high-impact papers, discovering the research direction concerned by domestic and foreign peer authorities, revealing the development trend of topics, and selecting appropriate journals for submission. An innovative research platform of "retrieval - analysis - management - writing" has been established for researchers (Tan et al., 2023).

2.3. Bibliometrics

Bibliometrics refers to the interdisciplinary study that quantitatively analyzes all

knowledge carriers using mathematical and statistical methods. It is a comprehensive knowledge system that integrates mathematics, statistics, and literature, emphasizing quantification. The main measurement objects of bibliometrics are the quantity of literature (various publications, especially journal papers, and citations), number of authors (individual collective or group), and number of vocabulary (various literature identifiers, with the majority being descriptive). The most essential feature of bibliometrics is that its output must be "quantity".

Bibliometrics is centered around several empirical statistical laws. For example, Lotka's law (1926) characterizes the distribution of authors in the scientific literature; Zipf's Law (1948) characterizes the frequency distribution of words in literature; Bradford's Law (1934) and other methods used to determine the distribution of academic papers in a journal. Bibliometrics has always developed around these laws in two directions: firstly, to verify and improve these empirical laws; and second to expand and promote the practical application of these empirical laws. Bibliometrics has a wide range of applications. Microscopic applications include identifying core literature, evaluating publications, examining literature utilization, and achieving scientific management of library and information departments. Macroscopic applications include designing more economical intelligence systems and networks, improving intelligence processing efficiency, identifying shortcomings and deficiencies in literature services, predicting publishing directions, developing and improving basic intelligence theories, and so on.

Due to human factors that affect the flow of literature and information, many literature issues are still difficult to quantify. Especially due to the high complexity and instability of the literature system, we cannot obtain sufficient and effective information to reveal the macroscopic laws of the literature. The development of bibliometrics relies on the support of mathematical tools and statistical techniques. The transplantation or utilization of more effective mathematical tools and statistical methods will be an important direction for its development.

3. Results and Analysis

3.1. Management of the Radio Spectrum

Mobile communication is mainly wireless communication, so it depends on the use of spectrum. Especially in the past decade, mobile communication has developed from point-to-point communication or simple debugging networks to multi-means communication systems and complex integrated networks, and the use of radio frequency is increasing, which will confuse if not strictly managed (Akinwole & Yussuff, 2023). In 1927, at the ITU Congress held in Washington, DC, for the first time, all kinds of radio services were divided into dedicated frequency bands to prevent and reduce mutual interference. Subsequently, radio regulations were formulated and revised at subsequent radio administrative conferences, which are still in use today (Ahmad et al., 2022). It has relevant permanent bodies, among which the Consultative Committee on International

Radio (CCIR) and the International Frequency Registration Board (IFRB) do a lot of research work on spectrum management and are responsible for day-to-day operations. Many countries also attach great importance to the management and development of radio frequencies and have formulated some very strict rules and regulations on spectrum management, and set up specialized agencies to implement unified and centralized management under the direct leadership of the government.

To promote the wireless communication business, and even the entire communication business to develop faster and better, to meet the wireless users, especially the urgent increase of mobile users, wireless services of all kinds of increasing needs, human beings must make full use of frequency resources.

The literature search was carried out according to "Radio spectrum management", and the main topics and secondary topics were obtained based on CNKI, as shown in Figure 1 and Figure 2. The results retrieved through the WEB OF SCIENCE database are shown in Figure 3.

Statistics OF research topics with bibliometric data from CNKI and WEB OF SCIENCE; at the same time, according to the characteristics and nature of radio frequency resources, make full use of it. The following three aspects of specific work can be extracted.

