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Development Trend of Ocean Engineering Based on Literature and Patent Analysis

Logesh Lakshmi*

New Valley University, Egypt

**corresponding author*

Keywords: Literature and Patent, Patent Analysis, Ocean Engineering, Development Trend

Abstract: The development trend of Marine engineering had different time, at different times have different research focus, from the patent literature level on the trend of development of ocean engineering is analyzed, the build is based on the analysis of the patent literature and ocean engineering development situation, the research to the development of ocean engineering technology in the field is of great significance. In order to solve the existing literature and patent analysis based Marine engineering development trend research of ocean engineering function equation based on patent analysis based on map and patent literature analysis method is discussed on the basis of the analyses based on the literature and patents of ocean engineering development trend research of search keywords and data source has carried on the simple introduction. And based on the existing literature and ocean engineering development trend of patent analysis model of workflow design is discussed, finally the existing based on the analysis of ocean engineering and patent application development situation of experimental analysis, the experimental data show that the number of patent for academic and research in ocean engineering from 1987 to 2007 before the slow growth, However, the number of patents showed a significant growth trend from 2007 to 2017, and reached 150 after 2020. Therefore, the research on the development situation of ocean engineering based on literature and patent analysis has certain reference significance.

1. Introduction

Ocean engineering is a new development enterprise field of strategic significance with great development potential. At present, the world's offshore resources mainly include oil, natural gas and offshore wind energy, and their corresponding production platforms and supporting equipment have been spread all over the world, with a huge number of them. Marine engineering will become a strategic transportation channel and lifeline for the economic development of our country.

Nowadays, more and more scholars pay attention to the research of various technologies and

platforms in the multi-objective optimization design system of rural landscape transformation, and through practical research, some research results have been achieved. Narayanamurthy V believed that because the technical features in the claim were complicated and difficult to describe, it was difficult to accurately extract the retrieval elements. In addition to tracing applicants or inventors, traditional means of retrieval, such as extended keywords or class numbers, are usually not appropriate in this situation. Narayanamurthy V proposed a three-factor search method to extract retrieval elements from multiple formulas in order to obtain effective relevant documents. In addition, the formula flow chart is introduced as an auxiliary search tool, which is helpful to adjust the search strategy clearly and reasonably by combing and pruning the formula flow chart. Through two examples, the application of three-factor search method is introduced [1]. Jened R proposes a systematic and reproducible patent analysis approach to facilitate problem identification by implementing the concept of "context" to identify problems that need to be addressed for sustainable technology planning and evolution. The main concepts of the approach include the importance of links between contextual information and issues, thereby providing more focused, relevant and constructive insights that are essential for setting the objectives of research and development activities. These contextual problem entities and their interwoven connections can be discovered using keyword pattern matching, syntact-based text mining, and co-word analysis techniques [2]. Helm K A proposed A similar patent retrieval method by fusing functional information. Firstly, candidate words are selected. Candidate words are words that have a great contribution to judging whether a sentence contains functional information. A short text classification method based on candidate words is proposed to judge the functional sentences, and the functional phrases of patents are determined by combining the functional expression rules. Finally, on the basis of functional expression sentences, Helm K A proposed A sentence similarity calculation method based on Word2VEC and syntactic dependence to search for patents with similar functional information. Experiments show that this method has certain accuracy and effectiveness in the automatic extraction and retrieval of functional information [3]. Although the existing research on rural landscape transformation is very rich, the research on the multi-objective optimization design system of rural landscape transformation based on Pareto evolutionary algorithm still has shortcomings.

So in order to solve the existing literature and patent analysis based on the study of Marine engineering development situation, this article first introduced the patent analysis function equation of ocean engineering model steps and patent literature map analysis, secondly discusses the is based on the analysis of the patent literature and ocean engineering development situation of search keywords and data sources, Finally, the paper designs the application model framework of Marine engineering development situation based on literature and patent analysis, and conducts experiments on the application of Marine engineering development situation research based on literature and patent analysis. The final experiments show the feasibility of the Marine engineering development situation research application based on literature and patent analysis proposed in this paper.

