

Research on the Evolution of Government Attention in China's Science, Technology and Innovation Policy: A Text Analysis (1983-2022)

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Abstract: Amidst escalating global technological competition, the Chinese government has prioritized science, technology and innovation (STI) policy as a means to bolster our competitiveness. This study collected and analyzed 929 policy documents related to STI in China between 1983 and 2022. Employing government attention theory and text analysis methodologies, the study systematically examined the evolutionary characteristics of these policies. The findings unveil distinct stages in the evolution of government attention within this policy domain, accompanied by corresponding shifts in focus. In the Starting Stage, policy emphasis was placed on scientific and technological development itself and the construction of basic capabilities. With economic and social development, the policy focus shifted towards the transformation and application of scientific and technological achievements, with greater emphasis on the leading role of enterprises in scientific and technological innovation. In recent years, policy priorities have centered on breakthroughs in key areas and core technologies, while striving to build a comprehensive STI ecosystem. This study provides insights into understanding the evolutionary patterns of China's STI policy, optimizing relevant policies, and enhancing government governance capabilities.

1. Introduction

Amidst accelerating globalization and technological revolutions, science, technology and innovation (STI) has emerged as a crucial driver of national competitive edge. The Chinese government highly values STI, enacting a comprehensive array of policies aimed at sustainable development in its scientific and technological sectors. These policies are designed to enhance China's prowess in technological innovation and its overall national strength. However, due to finite resources, strategic prioritization and decision-making—an aspect termed as the allocation of government attention (Jones & Baumgartner, 2005) [1]—becomes essential. Understanding how the government allocates attention and analyzing its evolutionary process is crucial for developing more

effective STI policies.

The theory of government attention provides a novel perspective for analyzing the dynamics of STI policies. This concept suggests that government resources are intrinsically limited and cannot be distributed equally across all issues, leading to selective concentration on specific areas (Jones & Baumgartner, 2005) [1]. Observing the shifts in government focus on science and technology topics reveals new preferences and directions in policy formulation. Although the theory of government attention is well-recognized in public administration and policy science, its deployment in scrutinizing STI policies is limited. This paper seeks to fill this void by harnessing the theory of government attention to assess the developmental characteristics of China's STI policies, thus providing insights for policy enhancement and refinement.

Previous analyses of the progression of China's STI policies have primarily been qualitative, relying on the subjective interpretations of researchers to categorize the development into distinct stages. Examples include demarcations based on significant events in China's key technological areas, framing them into imitation, tracking and parallel, and leadership phases (Liu & Fan, 2021) [2]. Others dissect government focus transformations into nine stages via semantic network analysis of policies across timeframes (Duan et al., 2022) [3], or through keyword extraction combined with Python to determine different stages of evolution (Chen & Shen, 2022) [4]. Considering the Chinese government's five-year term cycles, this paper utilizes the theory of government attention and textual analysis, treating each five-year period as a unit of analysis. It systematically examines the distinct evolutionary characteristics of China's STI policies. Comparative studies on various stages of government attention in STI policies aim to contribute to the academic discourse and provide guidance for optimizing policies and improving governmental governance.

2. Literature Review

2.1. Government Attention

The concept of "attention" originates from psychology, broadly referring to the directionality of mental activities exhibited by an individual in a specific context, manifested as the focused orientation of intuition, thinking, and perception (Lin et al., 2003) [5]. Subsequently, the psychological concept of attention was gradually introduced into economic and management studies. Jones and Baumgartner pioneered the government attention theory, proposing that government attention refers to the tendency of governments to allocate finite time, energy, and resources to specific issues (Jones & Baumgartner, 2005) [1]. Due to cognitive and resource limitations, governments cannot give equal attention to all issues and therefore exhibit a clear selectivity. Governments focus their attention on specific issues through agenda-setting, thereby promoting the formulation and implementation of relevant policies (Jones & Baumgartner, 2012) [6]. Since then, government attention theory has been widely applied in policy science, public administration and other fields.

Chinese scholars' research on government attention primarily focuses on how governments allocate their limited attention resources to address complex and ever-changing social problems and decision-making challenges. These studies encompass various domains, ranging from basic public services (Wen, 2014) [7], environmental protection tasks (Sun, 2019) [8], STI policies (Duan et al., 2022) [3] to information technology construction (Li & He, 2021) [9]. While these studies have enriched and developed government attention theory, they rarely delve into the specific field of STI.

2.2. Research on the Evolution of STI Policy

STI policies are policy measures formulated by governments to promote scientific and

technological progress and innovation activities, including aspects such as R&D investment, talent cultivation, and intellectual property protection (Edquist, 1997) [10]. These policies aim to stimulate the innovation vitality of enterprises and research institutions by providing financial support, optimizing the innovation environment, and safeguarding intellectual property rights (Peng & Xu, 2015; Ma, 2014) [11][12].

Academic research on STI policy has a long history. From a methodological perspective, studies in this field have employed various research methods, including statistical analysis (Liu & Sun, 2007) [13], co-word analysis and cluster analysis (Huang et al., 2015) [14], text mining techniques (Zhang et al., 2019) [15], bibliometric analysis (Xiao & Zhang, 2016) [16], and system dynamics modeling (Hu, 2020) [17]. Each of these methods has its own emphasis, covering a wide range from quantitative to qualitative analysis, reflecting the diversity and complexity of STI policy research. The research primarily concentrates on the following aspects:

Analysis of the content of STI policies: Identifying policy elements, characteristics, and mechanisms of action through the analysis of policy text content (Tian et al., 2019) [18]; exploring changes in policy themes, adjustments in policy intensity, and feedback on policy effects by analyzing the evolution of policy texts, thereby understanding the development trends and patterns of the policy system (Zhang et al., 2019; Liu & Sun, 2007) [13][15].

Evaluation of the effectiveness of STI policies: Borrás and Edquist (2013) systematically reviewed the theories and methods of STI policy evaluation [19]; extensive research has been conducted on the effects, influencing factors, and policy tools of STI policies (David & Foray, 2002; Freeman, 1987) [20][21]; evaluation of the differential effects of policies in different regions and on different types of enterprises (Zhang & Yan, 2015; Wang et al., 2017) [22][23].

International comparison of STI policies: For instance, Intarakumnerd and Goto (2018) conducted a comparative analysis of the similarities and differences in STI policies among East Asian countries [24].