1) Implement strict management and coordination of frequency. Internationally, specific departments have made detailed regulations on the frequency, frequency tolerance, necessary bandwidth, and other content used by various radio services in the form of rules, and constantly revised and supplemented, such as the World Radiocommunication Conferences (WRC, etc.) often meet to analyze and discuss, and constantly put forward new methods, measures, and regulations. Accordingly, our national and provincial, municipal radio administration at all levels have also continuously improved and improved their management methods and levels, the allocation of frequency resources, monitoring and supervision, and other management work has achieved relatively obvious results. It is understood that at present, China's radio administration at all levels, especially the National Radio Monitoring Center's radio detection equipment has been relatively perfect, the means are more advanced, the supervision work has been carried out, and increased the intensity of frequency management.

2) Develop new frequency bands. This is a very difficult pioneering work. At present, there have been reports on the development of extremely high frequencies (30 GHz - 300 GHz).

3) Research on the effective use of various frequencies has been very active. To sum up, it can be roughly divided into two categories: one is to improve the spectrum utilization rate of radio waves so that the spectrum occupied by each channel is reduced as much as possible, if the use of efficient modulation technology, or the use of spread spectrum technology, the actual occupied spectrum is reduced; The other is to improve the utilization of radio channels, in a certain level of service (GOS), given channel interval conditions, statistically speaking,

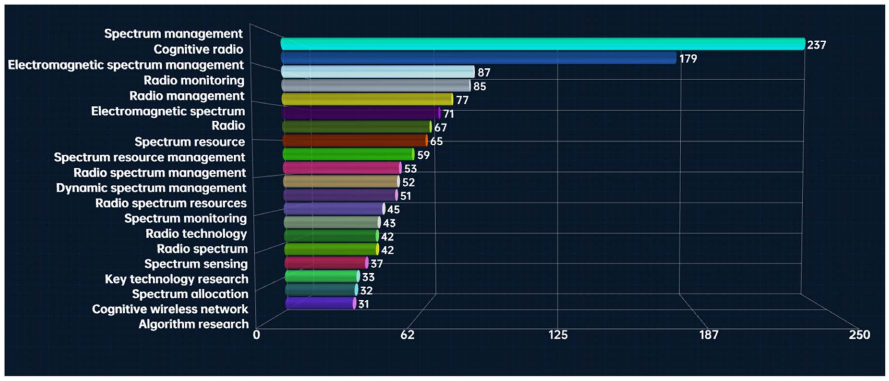

Figure 1. Statistics of the main topics presented by CNKI.

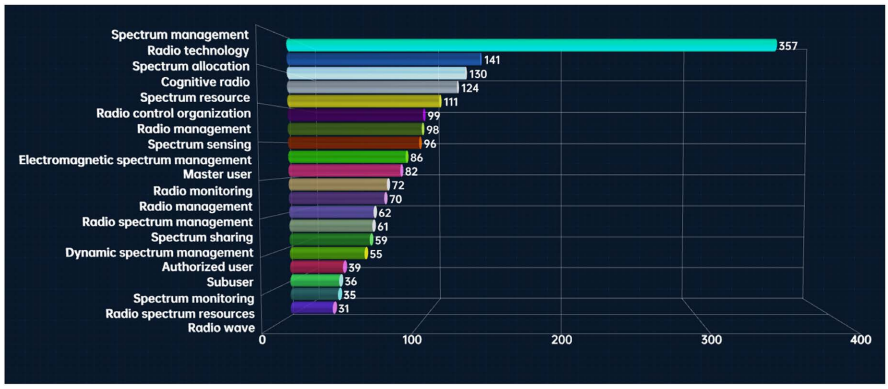

Figure 2. Statistics of secondary topics presented by CNKI.

