



Review and Outlook of Chinese Innovation Research Since Reform and Opening-up

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Abstract

In order to enhance international scholars' understanding of the Chinese innovation research, this paper systematically reviewed the innovation research literature over the past 40 years since China's reform and opening-up. The research progress of the Chinese innovation field is analyzed from the aspects of academic research team, research object, research methodology, research topic, contextualized depth and comparative investigation on Chinese and international innovation research. Research findings are as follows: in Chinese innovation field, three advanced research echelons have emerged together with numerous representative teams with distinctive focuses; enterprise level is the main research object, and the research on theories and countermeasures at the international level is being strengthened; quantitative research with multiple samples occupies the largest proportion, and the number of qualitative analysis is in an increasing trend; the hottest topics closely follow the change of innovation practice of China and update constantly; research in this field has presented the characteristics of increasingly contextualized depth; through the comparison with international mainstream research, Chinese innovation research presents evident differences and unique Chinese characteristics, and the international influence of Chinese innovation research remains to be enhanced. This paper also points out suggestions for future studies. First, innovation scholars should further develop the innovation theories rooted in Chinese indigenous context to increase the diversity of global innovation management knowledge. Second, it is necessary to attach importance to basic and frontier research, so as to obtain more recognition from international peers.

Keywords

Chinese innovation research; visualized analysis; systematic review

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1. Introduction

It is increasingly acknowledged that innovation has become the dominant force that determines the quality of economic development and national competitiveness in the global arena, and the development of innovation capacity has been regarded as the strategic focus of all countries. From the beginning of the socialist reform and opening-up in 1978 to the proposal of “Innovation is the primary engine of economic development” in 2012, China is firmly committed to the path of independent innovation with Chinese characteristics. Especially in recent years, Chinese innovation capacity has been developing rapidly, which could be evidenced by the number of patents applied. According to the *2019 World Intellectual Property Index* released by the World Intellectual Property Organization (WIPO), China has ranked the first for eight consecutive years in intellectual property applications of patents, trademarks, and industrial designs. Moreover, 129 Chinese companies were listed into the 2019 *Fortune* global 500 list, which is also the first time for China to become the country with the most companies on the list. China has become one of the countries that develop the fastest in the world, and its ability to innovate is also improved from the past position lagging behind the international advanced level to the present one taking the lead in several fields.

However, comparing with the fruitful results achieved through Chinese innovation practices, what is the status of Chinese theoretical research? What are the main research topics that Chinese innovation scholars have focused on? Comparing to international researches, are there unique and compelling characteristics in the Chinese innovation field? And what directions should the future Chinese innovation research endeavor in? To address these questions, a systematic review of the development process of Chinese innovation researches and achievements is needed; such a review could also enhance the mutual exchange and understanding among international innovation scholars.

First of all, few studies are dedicated to comprehensively reviewing the status of innovation research using both bibliometric and social network analysis methods. In fact, Rossetto *et al.* (2018) was the first to explore the intellectual structure and dynamic evolution of innovation research over the last 60 years with visualized analysis methods. Secondly, previous researches focused more on systematic reviews of specific areas within innovation, such as the literature reviews of innovation ecosystems, digital innovation, open innovation, strategic alliance and innovation, innovation diffusion and technology transfer (Cottrill *et al.*, 1989; Di Guardo and Harrigan, 2012; Granstrand and Holgersson, 2020; Kohli and Melville, 2019; Lopes and De Carvalho, 2018). In addition, scholars analyzed the academic research in innovation through a comparative analysis of different countries, presenting those countries and regions the most productive and influential in innovation research (Merigo *et al.*, 2016). Overall, few scholars have carried out a systematic and comprehensive overview of one specific country, which may not be conducive to understanding the differences and preferences of innovation research across countries. Thus international exchanges and cooperation in the field of innovation are restricted.

In light of this, based on the 10 883 innovation-related articles collected from the China National Knowledge Infrastructure Database (CNKI) during 1980–2018, this paper carries out a systematic investigation of the overview as well as the evolution of the innovation area over the last 40 years since the reform and opening-up in China with the assistance of the bibliometrics and visualization tools. Moreover, a comparison with international innovation researches is also conducted to objectively present the core features and process of Chinese innovation field to interested scholars. It should be noted that, although a considerable number of articles relevant to innovation have been published in international journals recently by Chinese scholars, the relatively small size of the international dataset as well as

its lacking of some early research data limits their value in representing the overall level of innovation research in China. This paper, hence, selects the Chinese database CNKI, which contains a considerable amount of research data over the past 40 years since reform and opening-up, as its data source.

2. Research Design

2.1. Data retrieval

CNKI is widely considered as the most comprehensive database for scholarly works in China, and is thus adopted in this study. To be specific, we firstly frame the search scope in 30 important journals within the management category¹, which are recognized by the Management Science Department of National Natural Science Foundation of China. And then with “innovation” as the searching theme (to search “innovation” in the field of title, abstract and keywords) and the time set from January 1, 1980 to December 31, 2018, we choose the top 10 business administration journals in terms of the quantity of published papers as the journal source (Fig. 1). The quantity of publications with the theme of innovation in top 10 journals (11 147) accounts for roughly 82.5% of the total quantity of 30 journals (13 511), thus it can represent the overall level of high-quality journals of innovation management research in China. As a result, 10 883 papers are obtained as the final analysis sample after searching and screening in these top 10 journals with the theme of “innovation”.