In summary, existing research pays limited attention to the changes in government attention during the formulation process of STI policies. As the formulation of such policies is inseparable from the participation and promotion of government departments, government attention theory can provide a novel analytical perspective for studying STI policies. Examining the changes in government attention to STI issues can help reveal the evolutionary logic and driving mechanisms behind these policies.

3. Research Design

3.1. Research Method

This study initially utilizes Python programming for word segmentation, frequency counts of high-frequency words, and co-word matrix generation. Frequency analysis and co-word network analysis are two common methods used in text analysis that identify key terms in the text by counting the frequency of each word's appearance and the occurrences of word co-occurrences. The co-word matrix is then imported into UCINET software to complete analyses such as visualization, which include generating semantic network graphs and calculating degree centrality. Based on the results from different stages, the study summarizes the policy focuses and analyzes the characteristics of government attention to China's STI policies at various stages.

3.2. Data Sources

The text data of STI policy collected for this study mainly come from the PKULAW database, encompassing policies released by China from 1983 to 2022. The search was conducted using

keywords "science," "technology," "innovation," and "science and technology." After excluding invalid policies and documents of low relevance, a total of 929 texts related to STI policies were collected [25-28].

Figure 1 shows the annual publication count of policies related to STI, illustrating a clear temporal characteristic of China's STI policy publications. During the period from 1983-1992, the average annual publication count was about 5, indicating a relatively low level of government attention to STI policies during this period. From 1993 to 2002, the average annual publication counts slightly increased to around 17, showing a gradual increase in government attention to STI. From 2003 to 2012, the average annual publication count reached about 28, indicating further increased attention to STI policies. During this time, China introduced a series of documents to promote STI. Among the most influential were the decisions by the CCP Central Committee and the State Council on implementing the technology plan outline to enhance independent innovation capabilities, as well as the Seventeenth National Congress of the CCP further proposed a development strategy to enhance independent innovation capacity and build an innovation-oriented nation. Consequently, during this period, China began to place greater emphasis on STI, and the number of corresponding policy documents further increased. From 2013 to 2017, the average annual publication count was 64, rapidly increasing, especially during 2016 and 2017, which saw a peak in publication numbers in recent years. In 2016, the Chinese government proposed to deeply implement the innovation-driven development strategy, elevating STI to a strategic level, leading to increased attention to STI policies. During 2018-2022, there was a slight decrease with an average annual publication count of 43, though it remained at a relatively high level.

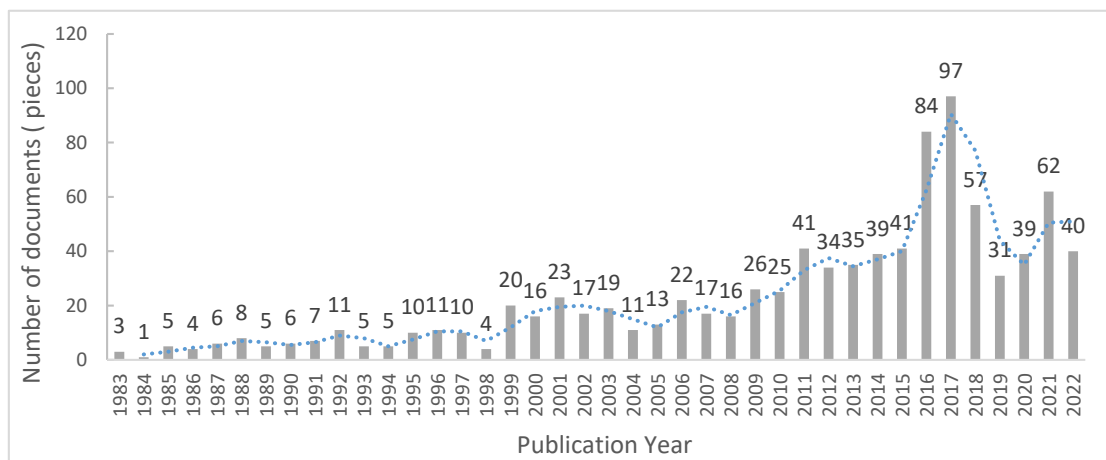


Figure 1: Annual Publication Count of STI Policies.

3.3. Government Attention Measurement

The paper measures the government's attention to STI policy by analyzing high-frequency words, semantic network graphs, and degree centrality.

High-frequency words are terms that appear frequently in policy texts, reflecting the focus and thematic content of policy makers. This paper excludes function words without substantial meaning, retaining the top 20 high-frequency words after the screening.

The semantic network graph represents the semantic associations between high-frequency words. The graph intuitively displays the connections between high-frequency words. The lines between nodes represent certain semantic relations between two words. The thickness of the line denotes the strength of this association, measured by the co-occurrence frequency of the two words in policy texts. The size of a node signifies the word's importance in the entire network, with larger nodes

indicating more central words. The node size is measured by degree centrality.

Degree centrality represents the centrality and importance of a node within the network. A higher degree centrality of a node indicates more connections with other nodes in the network, positioning it more centrally to the whole. To enable comparison of degree centrality of word frequencies in policy texts from different periods, this paper uses normalized degree centrality data.

By analyzing high-frequency words, a semantic network graph, and degree centrality, it is possible to comprehensively characterize the changes in the government's focus and thematic content of STI policy at different times, thereby measuring the evolution of government attention at various stages. Table 1 shows the top 20 high-frequency words and their frequencies of occurrence in texts related to STI policies from different periods.