2. Offshore Engineering Research Based on Literature and Patent Analysis

2.1. Patent Analysis Marine Rngineering Function

The goal of patent analysis of ocean engineering function optimization is to maximize the probability of its neighbor nodes appearing under the conditions of each node, as shown in formula 1, where $k(r)$ is a mapping function that maps node r to a vector. For each node r, $Q_z(R)$ is defined as the set of neighbor nodes of node r obtained by sampling strategy Z [4].

$$\max k\sum_{r\in M}\log Tf(Q_z(R)|k(r)) \tag{1}$$

Assuming that a node has the same vector representation as the source node and the neighbor node of other nodes, the conditional probability formula in the above formula can be expressed as formula 2.7 [5].

$$Tf(l_x|k(r)) = \frac{\exp k(l_x)k(r)}{\sum_{m\in M}\exp k(m)k(r)} \tag{2}$$

After entering the marine engineering patent information into the model, the vector representation of each applicant in the vector space can be obtained, and then the Euclidean distance is used to calculate the similarity between the vectors. The Euclidean distance calculation formula is as follows:

$$h(i,j) = \sqrt{\sum_x^l (i_x, j_y)^2} \tag{3}$$

In the formula, (i, j) represents the closeness of the two nodes calculated by the Euclidean distance in the vector space. i_x and j_y are the vectors of each dimension after the two nodes are represented as l-dimensional vectors. The closer the distance is, the more likely the nodes are to cooperate in applying for a patent. The higher the sex is [6].

2.2. Patent Document Map Analysis Method

The functions of the patent map are:

(1) It is an information management tool, and a patent map is a tool for the collection, arrangement and utilization of patent information [7]. It can dig out complex and even hidden information and express it in popular language for further analysis of patent information.

(2) It is a technologically intelligent tool. The patent map can accurately analyze the development trend of ocean engineering technology, discover the development trend of ocean engineering, establish the technology strategy of ocean engineering, and also point out the direction for the technological development of ocean engineering [8].

(3) It is an information acquisition tool. Due to the intuitiveness of the patent map, it facilitates the communication between marine engineering technicians and managers, and between technicians, and is conducive to the internal flow and sharing of marine engineering information [9] .

3. Investigation and Research on The Development Trend of Marine Engineering Based on Literature and Patent Analysis

3.1. Key Words for Offshore Engineering Development Trend Retrieval Based on Literature and Patent Analysis

The search terms are selected based on the name, development trend and technology in the development process of ocean engineering [10]. Because it is difficult to accurately define and cover the related technologies of the development trend, some of them are technical patents for marine engineering [11]. In order to improve the retrieval efficiency and the completeness of retrieval results, we try to determine and expand the retrieval keywords according to "ocean development trend" and "ocean engineering development", and then combine the keywords to form a search for "ocean engineering development trend". Search keywords [12].

3.2. Data Sources of Ocean Engineering Development Trends Based on Literature and Patent Analysis

(1) Patent data

Since the time required for a patent to go from application to publication is ten to sixteen, the search time is set from October 1, 1988 to December 31, 2021 [13]. Moreover, compared with utility model patents and design patents, ocean engineering invention patents have higher technical content, so only invention applications and invention authorization patents are selected, and the country is limited to mainland China, and 12,547 pieces of data are finally obtained [14].

(2) Literature data

This system uses the Oracle database [15]. The development tool is PLSQL, which mainly involves the basic data table of the literature, the basic table of the literature of the marine engineering information bibliometric system and the content of the subject heading information [16].