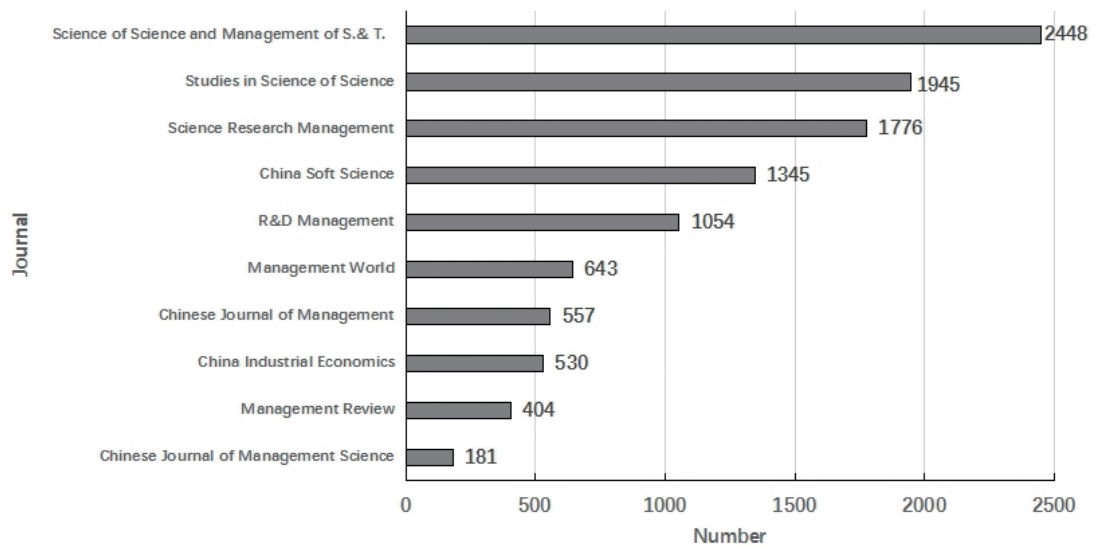


Fig. 1 Distribution of publications in top 10 journals (1980-2018)

Note: The top 10 journals shown in Fig. 1 are Chinese journals which only publish articles in Chinese language.

¹ The 30 important journals are: (1) Journal of Management Sciences in China. (2) Systems Engineering-Theory & Practice. (3) Management World. (4) The Journal of Quantitative & Technical Economics. (5) Journal of Financial Research. (6) China Soft Science. (7) Chinese Journal of Management Science. (8) Journal of Systems Engineering. (9) Accounting Research. (10) Journal of Systems & Management. (11) Management Review. (12) Journal of Industrial Engineering and Engineering Management. (13) Nankai Business Review. (14) Science Research Management. (15) Journal of the China Society for Scientific and Technical Information. (16) Journal of Public Management. (17) Journal of Management Science. (18) Forecasting. (19) Operations Research and Management Science. (20) Studies in Science of Science. (21) China Industrial Economics. (22) Issues in Agricultural Economy. (23) Chinese Journal of Management. (24) Industrial Engineering and Management. (25) Systems Engineering. (26) Science of Science and Management of S.&T. (27) R&D Management. (28) China Population Resources and Environment. (29) Journal of Applied Statistics and Management. (30) Chinese Rural Economy.

Moreover, the entire timespan (1980–2018) is divided into three development phases, namely, the initial exploration phase (1980–1998), the rapid growth phase (1999–2013), and the stable development phase (2014–2018)², according to the annual number of papers published (Fig. 2).

2.2. Research methods and analysis framework

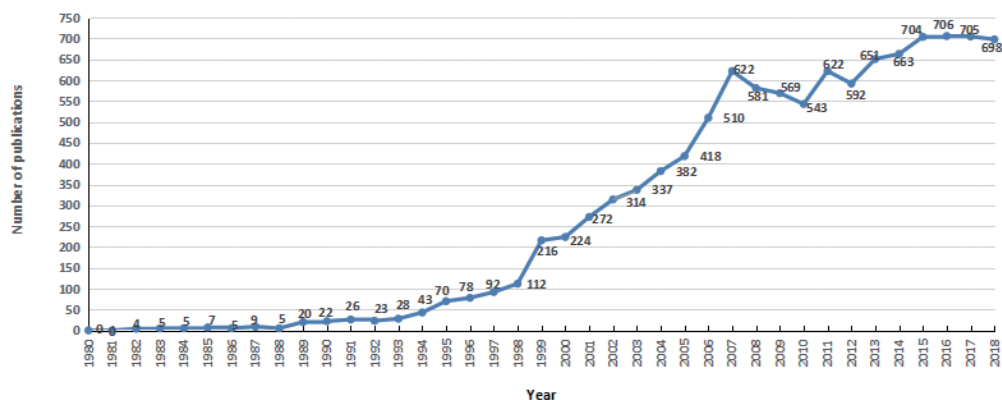


Fig. 2 Distribution of publications by year

In order to explore the current research status, research trends and the research background in Chinese innovation field, content analysis and quantitative methods including basic statistical methods, co-author network and co-word clustered analysis are adopted in this study. In addition, software tools used in the analysis process include the statistical analysis toolkit for informetrics (SATI), the mapping knowledge analysis software science of science (SCI2) tool, and the bibliometric tool CiteSpace.

Furthermore, much attention has been paid to the investigation into the journals, authors, research institutes, research objects, research methodologies, research topics, contextualized depth as well as its comparison with the international mainstream research. What's more, the research level, evolution pattern and future research directions of the Chinese innovation field also have been summarized, so that the progress of the innovation research in China can be fully presented. It is worth mentioning here that, first, regarding the visualized analysis of the innovation topics, 1 592, 11 555 and 7 700 original keywords were extracted respectively from the sample in the initial exploration phase (1980–1998), the rapid growth phase (1999–2013) and the stable development phase (2014–2018). Following specialists' opinions, similar keywords were merged and unified. Specifically, keywords of different forms with the same meanings were merged. For instances, "catch up" and "catching up", "technology innovation" and "technological innovation", "technology innovation" and "technology innovation activity" are merged. After the process of merging and deleting the invalid keywords, 759, 5 766 and 3 750 keywords were extracted in each phase. And then, the keyword maps were drawn using SCI2, which functions according to the co-occurrence intensity between the keywords. In other words, keywords with close and strong relationships were clustered to identify and detect the intellectual structure in each period. Each cluster was named based on grounded analysis and expert evaluation method. Secondly, with the assistance of bibliometrics

² The enthusiasm for innovative research among Chinese scholars has grown since premier Li Keqiang proposed the concept of "mass entrepreneurship and innovation" at the Davos forum in 2014.

and abstract analysis, we extracted the high-frequency keywords of contextual factors in each phase to explore the evolution of contextualized depth in innovation research.