Table 1: Main High-Frequency Keywords of STI Policies.

| No. | 1982-1987 | | 1988-1992 | | 1993-1997 | | 1998-2002 | |
|-----|--------------------------|------|---------------------------|------|-----------------------------|------|---------------------------|------|
| | High Frequency Words | % | High Frequency Words | % | High Frequency Words | % | High Frequency Words | % |
| 1 | Technology | 1.84 | Technology | 2.61 | Technology | 2.06 | Project | 2.26 |
| 2 | Technique | 1.45 | Technique | 1.70 | Enterprise | 1.75 | Technology | 1.94 |
| 3 | Organization | 1.26 | Organization | 1.28 | Technique | 1.68 | Enterprise | 1.13 |
| 4 | Technological Personnel | 1.17 | Appraisal | 1.19 | Organization | 1.30 | Technique | 1.11 |
| 5 | Enterprise | 1.01 | Outcome | 1.05 | Project | 1.27 | Research | 1.11 |
| 6 | Science and Technology | 1.00 | Research | 1.02 | Appraisal | 0.99 | Organization | 0.91 |
| 7 | Research | 0.86 | Project | 1.01 | Technological Innovation | 0.88 | Innovation | 0.87 |
| 8 | Organization | 0.80 | Technological Achievement | 0.73 | Research | 0.80 | Technological Innovation | 0.68 |
| 9 | Project | 0.74 | Organization | 0.72 | Technological Achievement | 0.78 | Strengthen | 0.67 |
| 10 | Economy | 0.61 | Economy | 0.69 | Organization | 0.76 | Subject | 0.64 |
| 11 | Personnel | 0.59 | Technological Personnel | 0.66 | Outcome | 0.72 | Funding | 0.58 |
| 12 | Funding | 0.55 | Science and Technology | 0.65 | Economy | 0.62 | Organization | 0.57 |
| 13 | Strengthen | 0.51 | Enterprise | 0.57 | Strengthen | 0.51 | Evaluation | 0.54 |
| 14 | Education | 0.48 | Development | 0.54 | Development | 0.46 | Technological Achievement | 0.54 |
| 15 | Outcome | 0.47 | Agriculture | 0.54 | Research Institution | 0.45 | IPR | 0.52 |
| 16 | Specialization | 0.47 | Service | 0.46 | National Science Commission | 0.43 | Service | 0.51 |
| 17 | Service | 0.47 | Enhancement | 0.44 | Collaboration | 0.42 | Outcome | 0.49 |
| 18 | State Council | 0.46 | Strengthen | 0.43 | Reform | 0.40 | Support | 0.47 |
| 19 | Agriculture and Forestry | 0.46 | Specialization | 0.42 | Agriculture | 0.39 | Focus | 0.46 |

| | | | | | | | | |
|----|---------------------|------|------------|------|-------|------|-------------|------|
| 20 | Scientific Research | 0.46 | Statistics | 0.42 | Focus | 0.38 | Significant | 0.46 |
|----|---------------------|------|------------|------|-------|------|-------------|------|

Table 1: Main High-Frequency Keywords of STI Policies (continued).

| No. | 2003-2007 | | 2008-2012 | | 2013-2017 | | 2018-2022 | |
|-----|----------------------|------|---------------------------|------|---------------------------|------|------------------------------------|------|
| | High Frequency Words | % | High Frequency Words | % | High Frequency Words | % | High Frequency Words | % |
| 1 | Technology | 2.19 | Technology | 2.42 | Innovation | 2.41 | Innovation | 2.37 |
| 2 | Project | 1.72 | Technique | 1.88 | Technology | 2.28 | Technology | 1.88 |
| 3 | Technique | 1.64 | Innovation | 1.67 | Technique | 1.31 | Organization | 1.05 |
| 4 | Enterprise | 1.23 | Project | 1.62 | Enterprise | 1.11 | Enterprise | 0.88 |
| 5 | Innovation | 1.18 | Enterprise | 1.46 | Organization | 0.88 | Technique | 0.84 |
| 6 | Research | 0.93 | Organization | 1.04 | Project | 0.85 | Project | 0.76 |
| 7 | Organization | 0.84 | IPR | 0.69 | Technological Achievement | 0.76 | Support | 0.71 |
| 8 | Strengthen | 0.70 | Strengthen | 0.67 | Commercialization | 0.72 | Service | 0.62 |
| 9 | IPR | 0.60 | Organization | 0.65 | Service | 0.72 | Technological Achievement | 0.61 |
| 10 | Talent | 0.58 | Research | 0.61 | Significant | 0.69 | Commercialization | 0.61 |
| 11 | Support | 0.56 | Support | 0.55 | Research | 0.66 | Significant | 0.60 |
| 12 | Subject | 0.53 | Service | 0.54 | Strengthen | 0.66 | Research | 0.59 |
| 13 | Focus | 0.51 | Subject | 0.53 | Support | 0.60 | Strengthen | 0.52 |
| 14 | Organization | 0.51 | Significant | 0.51 | Organization | 0.49 | Special | 0.49 |
| 15 | Funding | 0.51 | Industry | 0.50 | Special | 0.47 | Ministry of Science and Technology | 0.49 |
| 16 | Service | 0.48 | Base | 0.46 | Entrepreneurship | 0.46 | Organization | 0.49 |
| 17 | MOST. | 0.46 | Field | 0.43 | Focus | 0.45 | Entrepreneurship | 0.47 |
| 18 | Undertake | 0.42 | Independent | 0.40 | Field | 0.42 | Talent | 0.47 |
| 19 | Significant | 0.42 | MOST | 0.40 | Industry | 0.41 | Field | 0.46 |
| 20 | Enhancement | 0.42 | Technological Achievement | 0.40 | R&D | 0.41 | Reform | 0.45 |

4. Analysis Result

In this paper, we delve further into the high-frequency words and semantic networks of China's STI policy texts from 1983 to 2022, thereby effectively elucidating the evolution characteristics of policy content and keywords in the STI policy of various periods.

To provide a more intuitive visualization of the semantic associations within the STI policy text data, this study employs UCINET software to generate a semantic network graph. Firstly, a co-occurrence matrix is constructed based on the text content, representing the frequency with which words appear together. Subsequently, the co-occurrence matrix is imported into UCINET, utilizing NetDraw for network graph visualization. During the visualization process, node size is determined by degree centrality, reflecting the importance of each node within the network. Line thickness is determined by the values within the co-occurrence matrix, representing the strength of the semantic association between words. The resulting semantic network graph effectively illustrates the interconnected structure and semantic relationships among the words.

4.1. Focus of Government Attention in China's STI Policy from 1983-1987

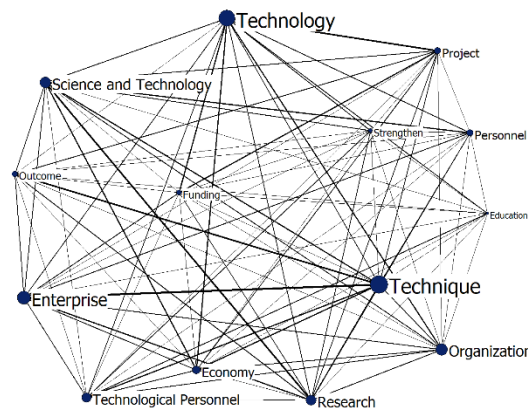


Figure 2: Semantic Network Diagram of STI Policies from 1983 to 1987.

