"The Policy Bricolage" of School-enterprise Collaborative Innovation of Research

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Keywords: School-enterprise collaborative innovation, The combination of technology policy, Qualitative comparative analysis.

Abstract. The development of First-class University collaborative innovation will be affected by the environment of technology policy, but how the combination of policy works has not yet been fully answered. Based on policy instrument theory, starting from the perspective of policy combination, this research analyzes the collaborative innovation development path of 21 "first-class universities" in 21 provinces of China by using the method of csQCA. The policy integration path is market-driven and government-driven. Among them, it focuses on the unitized design of financial support, talent supply and intellectual property policies.

1. Introduction

Collaborative innovation is a strategic choice to promote the construction of First-Class Universities in the world, and the objective needs of economic and social development, while technology policy is the cornerstone of the development of collaborative innovation. The relationship between Collaborative innovation and technology policy have a long history. As technology policy gradually enter the "3.0" era, the policy selective bias and inefficiency of government led innovation resource allocation have become increasingly prominent. It is urgent to deeply analyze the internal relationship structure and synergy of technology policy, so as to clarify the complex mechanism of collaborative innovation performance difference of First-class University. Existing research has certain limitations in theoretical perspective and research methods. From the perspective of policy content, existing research mainly discusses the impact of science and technology policy on collaborative innovation of First-class University from a single dimension [1-3]. From the perspective of research methods, it mainly uses qualitative or quantitative methods such as policy networks and policy texts [1-2]. Under the influence of technology policies, what are the development paths of First-class University for collaborative innovation? Related research is still insufficient. Based on this, from the perspective of policy combination, this article uses QCA to analyze the logical relationship between the collaborative innovation performance of First-class University and the support methods of technological policy, and trying to find out the combined path that affects the development of collaborative innovation of First-class University.

2. Research Foundation and Analysis Framework

2.1. Research on the Relationship Between Technology Policy and First-class University Collaborative Innovation

The use of policy tools is the most essential feature of technology policies, and is also the core of the implementation and operation of technology policies, shaping the goal and action framework of collaborative innovation for First-class University. At present, scholars at home and abroad have conducted relatively rich research on the theme of the policy and the collaborative innovation development of First-class University. According to Rothwell Roy and Zegveld's classification of policy tools [4], this paper divides existing research into supply-side policy and collaborative innovation research, demand-side policy and collaborative innovation research, and environmental policy research.
In supply-side policy and collaborative innovation research, financial subsidy policy and science and technology talent policy are important factors that affect the efficient operation of school-enterprise collaborative innovation. Financial subsidies have an incentive and demonstration effect on collaborative innovation\cite{5-6}. The science and technology talent policy has a guiding role in the flow, layout and structure of national science and technology talents, and has a positive impact on the development of collaborative innovation\cite{7}. In demand-side policy and collaborative innovation research, government procurement policies and technical standards policies are the main factors affecting the efficient operation of collaborative innovation. By introducing large-scale procurement and competition mechanisms to guide and encourage technological innovation activities, the government has a positive impact on the collaborative innovation development of schools and enterprises\cite{8}. The government publishes and stabilizes the market for the application of new technologies through technical standards and regulations, which has a catalytic effect on the collaborative innovation and development of schools and enterprises\cite{9-12}. In environmental policy and collaborative innovation research, preferential tax policies, financial support policies and intellectual property policies are important institutional guarantees for the development of collaborative innovation. In view of the universality, marketability, and certainty of preferential tax policies, academic circles generally believe that tax incentives have a significant incentive effect on technological innovation\cite{13}. Financial capital is an important factor in maintaining the virtuous cycle of the organization, and it is the "engine" of organizational development, especially for the technological innovation of enterprise organizations, enterprise organization management and operation, and industry development\cite{14}. Intellectual property policy is a lever for collaborative innovation input and has a positive effect on the development of collaborative innovation between schools and enterprises\cite{15}.

In summary, existing research shows that financial subsidy policies, innovative talent policies, government procurement policies, technical standards policies, tax incentives, financial support policies, and intellectual property policies are important institutional guarantees for the development of collaborative innovation. The relationship between innovation and policy tools has laid a certain foundation, but there are still certain limitations. Existing research mainly discusses the impact of science and technology policies on school-enterprise collaborative innovation from a single dimension, while studying a single technology policy without considering the combination of policies will cause deviations in the development of collaborative innovation.

2.2. Policy Bricolage Analysis Framework for School-enterprise Collaborative Innovation

From the perspective of qualitative comparative analysis based on set theory, the conditions under which social phenomena occur are mainly presented in a holistic and combined manner, which is an inter-dependence relationship, not an independent relationship in the traditional sense\cite{16}. In practice, there is no uniform symmetric relationship between the independent variable and the dependent variable\cite{17}. Putting the above understanding on the collaborative innovation and development of schools and enterprises, it can be seen that the collaborative innovation and development of schools and enterprises is a combination of financial subsidy policies, innovative talent policies, intellectual property policies, tax preferential policies, financial support policies, government procurement policies, and technical standards policy factors. As a result, based on this, this paper constructs an analytical framework for the bricolage research of school-enterprise collaborative innovation policies.