3. Research Findings

3.1. Emergence of a group of research teams and leading scholars

Based on the clustering result of the number of publications of high-level journals, it is evident that Chinese academia in the field of innovation research has formed three leading echelons of numerous representative teams. As is shown in Table 1, the first leading echelon mainly includes Zhejiang University, Tsinghua University, Dalian University of Technology, and Xi'an Jiaotong University, while the Huazhong University of Science and Technology, the Chinese Academy of Sciences, South China University of Technology, the Chinese Academy of Social Sciences, Nankai University, Shanghai Jiaotong University, Fudan University, Nanjing University, and University of Electronic Science and Technology of China stand in the second leading echelon. In addition, Renmin University of China, Harbin Institute of Technology, Tongji University and so forth have also contributed quite a lot to the development of the innovation field through publishing 50 plus valuable papers in high-level journals. Furthermore, close

Table 1 The three leading research echelons in the field of innovation

<p>The First Leading Echelon (published 450-700 articles)</p>	<p>Zhejiang University (686) Tsinghua University (582) Dalian University of Technology (465) Xi'an Jiaotong University (453)</p>
<p>The Second Leading Echelon (published 200-450 articles)</p>	<p>Huazhong University of Science and Technology (281) Chinese Academy of Sciences (277) South China University of Technology (264) Chinese Academy of Social Sciences (254) Nankai University (238) Shanghai Jiaotong University (230) Fudan University (221) Nanjing University (217) University of Electronic Science and Technology of China (213)</p>
<p>The Third Leading Echelon (published 50-200 articles)</p>	<p>Renmin University of China (195) Harbin Institute of Technology (192) Tongji University (179) Harbin Engineering University (171) Southeast University (158) Wuhan University (158) Xi'an University of Technology (156) Chongqing University (150) Zhejiang Gongshang University (141) Peking University (137) Zhejiang University of Technology (135) Tianjin University (134) Beijing Institute of Technology (125) Nanjing University of Aeronautics and Astronautics (125) Beijing University of Aeronautics and Astronautics (113) Wuhan University of Technology (113) Central South University (112) Hunan University (105) Fuzhou University (105) University of Science and Technology of China (104) University of International Business and Economics (99) Sun Yat-sen University (94) Northeastern University (93) Harbin University of Science and Technology (90) Beijing University of Technology (77) Dongbei University of Finance and Economics (71) Jilin University (68) Zhongnan University of Economics and Law (68) Sichuan University (68) Southwestern University of Finance and Economics (67) Shanghai University (63) Suzhou University (58) Shanghai University of Finance and Economics (55) Central University of Finance and Economics (51) Shandong University (50)</p>

Note: The number in the bracket means the publication quantity of each university. In addition, 48 institutes with 50+ publications accounts for roughly 26% of the total publication institutes (182). Therefore, institutes with 50+ publications can be regarded as leading research teams in the field of innovation management.

Table 2 Ranking of the top 20 productive authors

AUTHOR	INSTITUTE	PUBLICATION QUANTITY	CITATION FREQUENCY	AUTHOR	INSTITUTE	PUBLICATION QUANTITY	CITATION FREQUENCY
Chen Jin	Tsinghua University	182	12,792	Zhu Guilong	South China University of Technology	36	1,706
Liu Xielin	University of Chinese Academy of Sciences	87	2,694	Shao Yunfei	University of Electronic Science and Technology of China	32	1,155
Wei Jiang	Zhejiang University	81	5,841	Xie Hongming	Zhejiang University of Technology	30	2,401
Su Jingqin	Dalian University of Technology	78	2,429	Li Baizhou	Harbin Engineering University	30	1,186
Dang Xinghua	Xi'an University of Technology	73	2,940	Guan Jiancheng	University of Chinese Academy of Sciences	30	3,325
Xu Qingrui	Zhejiang University	71	6,027	Liu Yang	South China University of Technology	29	971
Liu Fengchao	Dalian University of Technology	69	3,136	Bi Kexin	Harbin Engineering University	29	1,306
Wu Guisheng	Tsinghua University	47	3,749	Huang Lucheng	Beijing University of Technology	27	2,894
Gao Shanxing	Xi'an Jiaotong University	44	1,343	Wu Xiaobo	Zhejiang University	27	2,661
Li Yuan	Tongji University	43	2,245	Xie Fuji	Shanghai Jiaotong University	24	867

on the deconstruction and discussion of innovation issues relevant to enterprise management. As the core component of social economy, enterprise belongs to the micro research unit which is also the easiest one for most researchers to conduct. Therefore, research at the enterprise level always occupies a high proportion.

However, researches of the industrial cluster, regional and national level often provide more accurate basis for optimizing the construction of national innovation regime and promoting the coordinated and stable development of regional or national economy, among which the researches at industrial cluster level mainly focus on the synergistic effect, operation and governance mechanism caused by its network characteristics. And the research on the cluster level is quite scarce in the early stage, because of the relatively backward development of the innovation cluster practice in China, while its proportion increases in the rapid growth and stable development phase.

The researches centered on regional level mainly consider the region as its analysis unit, and conduct studies concerning the improvement of provincial innovation capacity, measurement evaluation and comparative analysis, as well as the influence of industrial agglomeration on regional innovation. There is a little fluctuation in the proportion of regional level researches, presenting good continuity in regional theoretical research.

As to the national level, the researches mainly devote to issues such as the driving forces of economic development, macro-policy regulation, reforms on critical fields and construction of national innovation system from the strategic perspective. Early studies pay particular attention to discussing the construction of national innovation environment and system from a macro perspective. However, in the rapid growth and stable development period, scholars tended to deconstruct the macro issues and focus more on certain critical point, which led to the decrease in the number of papers published on the national level.

While at the international level, the researches contribute more on innovation issues such as comparative advantage, foreign economic relationship, international knowledge flow and participation in global governance. In the initial exploration phase, compared with developed countries, innovation management in China both in theory and practice displays the feature of late-developing, and scholars pay more attention to the enlightenment summarized from the experience of developed countries. While in the rapid growth period, scholars centered on issues such as global value chain governance in the context of global economic integration. In recent years, researches in the international level have experienced an upward trend. Innovation internationalization has become a realistic choice for Chinese economic organizations to expand their own development space and obtain diversified innovation resources. The new round of science and technology (S&T) revolution and industrial transformation provide a window of opportunity for all countries to stand on the same starting line. Thus, how to improve the international competitiveness of a country has become a practical problem to be solved urgently. Therefore, the research on theories and countermeasures at the international level is being strengthened constantly.

To summarize, research at enterprise level occupies the core position among the research objects, and the research level presents a trend moving from domestic to the international (as shown in Fig.4).