Based on the word frequency analysis, semantic network analysis (Figure 2), we can summarize the following characteristics and focal points of China's STI policy during this period:

Emphasis on the importance of science and technology: The words "science and technology" and "technology" have the highest frequency and occupy a central position in co-occurrence and centrality analyses, indicating that science and technological development were the focus of China's STI policy at that time.

Attention to building a team of science and technology personnel: "Technological Personnel" has a high frequency and centrality, indicating that the government realized the key role of scientific and technological talent in innovation, and began to pay attention to the cultivation and introduction of such talent.

Focus on the role of enterprises in STI: "Enterprise" also rank high in frequency and centrality, suggesting that the government was starting to acknowledge the role of companies in STI and began to encourage and support technological innovation within these enterprises.

Importance of organizing and managing scientific research projects: Words like "organization" and "project" also have high frequency and centrality, which implies that the government was starting to emphasize the organization and management of research projects to improve its efficiency and effectiveness.

Awareness of the impact of STI on economic and social development: Terms like "economy" and "personnel" also rank high in frequency and centrality, indicating that the government began to consider the impact of STI on economic and social development, hoping that such innovation would propel development in these areas.

Overall, during this stage, the characteristics of the STI policy emphasized the importance of science and technology, seeing scientific and technological innovation as an important means to drive economic and social development. The government started to give due regard to the construction of science and technology talent teams, the role of enterprises in scientific and technological innovation, as well as the organization and management of scientific research projects. China's STI policy from 1983-1987 was still in its initial stages, with policy focus mainly on the development of science and technology itself, while the attention to technology commercialization and intellectual property protection was relatively lower [29-31]. This was related to the socio-economic development level and the stage of scientific and technological innovation development at that time.

4.2. Focus of Government Attention in China's STI Policy from 1988-1992

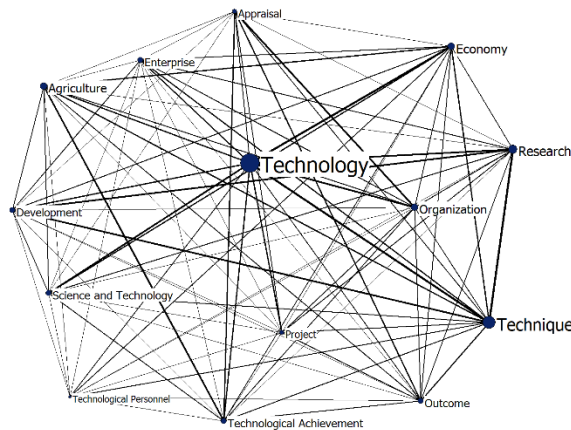


Figure 3: Semantic Network of STI Policy from 1988-1992.

Based on the word frequency analysis, semantic network analysis (Figure 3) from 1988-1992, we can summarize the following characteristics and focal points of China's STI policy during this period:

Continued emphasis on the importance of science and technology: "Science and technology" and "technology" continue to have the highest frequency of words and retain a central position in co-occurrence and centrality analyses, indicating that the development of science and technology remains the priority of this period's policy focus.

Attention to the appraisal and transformation of scientific and technological achievements: Words like "appraisal," "outcome," and "Commercialization" are high in frequency and centrality, showing that the government began to focus on the appraisal and transformation of scientific achievements, regarding them as an important means to drive economic and social development.

Enhanced support for research and projects: Terms like "research" and "project" also have high frequency and centrality, indicating that the government is increasing support for research and projects to improve the efficiency and benefits of scientific and technological innovation.

Focus on enterprise innovation: "Enterprise" maintains a high frequency and centrality, suggesting that the government started recognizing the primary role of enterprises in scientific and technological innovation and began to pay attention to and support technological innovation by enterprises.

Emerging emphasis on the technology service industry: The occurrence of words such as "service" and "service industry" indicates an increasing focus on the development of the technology service industry during this period, promoting the integration of science and technology with the service economy.

Overall, during this period, the focal points of China's STI policy include continued emphasis on the importance of science and technology, beginning to focus on the transformation and application of scientific achievements, emphasizing the primary role of enterprises in scientific and technological innovation, and starting to pay attention to and support technological innovation by enterprises. The focus shifted from emphasizing the development of science and technology itself to combining scientific and technological development with economic and social development.

4.3. Focus of Government Attention in China's STI Policy from 1993-1997

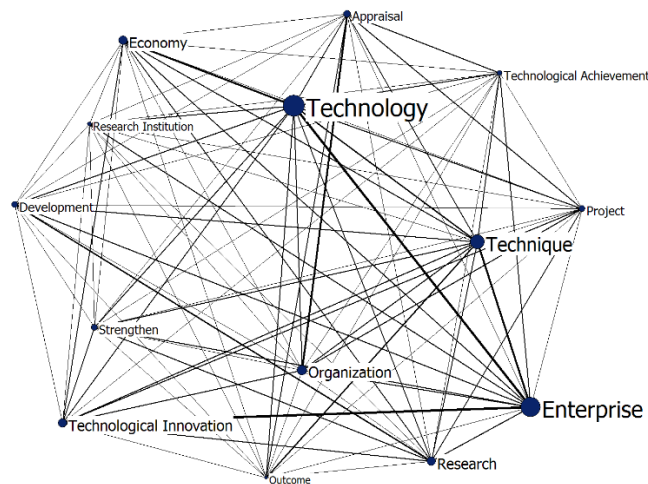


Figure 4: Semantic Network of STI Policy from 1993-1997.

For the word frequency analysis, semantic network analysis (Figure 4), regarding China's STI policy texts from 1993-1997, we can summarize the following characteristics and focal points:

Further emphasis on the primary role of enterprises in scientific and technological innovation: The word "enterprise" ranks second in frequency and centrality only to "science and technology," and it has high co-occurrence rates with phrases like "technological innovation," "technology," and "development." This indicates that during this period, policies increasingly emphasized the role of enterprises in scientific and technological innovation, supporting and guiding their efforts in technological innovation and R&D activities.

