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Study on Shanghai's Policy Implementation of Science and Technology Based on Content Analysis and Grounded Theory

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Abstract: The study of science and technology policies was generally focused on formulation and assessment while the policy implementation analysis has been neglected for a long time. In this paper, we studied 315 enterprises in survey that conducted by the Shanghai Development and Reform Commission in 2010 based on Content Analysis. Moreover, we quantified each qualitative information and analyzed the implementation of science and technology policies by means of Grounded Theory. Finally, we draw a conclusion as follows: (1) The general level of Shanghai policy implementation of science and technology is relatively high majored by the priority on platform policy and external innovative climate. (2) Policy making process is target-oriented and communication between the government and enterprises is effective. (3) Enterprises eagerly look forward to the indirect support and service-oriented policies from the government. Accordingly, we suggested that increasing the scientific and technological investment, optimizing the support direction of fiscal and tax policy, creating a favorable external environment for innovation and staff training, promoting scientific and technological achievements conversion and satisfying the service demands of enterprises.

Key words: Science and technology policies, content analysis, grounded theory, implementation analysis

INTRODUCTION

Now-a-days science and technology has bloomed into the main momentum for economic and society development. As an important means of allocating science and technology resources, technology policies plays a guiding role in science and technology's development. And since enterprises significantly push forward economic progress and technology advance, they have become an important session in innovation system. Shanghai, being an enterprise-intensive area, must vigorously advance technology development so as to maintain its overall high development level. Former studies of technology policies were usually focused on formulation and assessment while the implementation analysis was overlooked. This thesis, adopting the method of content analysis that quantifies qualitative information and grounded theory, studied questionnaires from 315 enterprises and analyzed the implementation of Shanghai technology policies from the perspective of enterprises, thus providing references for technology innovation policy making and deciding in Shanghai and other areas.

RESEARCH METHODS AND DATA SOURCES

Research methods: Content analysis, a research method that describes qualitative information in a systematic, objective and quantitative way, is suitable for quantitative study on valuable documents worthy of recording and reserving. It is known for normative analysis.

Grounded theory, proposed by Glaser and Strauss (1967), is regarded as a scientific method in qualitative research (Zhang and Ma, 2009). The research starts directly from the actual observation with no theoretical assumption but research questions and ends up with concepts and categories summing up from the source materials which will rise to the theory. Grounded theory is generally utilized as a tool to establish substantive theories from bottom to top (Suddaby, 2006).

Grounded upon content analysis and grounded theory, this paper studied the survey materials and then made some analysis as follows: (1) With content analysis applied, building analyzing categories for content analysis on data collection and analysis of questionnaires that met the inclusion criteria; (2) With analytical standards as the unit of analysis, discussing the policy implementation of

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science and technology; (3) On the basis of grounded theory, encoding the analytical standards in three levels, namely open coding, axial coding and selective coding (Benz *et al*., 2007; Vedung, 1997).

Data sources: All the data of this research came from the survey to technology policies' implementation of large, medium and small-sized enterprises conducted by the Shanghai Development and Reform Commission in 2010. It owned strong objectivity and authenticity.

Research process

Policy implementation analysis of science and technology

Content sampling and fundamental state of samples: Sample selection criteria in this thesis demanded compliance with research purposes, huge content of information, continuity and consistency in contents (Ma, 2000). Employing these criteria above, we eliminated the unqualified samples from the investigation to large, medium and small-sized companies carried out in 2010 by the Shanghai Development and Reform Commission and ultimately obtained 315 pieces of questionnaires that satisfied the demands. The samples consisted of survey findings on all the districts and counties of Shanghai and all the business of various sizes and types, covering a wide range of policies. Consequently, the samples that had been chosen could be very representative.

Defining of analyzing units and categories: The core issue of content analysis meant establishing the analytical framework, whose primary task was to determine the analyzing units and build the analyzing categories. On one hand, the analyzing unit referred to the minimum and the most basic element when describing and explaining the research object in content analysis. For instance, every single questionnaire of technology policies' implementation was defined in this paper as an analyzing unit. On the other hand, building analyzing categories was saying to find out which category that analyzing unit belonged to. In order to study the policy implementation of science and technology, the analyzing categories drawn up in this regard were shown in Table 1.

Course of evaluating and judging on implementation analysis units: To make reasonable judgment on each implementation analyzing unit, a binary-state data was utilized, taking digit 1 as yes or belonging to and digit 2 as no or not belonging to. Specifically in this research to analyze policy implementation on science and technology, "1" referred to companies enjoying the certain policy while "0" referred to firms failing to share the certain policy. The above encoding rules thus decreased the probability that ambiguity might emerge when the same message was interpreted by different researchers. Moreover, the rules enabled the research process repeatable. Parts of the judging processes were listed as follows in Table 2.