1) Literature basic data table

The literature base table mainly stores all information such as title, author, source, keywords, abstract, etc [17]. As shown in Table 1:

Table 1. Literature data table

Describe	Data type	Whether is empty
Title	VRTYS1(400)	Y
Author	VRTYS1(300)	Y
Source	VRTYS1(500)	Y
Keywords	VRTYS1(300)	Y
Abstract	VRTYS1(200)	N

2) Subject heading information table basic table

Subject heading information table The basic table mainly stores all information such as keywords, years, subject headings, and titles [18]. As shown in table 2:

Table 2. Subject heading information table

Describe	Data type	Whether is empty
Serial number	VRTYS2(100)	N
Title	VRTYS2(100)	Y
Keywords	VRTYS2(100)	Y
Year	VRTYS2(100)	N

4. Application Research on the Development Trend of Marine Engineering Based on Literature and Patent Analysis

4.1. Model Structure Design of Ocean Engineering Development Trend Research Based on Literature and Patent Analysis

The steps of patent document analysis are shown in Figure 1:

(1) Analyze the needs of the development trend of marine engineering and determine the amount of statistical data. The patent literature analysis is carried out with the goal of meeting the development needs of marine engineering technology. The marine engineering should make plans according to the long-term goals, and then use the patent and literature analysis to carry out the

development trend of marine engineering.

(2) Search the target patent literature. Patent document search is the basis of analysis work, and the accuracy of patent document search is also directly related to the data quality of patent document analysis.

(3)Choose to search for the patent analysis method of marine engineering technology, and conduct statistics, summarization and analysis. After the patent literature search is carried out, the analysis of the patent literature begins.

Prepare an analysis report on the development trend of marine engineering for reference by those who analyze the development trend of the ocean.

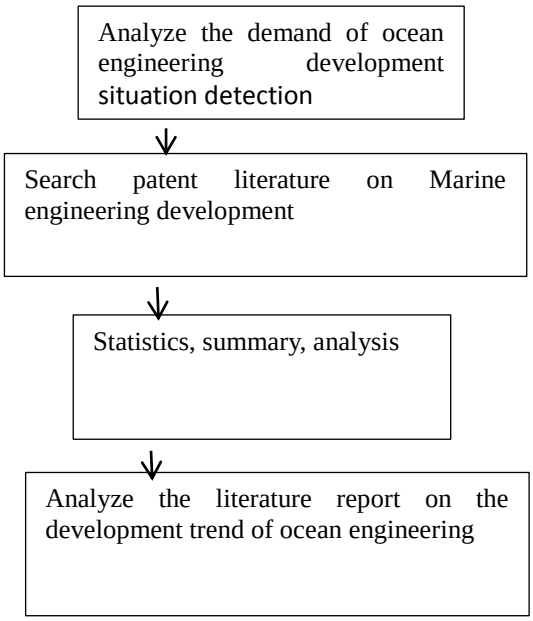

Figure 1. The development trend of marine engineering literature and patent detection

4.2. Application of Ocean Engineering Development Trend Based on Literature and Patent Analysis

(1) The development trend of marine engineering based on literature and patent analysis

Literature screening and patent analysis through patent cooperation network and literature search can discover the core and key points in the patent cooperation application network, analyze the technical patents in marine engineering, the academic patents, research patents and academic and technical development of marine engineering technology development research The number of research patents was searched in the literature to judge the development trend of patent cooperation applications in the field of marine engineering technology, as shown in Table 1.

Table 3. Number of Academic and Research Patents in Ocean Engineering

Year	Academic patent	The patent	Academic and research patents
1987	1	0	0
1997	0	0	0
2007	13	7	9
2014	79	47	43
2017	59	38	39
2022	150	108	129