Importance given to technological innovation: The frequency and centrality of the term "technological innovation" are high, as well as its co-occurrence with "enterprise," "technology," and "development." This shows that the government attached more importance to technological innovation as a means of advancing scientific progress and socio-economic development.

Continued enhancement of support for research and projects: The words "research" and "projects" also rank high in frequency and centrality, suggesting that the government continued to increase support for research and projects to improve the efficiency and benefits of scientific and technological innovation.

Focus on the transformation and application of scientific achievements: Terms such as "scientific achievements," "achievements," and "transformation" have high frequency and centrality, indicating that the government gave more attention to the transformation and application of scientific results as an important means of propelling economic and social development.

This period represents a crucial phase in China's transition to a socialist market economy and the comprehensive advancement of scientific and technological progress and innovation. The key focal points of China's STI policy during this stage were clearly centered on strengthening the core role of enterprises in scientific and technological innovation, emphasizing technological innovation and the transformation of scientific outcomes, and supporting research, organization, and project implementation. China's STI policy started shifting from focusing solely on scientific development towards integrating science and technology with socio-economic development. Moreover, there was an increased emphasis on leveraging the role of enterprises in scientific and technological innovation.

4.4. Focus of Government Attention in China's STI Policy from 1998-2002

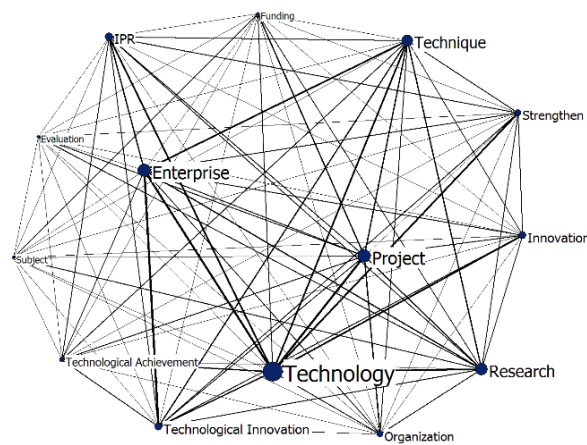


Figure 5: Semantic Network of STI Policy from 1998-2002.

Drawing upon the word frequency analysis, semantic network analysis (Figure 5) of China's STI policy texts from 1998-2002, we can distill the following characteristics and focus areas of the policy during this period:

Increased emphasis on the organization and management of scientific research projects: The word "project" ranks highest in both frequency and centrality, with a high co-occurrence rate with terms like "science and technology," "research," and "funding." This demonstrates a greater policy focus on the organization and management of scientific research projects to enhance their efficiency and benefits.

Continued stress on the importance of science and technology: The frequency and centrality of "science and technology" and "technology" remain high and show high co-occurrence with terms like "project," "research," and "innovation." This indicates that science and technological development continue to be at the core of China's STI policy during this period.

More pronounced focus on the leading role of enterprise innovation: The word "enterprise" has high frequency and centrality and co-occurs frequently with "technological innovation," "technique," and "development." This suggests that the government placed greater emphasis on the primary role of enterprises in scientific and technological innovation, actively supporting and guiding their technological innovation and R&D activities.

Attention to intellectual property protection: The frequency and centrality of "intellectual property" significantly increased, which indicates that the government started to take intellectual property protection more seriously to encourage the dissemination and application of innovative scientific and technological achievements.

Focus on the construction of a scientific and technological innovation service system: Terms like "service" and "support" also rank high in frequency and centrality, showing that the government paid more attention to the construction of a STI service system. This was supported by providing policy aid and building service platforms to offer better services and support for scientific and technological innovation.

In summary, the characteristics of this phase of China's STI policy included greater emphasis on the organization and management of research projects and continued stress on the importance of science and technology. Additionally, the government accentuated the principal role of enterprise innovation, attention to intellectual property protection, and the establishment of a scientific and technological innovation service system. These points show a deeper understanding by the Chinese government regarding scientific and technological innovation, focusing on the systematic and effective aspect of policy to drive the transformation of economic development methods and

optimize and upgrade the industrial structure.

4.5. Focus of Government Attention in China's STI Policy from 2003-2007

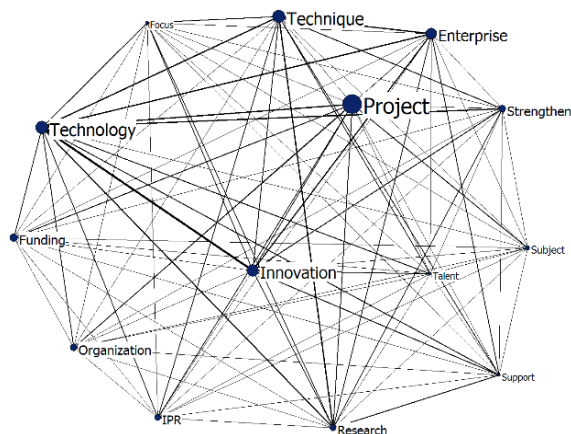


Figure 6: Semantic Network of STI Policy from 2003-2007.

From the word frequency analysis, semantic network analysis (Figure 6) for China's STI policy texts between 2003-2007, we can highlight the following features and focal points during this period:

Even greater emphasis on the primary role of enterprises in innovation: The term "enterprise" continues to rank highly in both frequency and centrality, and has high co-occurrence with "innovation," "technique," and "R&D." This indicates an increased policy focus on the primary role of enterprises in science and technological innovation, actively supporting and guiding their efforts in technological innovation and R&D.

Focus on breakthroughs in key areas and core technologies: An increased frequency and centrality of terms like "significant," "focus," suggest that the government paid more attention to the impact of scientific and technological innovation on national strategic needs and industry development. The government focused on breakthroughs in key areas and core technologies to enhance the country's scientific and technological competitiveness.

Strengthening the organization and management of scientific research projects: Terms like "project," "organization," and "management" have increased in frequency and centrality, indicating a greater emphasis on the organization and management of scientific research projects to improve their efficiency and benefits.