3.3. Focusing on the quantitative methods, while the proportion of theoretical construction increases

There are various research methods being used in the innovation field, each of which has its own prerequisites and boundaries. Through a further investigation of the previous studies, and also, referring to the research of Tan *et al.* (2016), we divide the research paradigms in the field of innovation into

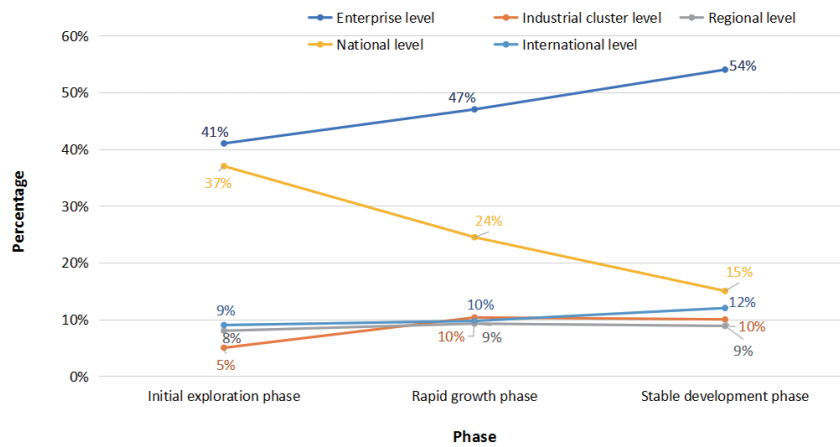


Fig. 4 Dynamic evolution of the distribution of research objects

four types: theoretical deduction, qualitative analysis, quantitative research and econometric model, in accordance with the objectivity degree from low to high. To be specific, the theoretical deduction method follows the research steps of “from proposing questions, to logical deduction based on theories, formulas and historical facts, and then to putting forward insightful conclusions”. As a matter of fact, in the early stage, it was the qualitative and speculative theoretical deduction research paradigm that was mostly used, owing to the deficiency of general and standardized research methods. Nevertheless, the quantity of researches using theoretical deduction method has declined rapidly in recent years.

Quantitative research is to predict theories in a deductive way. It functions by proving or falsifying the expected model or hypothesis through data measurement. After the introduction of the quantitative methods, it has been widely favored and applied by scholars in this field, and according to statistics, the proportion of the researches using this method continues to increase, because for one thing, the research conclusions reached are of statistical rigor and regularity; for another, the appearance of various commercial and research databases can facilitate the obtainment of adequate evidence.

The econometric model is mainly used to measure and evaluate the S&T innovation contribution rate, S&T input-output and other issues concerned by the government, industrial sectors, enterprises, and academia. To be precise, it refers to the measurement of certain indexes or seeking reasonable solutions through inputting statistics into the original or improved mathematical function model (Zhang, 2010). The proportion of relevant researches maintains a steady growth and the method used is increasingly standardized.

Qualitative research adopts various data collection methods to holistically explore social phenomena in a natural context. It applies inductive method into the analysis of data and the generation of theories, and it also obtains explanatory understanding through behavior and meaning construction after interacting with research objects. At present, the innovation research in China generally stays in the stage of regarding China as a natural experimental field to test western theories. However, with the increasingly standardization of qualitative methods, the objectivity of research conclusions, and the rationality of constructing characteristic theories (Su and Jia, 2018), an increasing number of Chinese scholars attempt to use qualitative research methods to insightfully explore some of the most unique and interesting innovation phenomena in China and to construct local innovation theories.

In summary, the quantitative method is the mainly adopted one, and the proportion of theoretical construction is constantly increasing (as shown in Fig.5).

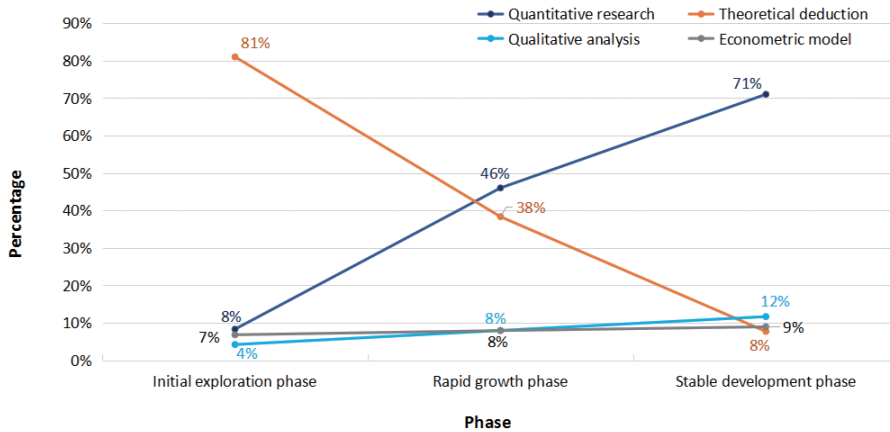


Fig. 5 Dynamic evolution of the distribution of research methodologies

3.4. Coinciding with the innovation practice of China, hottest topics update constantly

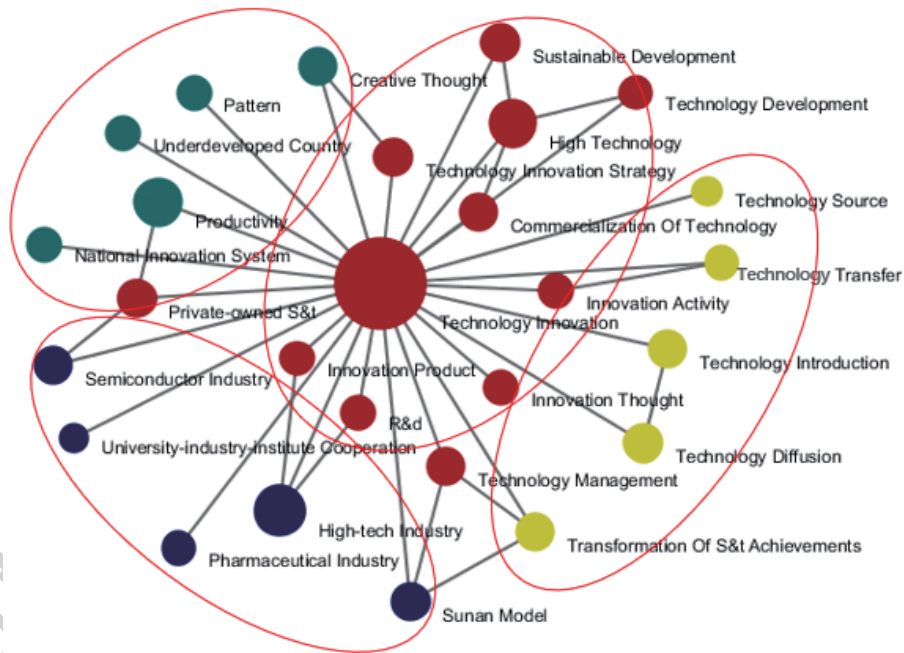


Fig. 6a The map of co-occurrence and clustering of high-frequency keywords in the initial exploration phase

