

# Patent Quality Literature Review

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**Abstract:** Patent quality is an early concept. At present, many researches on patent quality have been carried out. This paper combs the research on patent quality, and analyzes the views of relevant research to promote the research on patent quality. In this paper, the concept, measurement index and related research of patent quality are reviewed by literature analysis. Compared with defining patent quality, existing researches prefer to analyze the evaluation indicators of patent quality. The measurement of patent quality can be roughly divided into two categories: using a single indicator and using multiple indicators to build a comprehensive evaluation index. At present, there are more and more researches on patent quality in China, but they are obviously behind other countries. It has become the trend of patent quality research in China to study the evaluation indicators of patent quality and use them in empirical analysis.

**Keywords:** Patent quality, Measurement, Indicator.

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## 1. Introduction

In recent years, the role of innovation has become increasingly prominent. Innovation can stimulate economic vitality and provide impetus for economic growth. In terms of how to evaluate innovation capability, R&D investment is an important indicator to measure innovation investment, while patent is another important aspect to measure innovation output of enterprises. At present, most China scholars prefer to use the number of patents to measure the innovation output capacity of enterprises. In fact, according to the research, compared with the number of patents, it is more reasonable to use patent quality to measure the innovation achievements of enterprises. Zhu Xuezhong and Hu Cheng (2021) pointed out that the number of patents is difficult to reflect the economic value of technological innovation achievements, and multi-dimensional indicators should be used to comprehensively evaluate innovation performance [1]. Based on this, this paper combs and summarizes the patent quality related literature, aiming to promote the research on patent quality.

## 2. Research On Patent Quality

### 2.1. Concept definition

The concept of patent quality appeared early, but there is no uniform and accurate definition of it at present. Yuan Xiaodong and Liu Zhenlan (2011) defined the quality of patent rights as the degree of conformity or consistency between patents and statutory licensing standards [2]. Liu Yang and Guo Jian (2012) pointed out that the connotation of patent quality includes four dimensions: stability of rights, progressiveness of technology, market value and writing excellence [3]. Liu Bibei (2013) divided the connotation of patent quality into patent quality, patent technology quality and patent document quality, and proposed that patent quality means that patent authorization or confirmation conforms to the standards of the Patent Law, patent technology quality means that patent technology conforms to the licensing standards of the Patent Law, and patent document quality means that patent documents conform to the provisions of the Patent Law. Then the patent quality is defined as the degree to which the patent meets the standards set by the Patent Law and the requirements of the Patent Law [4]. Higham et al.

(2021) pointed out that patent quality is actually a collection of multi angle measurement concepts such as patent importance, impact, value and significance, so patent quality is a multi-dimensional concept [5].

### 2.2. Measurement

Compared with defining the concept of patent quality, scholars prefer to use patent quality evaluation indicators to indirectly explain the meaning of patent quality. In terms of the measurement of patent quality, it can be divided into two categories: directly using indicators and building model indexes.

From the existing research, there are many indicators of patent quality, involving multiple dimensions. Albert et al. (1991) have proved that, in the opinion of knowledgeable peer researchers and inventors, patents with high citation rate have higher technical importance than those with low citation rate, that is, the citation rate can reflect the quality of patents [6]. Ernst (2001) measured patent quality by the number of patent applications in Europe and Germany, studied the relationship between patent applications and enterprise performance, and found that European patent applications have higher quality and greater impact on enterprise sales growth [7]. Hirschey and Richardson (2001) used the number of patent citations to measure patent quality [8]. Harhoff et al. (2003) found that the number of citations of patent documents and patents was positively related to the patent value [9]. Zhu Xuezhong et al. (2009) measured patent quality by the duration of invention patents [10]. Trappey et al. (2011) measured the quality of patents from the perspective of patent trade, patent litigation and patent transfer, and believed that the quality of patents sold, won and transferred was higher [11]. Ye Jingyi et al. (2012) used the withdrawal rate and authorization rate of patent applications to represent the quality of patents, discussed the impact of the system of early disclosure of patent applications on the quality of patents, and found that the quality of patents disclosed in advance was higher than that of those legally disclosed [12]. Sterzi (2013), based on the data of universities and enterprises in the United Kingdom, measured the quality of patents by the number of citations of patents, and studied the relationship between the ownership of patents and the quality of patents [13]. Li Zhongfei and Yang Tingting (2015) measured the patent quality by using