3. Research Design

3.1. Research Methods

Qualitative Comparative Analysis (QCA) is based on the methodology of set theory and Boolean algebra, and is a hybrid research method that combines qualitative and quantitative analysis. This method was proposed by sociologist Charles C. Ragin in 1987 and is currently widely used in different research fields. QCA is divided into clear set qualitative comparative analysis (csQCA),
fuzzy set qualitative comparative analysis (fsQCA) and multi-value set qualitative comparative analysis (mvQCA). Among them, the clear set qualitative comparative analysis method is suitable for dealing with cases where the variable is a binary assignment, and is the most widely used.

3.2. Case Selection and Data Collection

This paper selects 21 First-class University in 21 provincial administrative regions as research samples. According to the requirements of QCA for case selection, the following selection criteria are formulated. First, the appropriateness of the case. The case details can fully reflect the actual situation of First-class University collaborative innovation and technology policy. Second, clarity of results and conditions. Ensure that the results and conditions can get clear binary variables, excluding fuzzy cases on variable values. Third, determine the number of case samples. According to the requirements of QCA for case samples, the number of independent variables is 7, the number of case suggestions is 10-12, and 21 case samples are selected. Fourth, the representativeness of cases and the availability of information. In the specific practice, firstly, 42 First-class University are selected; secondly, the provincial administrative regions are matched with First-class University; finally, the random principle is used to sort out the case samples for the last round.

3.3. Data Collection

(1) Data collection of condition variables.

The condition variables in this study is science and technology policies, and the data mainly comes from the Peking University Magic Weapons Laws and Regulations database. In terms of the form of policy release, the policy documents that directly reflect the Chinese government's promotion of the collaborative innovation and development of First-class University are mainly selected, and the types of documents are mainly administrative regulations and regulatory documents. The time span of the policy text is selected from 2011 to 2015, because of 2011 is a new stage of development for collaborative innovation in my country’s First-class University.

In terms of data retrieval, the title search was conducted with keywords of "innovation", "technological innovation" and "technological innovation", and the search period was August 2020, and 1621 policy documents were finally collected. After selecting and sorting out policy texts, this research has obtained 586 effective policy samples.

(2) Data collection of outcome variables.

For school-enterprise collaborative innovation, the most important output is the output of knowledge. With reference to existing research, the performance of school-enterprise collaborative innovation is measured by the total number of patent applications filed by enterprises and universities. The collaborative innovation performance data in this study mainly comes from the official website of the State Intellectual Property Office (SIPO) of China from 2014 to 2018. Taking into account the time lag of the effect of science and technology policy, the lag period of 2-3 years, this study selects the patent search of the State Intellectual Property Office from 2014 to 2018, and uses the application (patent owner) = XX university and (company or factory or Group) search style for data collection. The basis of patent selection is that the applicant (patent right) includes both the main university and at least one enterprise main body, and finally obtains the patent details table of school-enterprise collaborative innovation.

3.4. Variable Design

(1) Results and assignments.

The result variable of this paper is school-enterprise collaborative innovation, which mainly uses the ranking changes of the number of patents of each university in the SIPO to measure First-class University collaborative innovation. Specifically, the 2014 First-class University collaborative innovation performance ranking is used as the standard. If the average ranking of the First-class University collaborative innovation performance is higher or the same than the 2014 ranking, the value is 1; if the ranking declines, the value is 0.

(2) Conditions and assignments.

According to the above classification and description of science and technology innovation
policies, the condition variables of this study mainly include financial subsidy policy, innovative talent policy, government procurement policy, technical standard policy, tax preferential policy, financial support policy and intellectual property policy. According to the clear set qualitative comparative analysis method, firstly, the text analysis method is used to extract the key content of science and technology policies and classify them in dimensions. Then assign values to the condition variables in accordance with the "differentiated attribution principle" (Table 1).

Table 1. Assignment table of condition variable and result variable.

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Variable Name</th>
<th>Variable Number</th>
<th>Code Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antecedent</td>
<td>financial subsidy policy</td>
<td>czbt</td>
<td>The annual average number of policy provisions of the new subsidy method is greater than or equal to the average annual number of traditional subsidy policy provisions.</td>
</tr>
<tr>
<td></td>
<td>innovative talent policy</td>
<td>cxrc</td>
<td>The number of policy provisions is at the median and above.</td>
</tr>
<tr>
<td></td>
<td>government procurement policy</td>
<td>zfg</td>
<td>The number of policy provisions is at the median and above.</td>
</tr>
<tr>
<td></td>
<td>technical standard policy</td>
<td>jsbz</td>
<td>The number of policy provisions is at the median and above.</td>
</tr>
<tr>
<td></td>
<td>tax incentives policy</td>
<td>sxyh</td>
<td>The annual average number of direct reduction and exemption provisions is higher than or equal to the average annual number of indirect preferential provisions.</td>
</tr>
<tr>
<td></td>
<td>environmental policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>financial support policy</td>
<td>jzxc</td>
<td>The number of policy provisions is at the median and above.</td>
</tr>
<tr>
<td></td>
<td>intellectual property policy</td>
<td>zscq</td>
<td>The number of policy provisions is at the median and above.</td>
</tr>
<tr>
<td>Outcome</td>
<td>school-enterprise collaborative innovation performance</td>
<td>jx</td>
<td>greater than five-year average rank</td>
</tr>
</tbody>
</table>