Improvement of the STI service system: The terms "service," "platform," and "talent" show a rising trend in both frequency and centrality, signifying that the government placed more importance on constructing a service system for STI. The government worked to provide better services and support for scientific and technological innovation through building platforms and attracting and cultivating talent.

Attention to the transformation of outcomes and intellectual property protection: The frequency and centrality of "commercialization" and "intellectual property" have increased, underlining a greater focus on the transformation and application of scientific achievements, coupled with strengthened intellectual property protection to encourage the dissemination and application of innovative results.

In summary, the period between 2003 and 2007 constitutes a significant phase for China in accelerating the construction of an innovation-oriented nation and implementing a strategy where science and technology lead development. The STI policy during this stage shows a strengthened emphasis on enterprise innovation, with a core focus on breakthroughs in key areas and

technologies. In addition, the government also paid more attention to the organization and management of scientific research projects, the construction of the STI service system, and the transformation and protection of intellectual property.

4.6. Focus of Government Attention in China's STI Policy from 2008-2012

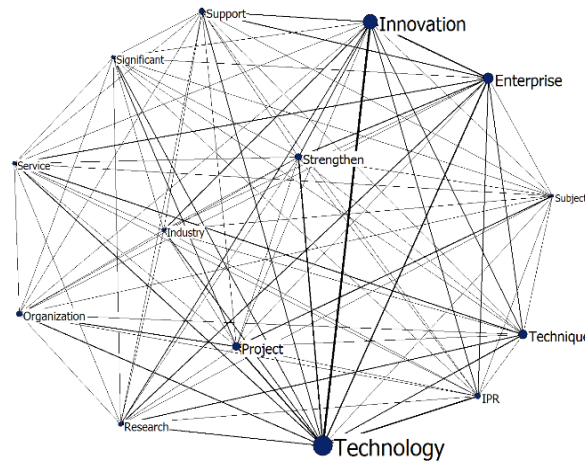


Figure 7: Semantic Network of STI Policy from 2008-2012.

Based on the word frequency analysis, semantic network analysis (Figure 7) of China's STI policy texts from 2008-2012, the following characteristics and focal points of the policy during this period can be summarized:

Attention to enterprise innovation: Co-occurrence analysis shows that the term "enterprise" frequently co-occurs with "technological innovation" and "technique," indicating that the policy prioritizes supporting and guiding enterprises in technological innovation. The third-place ranking of "enterprise" in the normalized degree centrality reflects the pivotal role of enterprises in the network of scientific and technological innovation policies.

Focus on key areas and breakthroughs in core technologies: The frequency and centrality of terms such as "significant," "focus," and "field" are high, reflecting that policymakers paid more attention to the impact of scientific and technological innovation on national strategic needs and industrial development. The focus was on key areas and breakthroughs in core technologies to enhance national technological competitiveness.

Strengthening organization and management of scientific research projects: Words like "project," "organization," and "management" have high frequency and centrality, indicating that the government placed greater emphasis on the organization and management of scientific research projects to improve their efficiency and benefits.

Improvement of the STI service system: Terms such as "service," "support," and "talent" are also high in frequency and centrality, suggesting that the government stressed the construction of a service system for STI. It sought to provide better services and support for scientific and technological innovation by offering policy support, building service platforms, and attracting and cultivating talent.

Emphasis on the transformation of results and intellectual property protection: The high frequency and centrality of terms like "outcome," "commercialization," and "intellectual property" indicate a heightened attention on the transformation and application of scientific results, as well as strengthened intellectual property protection, to promote the dissemination and application of innovation outcomes.

Overall, between 2008 and 2012, China's STI policy focused on enterprises as the main

innovators, concentrated on key areas, strengthened the organization and management of research projects, perfected the service system, and emphasized the transformation of results and intellectual property protection. The focus of the policy was to enhance the innovation capacity of enterprises, make concentrated efforts to achieve breakthroughs in key core technologies, and promote scientific and technological innovation to support and lead the transformation of economic development models and the optimization and upgrading of the industrial structure.

4.7. Focus of Government Attention in China's STI Policy from 2013-2017

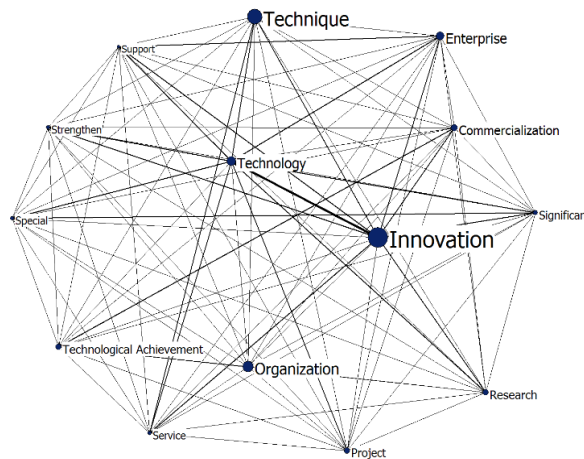


Figure 8: Semantic Network of STI Policy from 2013-2017.

Between 2013 and 2017, the policy attention within China's technological innovation landscape has undergone notable shifts, as delineated by linguistic analytics which include word frequency distribution, semantic network mapping (as seen in Figure 8). The period is characterized by the following tendencies and priorities:

Heightened prioritization of an innovation-centric development paradigm: The prominence of "innovation" in both frequency and centrality metrics, coupled with its recurrent association with terms such as "technology," "technique," and "enterprise," underscores the era's reinforced dedication to an innovation-led growth framework envisaged as the primary driver for socio-economic progression.

Sustained accentuation on the pivotal role of science and technology: The persistent salience of "technology" and "technique" in policy discourse, mirrored by their frequent correlation with "innovation," "research," and "project," reaffirms the steadfast centrality of scientific and technical evolution within the geopolitical strategy.

Continual emphasis on the entrepreneurial nucleus of innovation: The analytical prominence of "enterprise," evidenced through its occurrence and nodal significance, paired with its interlaced mentions alongside "innovation," "technique," and "R&D," reflects an unwavering governmental resolve to fortify the enterprise as the vanguard of technological innovation and foster its tech-innovative and research endeavors.

Concentrated focus on the enaction and employment of scientific and technological endeavors: The elevated recurrence and nodal augmentation of terms such as "outcome," "commercialization," highlight a governmental impetus on rendering scientific findings into practical applications with economic and social benefits.