As the map of co-occurrence and clustering of keywords indicates, the main research topics in the initial exploration phase are as follows (Fig. 6a). ① Technological introduction: it includes technology import, technology innovation diffusion and other issues. ② Technological innovation: it involves the process of technological innovation, S&T management, R&D and other issues. ③ Industrial innovation: it pays attention to the discussion of high-tech industrial innovation, industry-university-research cooperation, and other issues. ④ Institutional innovation: it focuses on the construction of national innovation system among underdeveloped countries, the construction of technological innovation policy system and its practical evaluation.

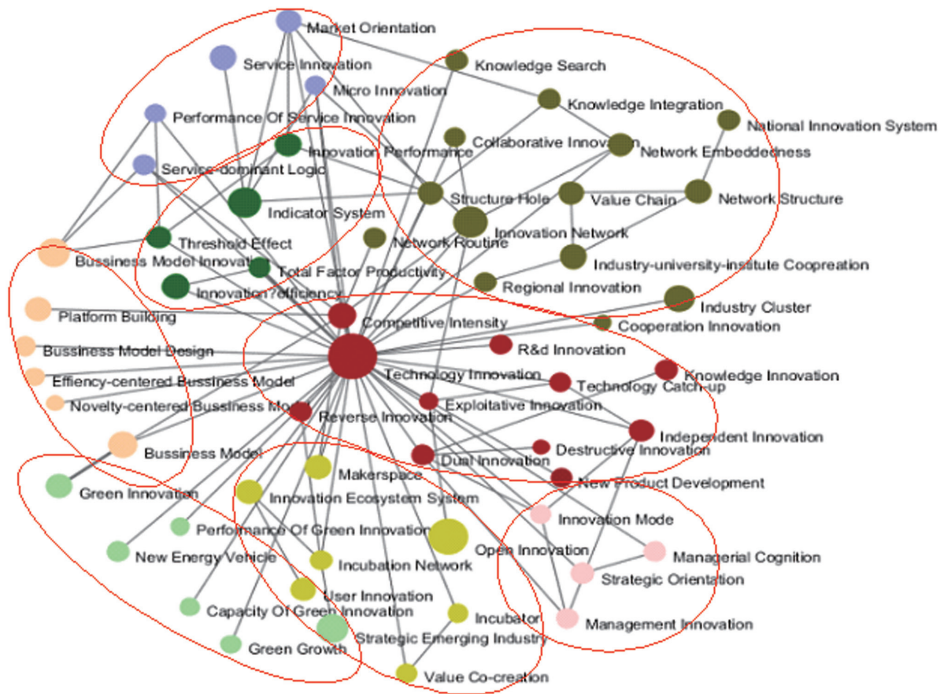


Fig. 6b Map of co-occurrence and clustering of high-frequency keywords in the rapid growth phase

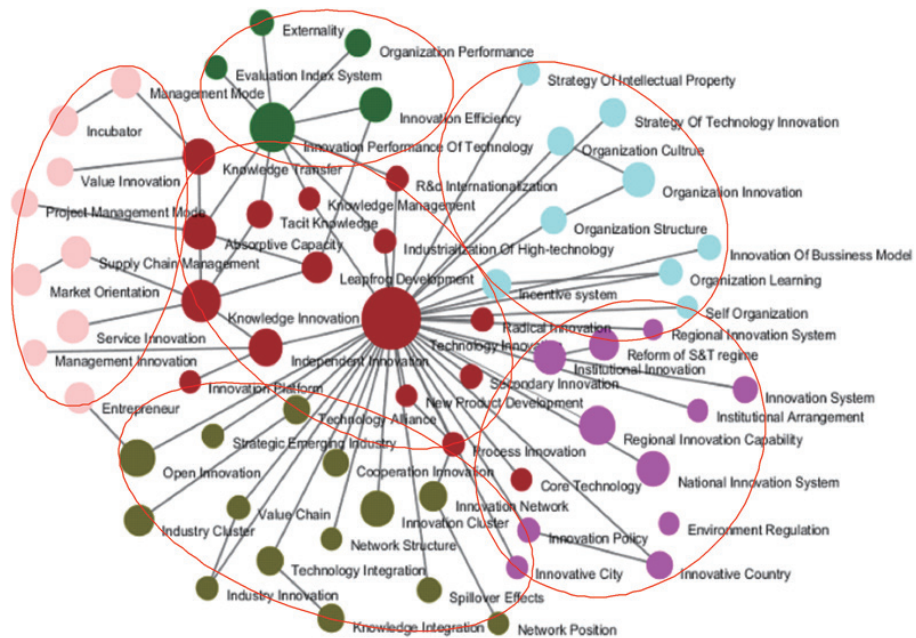


Fig. 6c Map of co-occurrence and clustering of high-frequency keywords in the stable development phase

The main research topics in the rapid growth phase are as follows (Fig. 6b). ① Technological innovation: it focuses on core technology, knowledge innovation and independent innovation. ② National innovation system: it involves the construction of innovative country, regional innovation system and

innovation ecosystem. ③ Innovative network: it mainly discusses the construction of late-developing national innovation network, the location and structure of the network, innovative cluster, knowledge network and cooperative innovation. ④ Organizational innovation: it pays attention to the organizational culture, organizational learning, business model innovation, and total innovation management. ⑤ Management innovation: it focuses on the innovation of management thoughts, and emphasizes the external relationship management that can directly promote the recognition of enterprises by external entities, such as customer management, supply chain management. ⑥ Innovation performance: it includes measurement of innovation performance/efficiency of different innovation subjects, and the interaction between various factors and innovation performance.