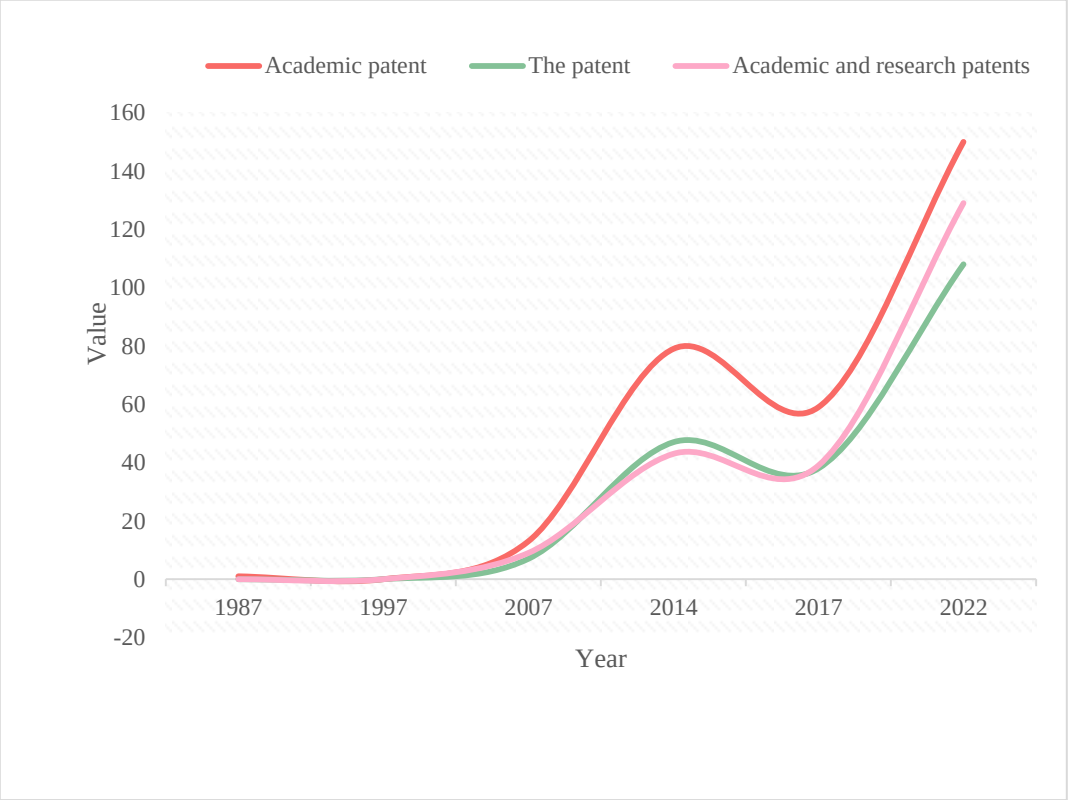

Figure 2. Trend in the number of offshore engineering patents

It can be seen from Table 1 and Figure 2 that the growth of the number of research patents and academic patents in marine engineering started in 1992. From 1997 to 2007, the number of research and academic patents in marine engineering showed a trend of flat growth. In 2007 The number of research patents in marine engineering increased to 13 in 1997, and increased to 12 in 1997. From 1997 to 2017, the number of research and academic patents in marine engineering has shown an obvious year-on-year growth trend. The number of new research patents in 2014 was 79, which was 4.5 times that of 2007. The number of new research and academic patents in marine engineering has fluctuated over the years. Due to patent quality issues, the number of new patents in 2014 decreased, and the number of new research and academic patents in marine engineering peaked in 2022. , reaching a historical peak of 150, which is caused by the surge in the number of research and academic patents. It can be seen that the fluctuation of the number of research and academic patents is only affected by the violent fluctuations of research patents or academic patents.

5. Conclusion

Therefore, in order to enrich the research on the development trend of marine engineering based on literature and patent analysis, this paper first briefly introduces the patent analysis ocean engineering functional equation and the patent literature map analysis method, and then analyzes the literature and patent analysis of the ocean engineering development trend literature. On the basis of the analysis and discussion of the development trend of ocean engineering based on the analysis of literature and patents, the research and design of the search keywords and data sources for the application of the development trend of ocean engineering based on literature and patent analysis are carried out. Secondly, design and analyze the framework of the application of the ocean engineering development situation based on literature and patent analysis, and finally analyze the

experimental data for the application of the ocean engineering development situation framework designed in this paper based on literature and patent analysis. and patent analysis of the use value of ocean engineering development trends.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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