Focused investment in the scaffolding of a technological innovation support network: The analytical ascendancy of terms "support," "service," "talent," intimates an increased governmental focus on erecting a robust framework to nurture technological ingenuity, manifested through policy

incentives, the institution of supportive infrastructures, and strategic talent acquisition and development.

Emphasizing the amalgamation of innovation with entrepreneurship and sectoral growth: A noticeable surge in the recurrence and centrality of "entrepreneurship," "industry" signals a governmental inclination towards an integrative approach, converging technological advancements with entrepreneurial dynamism and sector-specific growth, thereby catalyzing the proliferation and practical integration of innovative breakthroughs into the socio-economic milieu.

This period highlights an increasing emphasis on innovation as a principal impetus for development, with explicit encouragement of enterprise-centered innovation, a focus on actualizing research into actionable outcomes, and an augmented commitment to constructing an extensive support network for scientific ingenuity. Moreover, it denotes a definitive enhancement over prior periods (2008-2012) through its pronounced emphasis on marrying innovation with enterprise and industry, thereby affirming a strategic pivot in policy orientation towards maximizing the directive force and socio-economic contributions of technological innovation.

4.8. Focus of Government Attention in China's STI Policy from 2018-2022

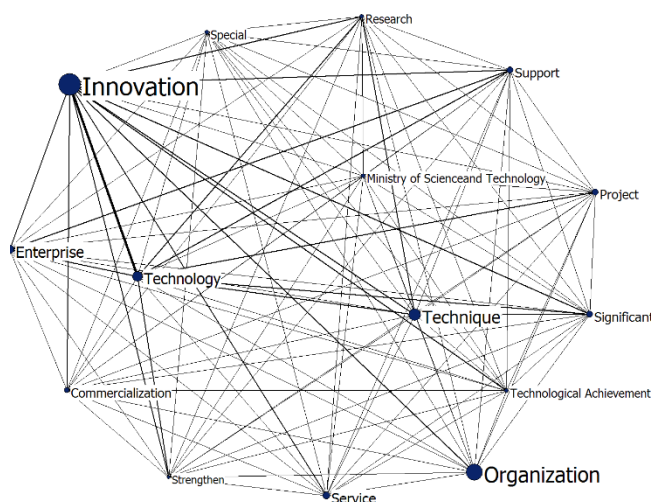


Figure 9: Semantic Network of STI Policy from 2018 to 2022.

Throughout the 2018-2022 period, an in-depth examination of China's policy focus on STI reveals persistent trends and priorities via a multifaceted lens encompassing word frequency dissection, semantic networking visualization (Figure 9), Notable policy measures and initiatives featured in this timeframe include:

Persisting Emphasis on the Anchoring Role of Corporate Innovation: The steadfast prominence of "enterprise" in lexical metrics alongside consistent associations with "innovation," "technique," and "R&D," reaffirms the commitment to propelling enterprises to the forefront of technological innovation, underlining strategic initiatives designed to catalyze and steer corporate-led technological innovation and research activities; **Strategic Focus on Pivotal Domains and Fundamental Technological Milestones:** The enhanced lexical prominence and centrality of terms encompassing "significant," "focus," and "field" indicates a deliberate policy tilt towards issues bearing relevance to national strategic imperatives and sectoral growth, targeting vital domains, and pioneering developments in foundational technologies, poised to augment national competitiveness in the global scientific arena; **Fortification of Research Project Governance:** The augmented occurrence and gravity accorded to "project," "organization," and "management" underscore an augmented policy interest in the rigorous stewardship of research endeavors, aimed at optimizing

operational efficiency and research returns; Refinement of Technological Innovation Support Structures: The progressive lexical ascendance and nodal significance of "service," "platform," "talent," reflects a concerted governmental impetus on reinforcing infrastructural support systems for technological innovation, manifested through concerted efforts in platform establishment and talent development to bolster scientific ventures; Protective Measures for Outcome Actualization and Intellectual Property Safeguards: An elevated emphasis and centrality noted in "commercialization" and "intellectual property" are indicative of intensified protective and promotional strategies aimed at nurturing outcome realization processes, alongside fortifying intellectual property regimes to facilitate the broad-based adoption and integration of innovative achievements.

The period from 2018 to 2022 signifies a critical phase in China's implementation of the innovation-driven development strategy, marked by rapid progress towards achieving science and technology self-reliance and building an innovation-oriented nation. As it stands, the policy framework accentuates the vanguard role of enterprise-led innovation, zeroes in on strategic sectors, and archetypal technological advancements. Concomitantly, the government's dedication to project management, service infrastructural improvements, and the enactment and safeguarding of intellectual property within the innovation landscape has been duly amplified. A comparison with the preceding epoch (2013–2017) denotes a consistent trajectory in policy focal points, revolving around corporate innovation impetus, key domain and technology breakthroughs, project organization, and service system refinement, as well as outcome implementation and intellectual property fortifications. These trends signal a phase of relative policy stability, geared towards continued policy maturation and enhancement.

5. Discussion

5.1. Analysis of Focal Points in STI Policy at Each Stage

This study analyzes the evolution of government attention in China's STI policy over a span of forty years, from 1983 to 2022. The analysis segments this period into five-year intervals, identifying distinct phases characterized by unique features and areas of focus. Based on these characteristics, the study further classifies these phases into eight stages: the Starting Stage, Development Stage, Transformation Stage, Deepening Stage, Strategic Focus Stage, Continuous Deepening Stage, Innovation-driven Stage, and Stable Development Stage. Table 2 provides a summarized overview of the government's focal points and policy priorities during each of these stages.