the licensing rate of invention patents, the number of inventors and the technical coverage, and studied the role of patent quality on the company's investment value and its impact mechanism [14]. Song Yan et al. (2020) used the method of hierarchical regression and group regression to explore the relationship between the three indicators of cited times of patents, number of claims, and number of patents with more than six years of service life and enterprise performance in three different dimensions of technology, law, and economy, as well as their mechanism [15]. Og et al. (2020) tested the relationship between family size, patent reverse reference, non patent literature reverse reference, number of claims, number of inventors, renewal fee, patent age, year of application and patent quality. The empirical study found that the three citation related indicators, family size and claim times were positively correlated with patent quality, while the number of inventors, renewal fee, patent age and application year were negatively correlated with patent quality [16]. Shadab et al. (2021) represented patent quality by showing technology advantage (RTA) and relative patent position (RPP). RTA measured the technical ability of a specific technology field compared with other companies, while RPP measured the leading position of enterprises in the technology field. The research shows that these two indicators representing patent quality are positively related to enterprise performance [17].

On the construction of patent quality evaluation model, Schankerman and Pakes (1986), Gao Shanxing and Guo Huatao (2002) built a model to evaluate patent quality using the data of patent maintenance time and cost [18-19]. Wu Hong et al. (2013) made the patent maintenance time dimensionless, and built a model of domain patent advantage and overall patent advantage to measure patent quality [20]. Schettino et al. (2013) constructed a comprehensive index to evaluate patent quality by using the number of citations, the number of claims and the number of families, and found that patent quality is not related to the productivity of the inventor, but related to the age, gender, experience, education level and other personal characteristics of the inventor [21]. Song Hefa et al. (2014) studied the connotation and composition of patent quality and built a patent quality measurement index system from four aspects: invention and creation quality, document writing quality, review quality and economic quality [22]. Hu Die and Wang Yuandi (2015) analyzed the existing patent quality evaluation indicators, and selected the proportion of effective invention patents, the proportion of patents with a life of more than 10 years, the number of patents with American/Japanese/European families, and the number of citations of enterprise patents to build a comprehensive index of enterprise patent quality using the principal component analysis method [23].

### 2.3. Correlational research

In terms of research on patent quality, Hirschey and Richardson (2003) found that scientific measurement of patent quality can transmit information about innovation activities and future profitability of enterprises to investors, thus affecting their share prices [24]. Song Hefa et al. (2010) extended the connotation of patent quality and proposed two different perspectives for measuring patent quality, namely, single patent and institutional patent. Aiming at the above two different perspectives, they respectively proposed methods for measuring patent quality and summarized the index system for measuring patent quality [25]. Bian Yali (2013)

focused on the nano industry and found that the quantity and quality of patent science citations and patent quality are positively related through empirical research [26]. Aiming at the defects of the traditional patent analysis system, Wu et al. (2016) and Tsao et al. (2017) developed an automatic patent quality analysis system based on the evaluation indicators of patent quality. Compared with the traditional manual analysis method, the new system can effectively and accurately analyze the patent quality while saving time and manpower [27-28]. Boeing and Mueller (2016) pointed out that although the number of patent applications in China has increased significantly in recent years, the quality of patents has declined [29]. Dindaro ğ Lu (2018) conducted research on the US manufacturing industry and found that the R&D intensity, technological diversity and conditions of misappropriation of enterprises are factors that affect the quality of patents, and there is a quality quantity balance in R&D [30]. Li Munan et al. (2019) studied the relationship between patent quality indicators of different dimensions and Tobin Q, and found that among many indicators related to patent quality, the number of patent citations and the number of citations were positively related to Tobin Q [31]. Zhao Zhongtao and Li Changying (2020) used the average forward citation frequency of patents to measure patent quality, confirmed the significant impact of patent quality on enterprise value, and explored the intermediary role of enterprise profitability and stock price [32]. Xu Haiyan and Wei Tie (2021) focused on the ICT industry and found that different enterprise sizes will lead to different impacts of patent strategies on patent quality [33]. Tang Heng et al. (2021) studied the intermediary role of the technical quality and economic quality of patents in the relationship between patent funding and enterprise performance, found that the quality of two different dimensions of patents has different degrees of intermediary role in different life cycles of enterprises, and proposed that the government should consider the indicators of multiple dimensions of patent quality when providing related subsidies to patents [34].

## 3. Conclusion

From the above literature, the research on patent quality can be divided into three categories. One is how to measure patent quality, which involves different indicators such as the number of citations. The second category is the research on factors affecting patent quality, including inventor characteristics, number of scientific citations and R&D investment of enterprises. The last category is about the impact of patent quality research, involving enterprise investment value, enterprise performance and enterprise value. In terms of research on patent quality, China started late, and most scholars refer to the practices of scholars from other countries in their research on patent quality. Compared with other countries, the research content on patent quality in China is still relatively small, and is not as fully expanded as that of scholars from other countries. Therefore, the research on patent quality in China is valuable and meaningful.

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