4. Research Results and Analysis

4.1. Necessity Analysis of Individual Conditions

The necessity analysis of a single condition is to test whether the result set is a subset of a certain condition set, which is an important content of qualitative comparative analysis research. In qualitative comparative analysis, when the consistency score is greater than 0.9, the condition is considered to be a necessary condition for the occurrence of the event; when the consistency score is greater than 0.8, the condition is considered to be a sufficient condition for the result[20]. When the results of innovation performance of First-class University exist, the consistency and coverage of financial subsidy variables are 1 and 0.125, respectively, indicating that the new financial subsidy method can become a necessary condition for the improvement of innovation performance of First-class University, and can explain about 12.5% Case. The consistency scores of other variables are all below 0.9. Combined with the coverage index, it shows that these antecedent variables have a certain independent interpretation ability for the outcome variables, and they are not enough to constitute the necessary conditions for the outcome variables, that is, they are the explanation of First-class University synergy An important factor in innovation performance.

4.2. Sufficiency Analysis of Conditional Configuration

Consistency is an important criterion for measuring the adequacy of the configuration. According to the QCA threshold setting criteria, the recommended frequency threshold for small and medium samples is 1, and the consistency level is 0.75. Therefore, the frequency threshold for this study is set to 1, and the consistency threshold is set to 0.8. Through counterfactual analysis, three different degrees of simplification, universality and revelation are obtained, namely parsimonious solution,
intermediate solution and complex solution. In order to deeply analyze the impact of science and technology policies on the performance of collaborative innovation of First-class University, this article groups all the conditional combinations of the intermediate programs according to the core conditions, and uses the logical scheme suggested by Larkin to show the support of the collaborative innovation policy tools of First-class University.

The single configuration consistency and total consistency of the performance path of First-class University are both greater than 0.9, reaching a reasonable level with sufficient conditions. From the results of the intermediate solution, it can be found that there are four paths leading to high efficiency First-class University collaborative innovation. According to the Boolean logic algorithm, merge and simplify, get market-driven and government-driven paths.

(1) Market-driven type. C1a and C1b can be combined into financial support policies*Government procurement policy*~Fiscal subsidy policy*~Innovative talent policy* (Intellectual Property Policy+Tax Preferential Policy+Technical Standard Policy+~Intellectual Property Policy+~Tax Preferential Policy+~Technical Standard Policy), the core condition of the two paths is financial support policy. It can be further seen that the collaborative innovation of First-class University is the result of the combined effect of demand-side and environmental-side policies. It focuses on demand-side policies and is relatively weak in supply-side policies.

(2) Government-driven. C2a and C2a can be merged into innovative talent policy*preferential tax policy*~government procurement policy*(financial subsidy policy+IP policy+financial support policy+technical standard policy+~fiscal subsidy policy+~IP policy+~financial support policy + ~technical standard policy), the core condition of the two paths is the policy of innovative talents. It can be further seen that the collaborative innovation of First-class University is mainly based on supply-side policies, which are the result of the combined effect of supply-side and environmental-side policies.

5. Conclusion

This study uses 21 First-class University in 21 provinces in China as case samples. From the perspective of policy content, this study uses QCA to explore the complex mechanisms that affect the differences in school-enterprise collaborative innovation performance. The following conclusions are obtained:

(1) Financial support policies and talent supply policies are important factors for the efficient operation of school-enterprise collaborative innovation. The study found that in the government-guided market-driven and government-led promotion path, financial support policies and talent support policies are the core influencing factors of school-enterprise collaborative innovation development, which, to a certain extent, it reflect continuous adjustment and improvement in the promotion and implementation of financial support policies and the development strategy of scientific and technological talents in China.

(2) The government-guided market-driven type and the government-led promotion type are the main paths for the efficient operation of school-enterprise collaborative innovation. The study found that the efficient operation of school-enterprise collaborative innovation is the result of a combination of multiple policy tools. The policy combination based on demand-side and environmental-side policies constitutes a government-guided market-driven type. This path reflects that the government does not directly interfere with science and education collaboration Innovation is independently determined by market demand to give full play to the role of the market. The combination of policies based on supply-side and environmental-side policies constitutes a government-led promotion type. This path reflects the government's dominant position in the allocation of scientific and technological resources.

References


