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Research on Disruptive Technology Recognition of China's Electronic Information and Communication Industry Based on Patent Influence

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ABSTRACT

This paper adopts the knowledge map method and selects the field of mobile communication technology and wireless communication technology to represent the electronic information and communication industry for disruptive technology recognition. Through the analysis of keyword co-occurrence network and keyword frequency changes in the relevant literature of CNKI from January 2000 to April 2018 by CiteSpace software, this paper constructs a disruptive technology identification framework for China's electronic information and communications industry from the perspective of technological frontier and technological breakthrough. Using DeWinter Patent Database as the patent data source, this paper further verifies 5G technology and internet of things (IoT) technology from the perspective of patent impact. Finally, the roadmap of disruptive technology development in China's electronic information and communication industry is proposed to provide reference for the follow-up research of China's electronic information and communication industry's disruptive technology.

KEYWORDS

Communication Technology, Disruptive Technology, Knowledge Map, Patent Impact Factor, Technology Identification

1. INTRODUCTION

The term of disruptive technology was first introduced by Christensen in his research on the disk-drive industry (Christensen, 1997). A technology is considered disruptive when its utilization generates products with different performance attributes that may not have been valued by existing customers (Bower and Christensen, 1996). The idea disruptive technology was populated in 1990s and led to extensive discussion in both academic and industrial research (Boccardi, et.al., 2014; Kostoff, Boylan and Simons, 2004; Walsh, 2004). Disruptive technology is an innovation that significantly changes the way that consumers or businesses operate. However, many disruptive technologies are not totally new principles or new concepts, but rather the transfer of existing technologies from one domain to another,

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or the intersection of multiple existing technologies. Past research shows that disruptive technology can lead to the destruction of an old technology, a business model or a community (Walsh, 2004). From the point of view of technology path, disruptive technology breaks the old technology life cycle and form a new technology track. Therefore, for technology forecasters or technology roadmap planners, traditional technology prediction method (especially for sustaining technology) is not suitable for disruptive technology identification. There are many definitions of disruptive technologies that focus on different factors: industry wide product technology factors (Abernathy and Clark, 1985), the gap between substitutable technological learning curves on cost or performance basis (McKee, 1992).

This paper proposes a hybrid method combining both subjective and objective identification methods. We design a framework for disruptive technology identification. The framework includes three parts: part 1 is to identify frontier and breakthrough technologies in a specific industry; part 2 is to analyze the technical influence of frontier and breakthrough technologies determined in part 1; and part 3 is to identify disruptive technologies based on technology discontinuity analysis and technology application analysis. The proposed framework is applied in ICT Industry to identify disruptive technologies and verify the effectiveness. In the end, the potential disruptive technologies of mobile communication field and wireless communication field are obtained, and the road map of disruptive technology innovation and development is drawn from the evolution track of the identified disruptive technologies.

2. LITERATURE REVIEW

In the recent research, the identification of disruptive technology is mainly based on subjective identification method (technology management and technology application evaluation analysis) and objective observation method (scientific literature analysis and patent data analysis).

2.1 Subjective Identification Method

Vojak et al (2004) present a heuristic five-component methodology based on observing past changes in industries to identify potential disruptive technologies. Prediction of disruption is difficult and sometimes uncertain. Traditional road map methods are more suitable for sustaining technology other than disruptive technologies. Therefore, in order to improve analyzing the potential disruptive technologies in specific fields, many scholars have proposed to combine the traditional road map methods and the subjective identification methods, and put forward the second generation technology roadmap method. Kostoff et al. (2004) propose a realistic method with support of text mining literature to identify disruptive technologies. The authors use text-mining to identify candidate technology alternatives, critical technology components of each technology alternative, and experts for each of these identified technology components. Then experts are brought together to identify the component technology characteristics and generate a roadmap for each technology alternative. TRIZ theory (Altshuller, 1999) can be used in disruptive technology forecasting. Base on TRIZ theory, Sun et al. (2008) use the law of technology evolution to determine mainstream evolutionary technologies, laggard evolutionary technologies and whether technologies are potential disruptive technologies.

Building and analyzing multi-index evaluation framework is also a common subjective identification method. Sainio et al. (2007) uses the characteristics of the disruptive technology to build the evaluation framework that includes: two middle variables, the technology's disruptiveness potential and its strategic importance to the firm. The framework is also used in a cross-case analysis. Hang et al. (2011) constructs a framework for evaluating disruptive technologies based on market positioning, technological breakthrough, and government policies. Four examples have been studied to verify the effectiveness of the framework. Diab et al. (2015) designs a forecasting framework to predict disruptive technologies. After identifying factors affecting product sales, including marketing budget, marketing channels, corporate net income, and technical performance breakthroughs, both mathematical models and judgmental method are used a four-step forecasting process.