The main research topics in the stable development phase are as follows (Fig. 6c). ① Technological innovation: it includes research that focuses on independent innovation, dual innovation, and breakthrough innovation. ② Innovation network: it discusses the construction of global R&D network, the relationship of cooperation and synergy as well as value creation within networks. ③ Management innovation: it focuses on the impacts of factors such as external environment variables and internal manager cognition on management innovation. ④ Innovation performance: it discusses element optimization and ability improvement in the innovation process, evaluation of process effectiveness and other issues. ⑤ Service innovation: it involves micro-innovation, service-dominant logic and other issues. ⑥ Business model innovation: it focuses on business model design, business model evolution and other issues. ⑦ Innovation ecosystem: it discusses the construction of innovation ecosystem, the emergence and operation of incubator and maker space. ⑧ Green innovation: it mainly discusses the impact of R&D subsidies, executive awareness, public opinion pressure and other factors on the green innovation response.

The hottest topics of innovation in China closely follow the change of innovation practice, showing a trend of rapid change and evolution. In the initial exploration phase, S&T innovation is the main research topic. However, after the 3rd Plenary Session of Chinese 11th Central Committee of the Communist in 1978 ushered in a new era of China's reform and opening-up as well as socialist modernization, S&T development has become a critical task to carry out. Therefore, much effort has been devoted to the stimulation of technological innovation, the development of technological knowledge and the promotion of technological progress. Moreover, scholars combine theory with practice to conduct in-depth investigation and research, and put forward suggestions for the implementation of technology innovation strategy for industries including automobile, numerical control machine tools, mobile communications, and tobacco. In addition, policy framework and directions for further improvement regarding technological innovation have also been proposed towards the state and governments at all levels (Chen and Yang, 1998).

During the rapid growth phase, scholars have shown increasing interests in the field of non-technical innovation, such as organizational innovation and management innovation. In fact, the construction of an innovation-oriented country relies not only on the unilateral achievements of technological innovation, but also on the effective support of non-technological innovation, such as organizational culture and institution, external relationship governance, and innovation efficiency improvement. Therefore, in order to effectively enhance the ability of organizational innovation to obtain sustainable competitive advantages, increasing attention has been paid to the comprehensive consideration of technological and non-technological innovation elements based on the system-view (Xie and Xu, 2004).

In the stable development phase, modern science, and technology such as digitization and cloud

computing are profoundly transforming traditional manufacturing and service activities, which suggests that innovation has entered a new era of globalization, overturning the traditional operation mode in an all-round way. The opportunities and space for innovation are broader, and the innovation researchers are constantly seeking new theoretical perspectives to explain how to make strategic choices and create value and how to improve social benefits when facing new competitions (Chen *et al.*, 2015; Wang *et al.*, 2019).

At present, innovation research has covered many topics, including technology innovation, innovation network, management innovation, innovation performance, service innovation, business model innovation, innovation ecosystem and green innovation. In the early stage, the research in the field of innovation mainly centers on technological innovation, and then quickly turns into a new trend of the parallel development of multiple themes.

3.5. Presenting the characteristics of increasingly contextualized depth

In the early stage, Chinese indigenous context was mainly regarded as the research background. However, after emerging economies with China as their representative rose abruptly, a large number of emerging industrial enterprises broke the curse of latecomers and stood in the forefront of the world. This attracted many scholars to pay increasing attention to the driving mechanism of how the Chinese-specific technology, market, and institution contexts function in this catching-up process (Table 3). In addition, more and more researches took the complex external contexts of China as the boundary condition of the research conclusion into the research framework, which not only comprehensively and objectively examines the innovation phenomenon, but also provides the possibility to the exploration and refinement of the innovation theory with Chinese characteristics.

Table 3 High frequency keywords of context factors in each period

Period	High frequency keywords of context factors
Initial exploration	S&T regime reform, State-owned enterprise reform, Market economy, Education, Creative thinking, Technology import
Rapid growth	Innovation policy, Institutional innovation, S&T regime reform, Environmental regulation, Globalization, WTO, Transition economy, Bottom of pyramid (BOP) market, Trust, Humanistic spirit, Values, Technological trajectory, A-U model
Stable development	Environmental regulation, Entrepreneurship orientation, Government subsidy, Political connection, Innovation-driven development, Financial constraint, Market orientation, Transitional economy, Sharing economy, BOP market, Innovation atmosphere, Innovation self-efficacy, Proactive personality, Internet +, Technology regime, Window of opportunity

In the initial exploration phase, the high-frequency keywords in the external research context include S&T regime reform, state-owned enterprise reform, market economy, education, creative thinking, and technology import. Macro issues such as macro regime reform, innovative education and mind cultivation, introduction and diffusion have captured considerable attention, and appeared as the research background. For example, Hu and Zhang (1998) analyzed the technological innovation of Chinese large-scale enterprises in the transition period of economic regime transformation and establishment of modern enterprise regime, while having the three rounds of large-scale technology introduction as its background, Fu and Shi (1994)

discussed the causes to the barriers of technology innovation in China. And taking the macro context of developed countries as a reference, Xu *et al.* (1996) explored the matching and accelerating role of American education in the S&T development as well as its enlightenment to China.

During the rapid growth phase, the high-frequency keywords include innovation policy, institutional innovation, S&T regime reform, environmental regulation, globalization, WTO, transition economy, BOP market, trust, humanistic spirit, values, technological trajectory, and A-U model. Scholars have focused more on exploring the role of external contexts or its moderating effect on innovation, and investigating how context factors moderate existing research models. For instance, Huang and Liu (2006) proved that environmental regulation has not only increased the costs for enterprises, but also stimulated independent innovation; and taking the Chinese “*shanzhai*” mobile phone industry as an example, Zhou *et al.* (2012) proposed a disruptive innovation mechanism oriented to the BOP; Li (2013) discovered that social trust as the mediating variable affected the relationship between cultural values and national innovation performance; and Hong and Su (2008) put forward four modes of industrial technological catching-up for late-developing countries based on the technological development path of pioneers.