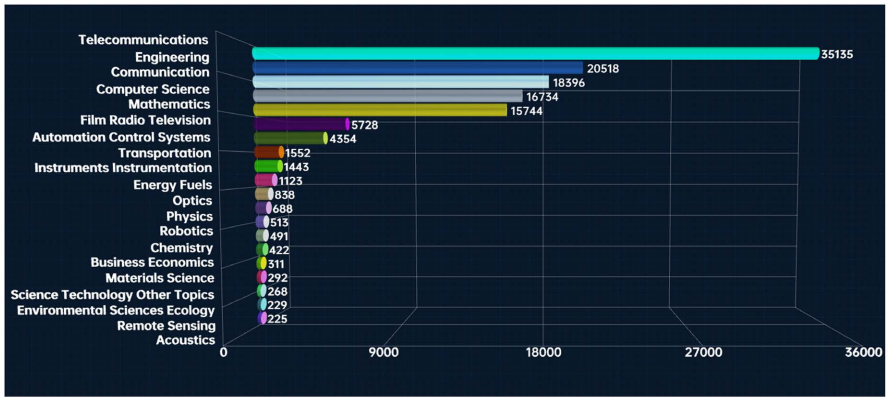

Figure 3. Subject statistics presented by WEB OF SCIENCE.

so that each channel can accommodate the maximum number of users, or can carry and complete the maximum traffic. In layman's terms, minimize channel idle time.

3.2. Spectrum Characteristics and Management of Mobile Communications

The frequency spectrum used by mobile communications shall take into account the regulations and assignments of the Radio Authority; Radio wave propagation

characteristics; Environmental noise and various disturbances; Coverage area range; Terrain, features, and various obstacles in the area; Several factors such as equipment characteristics and economic cost (Tabata et al., 2021).

Mobile communication is the communication between the mobile user and the base station, in addition to maritime and aviation and high-frequency long-distance mobile communication, usually uses direct wave propagation or line-of-sight propagation, so frequency modulation, high frequency, and over-modulation frequency bands are used more. The wavelength of these frequency bands is shorter, the corresponding underlying physical size is small, and the size of the device is also small, which is more in line with the requirements of mobile communication (Almawgani et al., 2023).

The noise interference of mobile communication is mainly environmental noise, and the environmental noise is mainly man-made. It generally appears in the form of pulses, for example, the ignition noise of the car engine, the noise of various electrical equipment on the car, not only the car, but other vehicle noise will also cause interference. The vehicle platform will also be subjected to strong noise interference after passing through high-voltage power stations, high-power transformers, and industrial areas (Phang et al., 2023). Generally speaking, the man-made noise of the city is larger than that of the suburb, the big city is larger than that of the small city, and the noise of the receiver itself is much smaller than the man-made noise.

Based on the bibliometric statistics data of China National Knowledge Network and Web of Science, as well as the development trend research and judgment in recent years, it can be seen that the frequency band used by mobile communication has increased from 800 MHz - 1000 MHz to more than 2000 MHz. With the development of mobile communication to the fourth generation, It will also increase to 5000 MHz - 6000 MHz or higher. The range of frequency bands available for mobile communication is very wide, and frequency allocation must be able to anticipate future developments. At present, the frequencies of land mobile communication are mainly 40 MHz, 150 MHz, 450 MHz, 800 MHz, 900 MHz, and 1.8 GHz - 2.0 GHz frequency bands. It's not that users can use whatever frequency they want. The frequency used by the user must apply to the local no-money electricity Administration, and after approval, it can be used (Prasad & Kumar, 2023; Mistry et al., 2020).

4. Peroration

With the frequent use of radio frequency, the corresponding management will be more and more strict and standardized. Specific performance: the management and coordination of frequency resources will continue to deepen, and effectively improve the optimal allocation of resources; the corresponding new frequency band resources will also be released, which is conducive to enhancing the vitality of the application level; at the same time, in order not to waste the frequency resources, the corresponding frequency-hopping or multiplexing

technology will also continue to appear. The management of frequency resources will be strengthened by the above means.

The world is in the tide of scientific and technological revolution, and the waves of innovation are surging, rising one after another, and competing to break through in various directions. This fully demonstrates the tremendous power of scientific and technological innovation, which will accelerate the occurrence of technological revolution.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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