Table 2: Stages of Government Attention and Policy Focus.

| Stage | Time Span | Policy Focus | Government Attention |
|---------------------------|-----------|--|--|
| the Starting Stage | 1983-1987 | Emphasis on the importance of science and technology, attention to the construction of scientific personnel, role of enterprises in tech innovation, and organization and management of research projects. | Mainly focused on the development of science and technology itself. |
| Development Stage | 1988-1992 | Focus on the integration of science and technology with economic and social development, attention to the transformation and application of scientific achievements, role of enterprises in tech innovation. | Began to pay attention to the connection between science-tech innovation and economic-social development, with increased emphasis on the role of enterprises in tech innovation. |

| | | | |
|-----------------------------------|-----------|---|--|
| Transformation Stage | 1993-1997 | Highlight the principal position of enterprises in tech innovation, focus on technological innovation, and the transformation of scientific achievements, support for research, organization, and project execution. | Increased focus on the principal position of enterprises in tech innovation and greater emphasis on the contribution of scientific innovation to economic and social development. |
| Deepening Stage | 1998-2002 | Attention to the organization and management of research projects and intellectual property protection, highlight the principal position of enterprise innovation, focus on the construction of tech innovation service systems. | More focus on the systematic and effective nature of science and tech innovation policy, and the beginning of focus on the construction of tech innovation service systems. |
| Strategic Focus Stage | 2003-2007 | Highlight the principal position of enterprise innovation, focus on key areas and core technology breakthroughs, attention to research project organization and management, tech innovation service system construction, and the transformation and protection of intellectual property rights. | Greater focus on the strategic nature and direction of tech innovation, and the construction of a tech innovation ecosystem. |
| Continuous Deepening Stage | 2008-2012 | Enterprise innovation, key areas and core tech breakthroughs, research project organization and management, tech innovation service system construction, and the transformation and protection of intellectual property rights. | Continued deepening and improvement of tech innovation policies, with increased focus on the role of tech innovation in the transformation of the economic development model and the optimization and upgrading of the industrial structure. |
| Innovation-Driven Stage | 2013-2017 | Emphasis on the innovation-driven development strategy, highlight the principal position of enterprise innovation, attention to the transformation and application of scientific achievements, focus on the construction of tech innovation service systems, and the combination of tech innovation with entrepreneurship and industrial development. | More focus on the leading role of tech innovation and its contribution to economic and social development, and greater emphasis on the integration of tech innovation with entrepreneurship and industrial development. |
| Stable Development Stage | 2018-2022 | Enterprise innovation, key areas and core tech breakthroughs, research project organization and management, tech innovation service system construction, and the transformation and protection of intellectual property rights. | Continued deepening and improvement of tech innovation policies, maintaining policy continuity and stability. |

5.2. The Evolution of Government Attention in STI Policy: Logic and Trends

The evolution of government attention in China's STI policy is a dynamic process that reflects the government's deepening understanding of scientific innovation and its grasp of the laws of innovation. The logic and trends of this evolution are primarily manifested in the following ways:

The shift from focusing on the development of science and technology itself to combining it with economic and social development. In the early stages, the government's attention was primarily focused on the development of science and technology itself, such as emphasizing the importance of science and technology and valuing the construction of scientific talent pools. As the role of scientific innovation in economic and social development became increasingly prominent, the government's focus shifted to combining science and technology with economic and social

development, such as highlighting the transformation and application of scientific achievements and emphasizing the principal status of enterprise innovation.

The shift from emphasizing government-led initiatives to utilizing market mechanisms. In the early stages, the government played a leading role in scientific innovation. With the establishment and improvement of the socialist market economy system, the government has started to place greater emphasis on the role of market mechanisms, for instance, encouraging and supporting corporate technological innovation and focusing on the protection of intellectual property rights.

The shift from relying on individual policy tools to a combination of policy instruments. In the early stages, the government relied on singular policy tools to promote scientific innovation, such as direct fiscal appropriations and tax incentives. With the increasing complexity and diversity of innovation activities, the government has started to focus on a combination of policy tools, such as integrating fiscal, tax, financial, and talent policies to create a synergistic policy effect.

The shift from short-term goals to long-term objectives. In the early stages, the government's STI policy goals were mainly focused on short-term targets, such as increasing the quantity of scientific achievements. As the importance of scientific innovation for the country's long-term development became more evident, the government started to place more emphasis on long-term objectives, such as building an innovative nation and enhancing the country's scientific and technological competitiveness on a global scale.

6. Conclusions and Implications

This study employs the theory of government attention and methods of textual analysis to systematically analyze the evolutionary characteristics of China's STI policies from 1983 to 2022. The research findings indicate that the government attention within China's STI policy has evolved from the initiation phase to a stable development phase, with corresponding changes in policy focus.

6.1. Research Conclusions

The government attention to China's STI policy has undergone an evolutionary process that includes shifting from a focus on the development of science and technology itself to an emphasis on its integration with economic and social development; from government-led to market mechanism-driven initiatives; from single policy tools to a combination of policy instruments; and from focusing on short-term goals to emphasizing long-term objectives.

In different development stages, the government's focal points for STI policy have varied. During the initiation phase, the government's main focus was on the development of science and technology itself. In the development phase, the government started focusing on the transformation and application of scientific results. During the transformation phase, there was an increased emphasis on the principal status of enterprises in technology innovation. In the deepening phase, the government placed more importance on the systematic and effective nature of the policy. During the strategic focus phase, there was a greater emphasis on the strategic orientation and direction of scientific and technological innovation. In the continuous deepening phase, the government focused more on the role of technology innovation in transforming the economic development model and upgrading the industrial structure. During the innovation-driven phase, the focus was on the leading role of technology innovation and its contributions to economic and social development. Finally, in the stable development phase, the government continued to deepen and refine the STI policy, maintaining its continuity and stability.

6.2. Implications

Government attention theory provides a valuable framework for analyzing STI policy, contributing to theoretical advancements in related fields. Analyzing government attention offers a comprehensive understanding of China's focus on STI issues and the transitions in policy priorities, providing a fresh perspective for policy research.

The evolution of China's STI policy exhibits clearly defined stages, each with specific focal points and priorities. This presents historical experiences and lessons for future policy formulation and implementation.

STI policy requires continuous adaptation to the evolving demands of technological advancements and socio-economic development, necessitating ongoing refinement and adjustments. Governments should actively respond to changes in the field of STI, and timely adjust attention and policy focus to ensure policy effectiveness and strategic vision.

This paper examines the evolutionary trajectory of China's STI policy through the lens of government attention theory and textual analysis methods. However, it is important to note that due to data and methodological limitations, this study may not cover all policy details and changes. Future research could further refine the analysis, examining government attention changes in specific stages or policy areas to gain more nuanced conclusions. Additionally, combining quantitative analysis with qualitative research could further validate and enrich the patterns of government attention evolution, providing a more comprehensive reference for the formulation of STI policy.

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