During the stable development phase, the high-frequency keywords include environmental regulation, entrepreneurship orientation, government subsidy, political connection, innovation-driven development, financial constraint, market orientation, transitional economy, sharing economy, BOP market, innovation atmosphere, innovation self-efficacy, proactive personality, Internet +, technology regime, and window of opportunity. In this phase, scholars have focused more on the effect mechanism of specific phenomena and context factors, and tried to build a new mechanism model based on new contexts. For example, Yang and Tu (2016) proposed the co-creation mechanism of user value under the sharing economy mode by taking the case study of internet travel platform. Peng *et al.* (2017) revealed the driving effect of technological regime diversity and multi-level market space on the catching-up of late-developing enterprises. They also examined the effect transmission mechanism of specific context factors, based on the longitudinal analysis of the Haitian Group case.

3.6. Showing evident differences compared with the international innovation research

In order to clearly present the unique features of the innovation research in China, we compared it with the description of the development status as well as the characteristics of the international innovation researches introduced in the paper “The Structure and Evolution of the 60-year Research on Innovation Management”, which was conducted by Rossetto *et al.* (2018) in the *Scientometrics* journal. In his paper, 803 907 publications in the field of innovation from 1956 to 2016 in the Web of Science Social Science Citation Index (SSCI) were collected as the analysis data source, and the period from 1956 to 2016 was divided into 4 phases with an interval of 15 years. Firstly, Rossetto *et al.* (2018) visualized the basic information of highly cited articles, authors, and journals in each stage. Secondly, the research hotspots and the evolution of intellectual structure in the field of innovation were presented by the author's co-citation network.

The features of the international innovation research are as follows. ① The interrelationships between innovation sub-fields become closer. And the increasing interaction between innovation subfields suggests the convergence of different schools of thought within the core of the innovation area, which indicates the trend of the creation of the common knowledge base. ② International innovation research focuses more on the basic innovation management, such as the process and management of innovation research.

And the most widely discussed topic of international innovation research at each stage respectively is “organizational measurement and technological change,” “technology adoption and innovation diffusion,” “technological change, intellectual property and organizational learning,” “stage-gate, new product development process and portfolio management,” among which the innovation process and management always occupies an important position in the field of innovation research. ③ A volume of theories have emerged as classics that provide the basis for the field, and some authors are ranking in the list of highly cited authors in three of the four periods. For example, March is a top 20 cited author in the 1st, 2nd and 4th periods, and his research focus is on organizational management; Rogers is a highly cited author at the first three stages, and he mainly focuses on the research of innovation diffusion process. These scholars and their works have made significant contributions to the theoretical development of innovation management field.

Compared with international studies, Chinese innovation research presents the following three characteristics. ① Innovation research in China has distinct Chinese features. Chinese scholars attach more attention to research topics with obvious Chinese contexts and characteristics, such as technology introduction, the construction of national innovation system in underdeveloped countries, and the construction of innovation network in underdeveloped countries, all of which fully reflect the characteristics of Chinese indigenous context. Meanwhile, since the crucial influence the complex and changeable external contexts have on the development of the theory, many scholars deconstruct Chinese indigenous contexts and put deconstructed context factors into the research framework to examine the innovation phenomenon more comprehensively and objectively. In addition, scholars have attempted to use qualitative methods to explore more emerging constructs and theories from phenomena that are unique in China, and focusing on innovation practices with Chinese characteristics has become an important research trend. ② The research focus of innovation studies published in China is different from that of the international community. The international innovation researches focus more on innovation processes and management, such as “technology management,” “knowledge management” and “new product development process.” These classical scientific issues have always been the focuses of international academia, and the researches hence enjoy a high degree of continuity as well. In contrast, Chinese innovation research focuses more on the investigations of “learning and introduction,” “technological catching-up” and “independent innovation.” These are the issues with obvious characteristics of emerging economies. Due to institutional and market constraints, China acted as the role of follower in the global competition in the early stage, and thus the primary problems it faced are the introduction of learning, catching up as the latecomers and leapfrog development. Therefore, research topics relevant to “catching-up” have always been the focus of Chinese scholars. ③ The international influence needs to be enhanced. Although the number of publications of Chinese scholars in the international innovation field ranked top worldwide (Wu and Fu, 2019), there were no Chinese scholars being listed in the highly cited scholars list in Rossetto *et al.* (2018), and also, none of the pioneers in the mainstream research field of international innovation came from China. This indicates that even though Chinese innovation research developed rapidly, there is still a major gap in research quality and academic influence between Chinese scholars and international forefront researches. By contrast, in the field of nature and S&T, China is considered as the second most creative country in the world (Mongeon and Paul-Hus, 2016). Likewise, in practice, since the reform and opening-up, numerous entrepreneurs with management characteristics and world-renowned enterprises have emerged in China. Nevertheless, Chinese theoretical development level fails to match its innovation practice ability. To illustrate, the

quantity of publications with “innovation” as the theme in the top innovation journal *Research Policy* is only roughly 1/8 of that of the UK and the USA³. It indicates there is a gap in research strength of innovation management between China and the world’s leading countries. And there are few original theories based on Chinese unique practices (Zhou *et al.*, 2017). Therefore, there is still a large space for Chinese theoretical development in the future.

4. Conclusion and Discussion

4.1. Conclusion

This paper introduces the innovation research progress in China over 40 years since the reform and opening-up through a retrospective analysis of the relevant literature. After a systematic investigation into the distribution of the most productive authors and their research institutes, the distribution of analysis objects and research methods, the core topics and contextualization depth, as well as the comparison with foreign research, the conclusions drawn are as follows: In terms of research institutes and authors, since the reform and opening-up, innovative research has developed rapidly and generated three advanced research echelons, and a large number of outstanding scholars have emerged with fruitful achievements. As to research objects, the micro level of enterprise innovation management research always accounts for a relatively larger proportion, and the theories and countermeasures of international level are constantly strengthened. Considering the research methods, large-sample quantitative research is the main research method in this field. And the number of qualitative analysis papers with advantages of theoretical construction is growing rapidly, meanwhile, the scholars are attempting to generate local innovation theories by examining the innovation practices that are unique to China. In the aspect of the dynamic evolution of topics, the research hotspots are consistent with Chinese domestic innovation practices and are constantly updated. To be specific, researches in the early stage focus on technological innovation, while the recent research hotspots are constantly more divergent, showing a development trend of diversification. As for the evolution analysis of the contextualization depth, it is increasingly characterized by contextual embeddedness. In the initial stage, more attention is paid to the universal contexts, which shows as the research background, while later the research steps further and focuses on the effect mechanism of specific context. Through the comparison with the international mainstream research, it is discovered that the innovation research in China shows distinctive Chinese features, and the research focuses are different from those of the international community. What’s more, the research quality and international influence need to be further enhanced.

4.2. Implications for theory and practice

This paper takes China, whose innovation capacity is growing rapidly, as the research object and introduces the current status as well as the dynamic evolution of Chinese innovation field. Firstly, with the assistance of the combination of bibliometrics and content analysis methods, it is the first time in history to systematically show the progress of Chinese innovation research to foreign scholars. The

³ We count the quantities of publications of Chinese, American and British scholars in international top journal on innovation named *Research Policy*, with “innovation” as the searching theme (search “innovation” in the field of title, abstract, author keywords, and keywords plus) and the time set from January 1, 1980 to December 31, 2018. As a result, the quantities of publications of Chinese, American and British scholars are respectively 62, 515, and 477.

study will help them quickly and objectively understand the innovation research situation in China, and clarify issues such as the hottest topics, high-impact scholars and research institutes relevant to Chinese innovation research field. Secondly, the differences between Chinese and foreign researches summarized through the comparison with international mainstream researches also provide directions and inspirations for Chinese innovation researches to follow international researches. In addition, the application value of this paper lies in that the rapidly developing Chinese innovation theory is a mapping and abstract summary of Chinese innovation practice, and the emerging themes and context factors relevant to Chinese innovation research can provide practical enlightenments for other developing countries from different aspects. Meanwhile, we hope that the introduction of the development trend and research features of innovation research in China could promote the cooperation and exchange between Chinese and international scientific research institutes, and can thus generate more creative research achievements.

4.3. *Limitations and future research*

4.3.1. *Limitations*

Much effort has been made to systematically review the progress of innovation research in China, our analysis is however, still subject to several limitations, which are mainly centered on data sets and research design. Firstly, CNKI database is one of the most complete sources of scientific publications in China, containing the majority of the important journals. Nevertheless, it should be noted that some publications such as books and non-Chinese publications are not fully included in that database. So, the results of our analysis so far could only be considered as a first stab in a comprehensive assessment, which presents a general picture of the innovation research in China. Secondly, since this paper aims to introduce innovation research in China, the comparison part only selects the paper approved by international mainstream peer-review journal, which however, may limit the generation of more findings on the comparison between Chinese and international innovation field. Therefore, future design can be improved in this regard, so that more interesting differences between Chinese and international innovation research could be discovered.

4.3.2. *Future research*

Based on the above comprehensive review of Chinese innovation research, we have also refined the development direction of Chinese innovation research in the future, which mainly focuses on the following two aspects.

4.3.2.1. *To further explore the contextualization depth and develop the innovation management theories rooted in Chinese indigenous context.*

Firstly, Chinese innovation literature is rich in research on political, economic, and technological situations. For example, special attention has been paid by Chinese scholars to the innovation issues in the context of institutional transformation economy, globalization, latecomer and so on, while there is still room left for consideration of social contexts. In fact, the long history of Chinese traditional philosophy and culture has a profound impact on Chinese values, beliefs, and norms of behavior. However, previous studies have rarely explored the role of social context factors such as traditional philosophy, customs, and social relations on innovation. An in-depth study of Chinese social context will be more conducive to the generation of innovative management thoughts with Chinese style, vitality, and explanatory power.

Secondly, the extant context-related researches either equate the context with the external environment, or focus on several context elements from different perspectives, showing research characteristics of diversification and decentralization. Considering that holistic view is also an important attribute of Chinese traditional thoughts, it is actual the multiple context factors from inside and outside of the organization that jointly determine the strategic logic and action of an organization. Therefore, in the future, it is necessary to break through the cognition of the context from the traditional and narrow perspective, and systematically introduce the internal as well as the external contexts of organization, so as to form a relatively complete picture (Huang *et al.*, 2019), so as much more profound insights could be generated.

Furthermore, the subjective meaning construction of the objective context will be formed through organizational cognition, which determines the allocation and core focus of limited attention, as well as the follow-up development framework. Therefore, organizational cognition is not only an internal factor but also a bridge between objective context and innovation action. It is of great value to study the extant cognitive mode of organizations and explore how the cognition system functions between objective context and innovation action. In conclusion, in the future, systematic discussions can be conducted around the essential, makeup and internalization mechanism of Chinese context, and scholars can further develop the constructs and innovation theories derived from Chinese indigenous context, to increase the diversity of global innovation management knowledge.

4.3.2.2. To attach importance to basic and frontier research, and obtain more recognition from international peers.

As mentioned above, the research on innovation process and its management is a hot research field and one important branch of innovation management research in the world, and has obtained valuable research achievements. However, the basic and original theory of innovation management in China is much less, and mainly in a state of learning and following. With the rapid development of China's economy and society, its technological strength and innovation capacity for scientific research have been continuously enhanced, and several fields have taken the leading position in the world. Therefore, innovation management research should not only focus on how to realize technological catching-up, but also on how to become an innovation leader. The basic theoretical research such as the innovation process and its management, is exactly the fundamental issue that should be focused on to improve the innovation ability and become an innovation leader. Chinese innovation filed should conform to the practical demands and keep pace with the international research to construct and develop relevant basic research theories.

As to the frontier research, the explosive growth of disruptive technologies in 5G, quantum information, new materials, and new energy, promotes and triggers a revolutionary change and rapid development of many fields and industries. For instance, the emergence of digital technology has contributed to the development of new industries, new businesses, and new service modes, which has brought huge changes to social production and lifestyle. In addition, the basic hypotheses of innovation management are also challenged (Liu *et al.*, 2020; Mendling *et al.*, 2020), depriving explanatory validity of traditional theories. The change of realistic context brought by the development of disruptive technology has triggered many frontier topics to be solved urgently. At this moment, the technology applications and developments of mobile interconnection, quantum information and artificial intelligence in China are standing at the forefront of the world, which offers Chinese innovation scholars a comparative advantage in developing corresponding theories. In the future, Chinese scholars can seize this opportunity to play a leading role in developing original innovation theories and win the recognition of international peers.

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