Reliability analysis of judgments on implementation analyzing units and categories: There existed necessity to check the confidence level of judging results conducted by the master referee which in other words was

Table 1: Implementation analysis categories for Shanghai scientific and technological policies

Direct support	R and D Expenses' Weighted Deduction Policy for Enterprises
	Innovation Fund
	Patents Application Fund
	Support for S&T Project Setting
	Support for Companies Being Public Listed
Indirect support	Support for Companies Building Engineering Technology Center
	Intellectual Property Rights Protection
	Tax Privilege for High-tech Companies
	Government Procurement of Independent Innovation Products
	Personnel Training
	High Technology Industrialization Policy
	Loans Guarantee for Companies' Technical Innovation
	Patents Information Service

Table 2: Judging process on implementation analysis units (excerpt)

	Shanghai TSRC Industrial Co., Ltd.	Shanghai Making Biological Project Co., Ltd.	Shanghai Meteorolo-gical Instrument Factory Co., Ltd.	Shanghai Hongyun Environmental Protection Equipment Co., Ltd.	Shanghai Zhicheng Telecommu-nication Material Co., Ltd.
R and D expenses' weighted deduction policy for enterprises	0	0	0	1	0
Innovation fund	1	0	0	0	0
Patents application fund	0	0	0	0	0
Support for S and T project setting	0	1	1	0	1
Support for companies being public listed	0	0	0	0	0
Support for companies building engineering technology center	0	0	1	0	0
Intellectual property rights protection	1	0	0	0	0
Tax privilege for high-tech companies	1	0	0	1	0
Government procurement of independent innovation products	1	1	0	0	0
Personnel training	0	1	1	0	1
High technology industrialization policy	0	0	0	1	0
Loans guarantee for companies' technical innovation	0	0	0	0	0
Patents information service	0	0	0	0	0

Table 3: Reliability judgments between referees

Criteria for analysis	Sample 1	Sample 2	Sample 89	Sample 90
R and D expenses' weighted deduction policy for enterprises	1	1	1	1
Innovation fund	1	1	1	1
Patents application fund	1	1	1	0
Support for S and T project setting	1	1	1	1
Support for companies being public listed	1	1	1	1
Support for companies building engineering technology center	1	1	1	1
Intellectual property rights protection	1	1	1	0
Tax privilege for high-tech companies	1	0	1	0
Government procurement of independent innovation products	1	1	1	1
Personnel training	1	1	1	1
High technology industrialization policy	1	1	1	1
Loans guarantee for companies' technical innovation	1	1	1	1
Patents information service	1	0	0	1
Sample reliability	100%	91.7%	92.3%	87.0%

called reliability analysis, namely analyzing the consistency of judgments on the same categories by two or more researchers involved in the content analysis. As to the credibility degree of content analysis, it would ordinarily develop positively along with this consistency mentioned above which meant to say that higher consistency, higher reliability of content analysis and vice versa. Theoretically, the reliability in content analysis could be represented by the following formula expression:

$$R = \frac{n \times k}{1 + (n\text{-}1) \times k}$$

where, R stood for the reliability, K indicated average mutual consensus (referring to the extent of reciprocal agreement between the n judges). Focusing on the evaluation of K, that measure in the method of content analysis was given by:

$$K = \frac{2M}{N_1 + N_2}$$

Note that the variable M represented the number of categories on which both judges had completely identical ideas and that, were respectively the numbers of sections analyzed by the first and second of these two judges. The judge particularly designated for comparative analysis in this study selected 90 qualified samples randomly from the 315 questionnaires (accounting for 28.6% of the total amount of samples) and then completed testing the research results from the main referee. To quantify the reliability analyzing process, as shown in Table 3, rate the degree of consistency a value of 1 if and only if the two judges share the same points of view, otherwise 0 when their judgments differed.

Sample 2 was described below as an example to illustrate the detailed process of calculation, where n = 2, M = 11, N_1 = 13, N_2 = 13, then the reliability of Sample 2 computed in equation sequences:

$$K = \frac{2M}{N_1 + N_2} = \frac{2 \times 11}{13 + 13} = \frac{11}{13}$$

$$R = \frac{n \times k}{1 + (n\text{-}1) \times k} = \frac{2 \times 11}{1 + (2\text{-}1) \times 11} = 91.7\%$$

The calculation tells us that mutual consensus extent of Sample 2 by the two judges was 91.7%. Consequently, the total reliability of all samples' judgments in this research could be expressed as the weighted sum of each sample's reliability, i.e., which outnumbered the basic standard of 80%, meaning the judging conclusions made by the chief judge was acceptable.

Data analysis: Since the content analysis employed, data analysis turned out to be allocating the analyzing units into cataloging system, followed up with measuring the times and frequencies that two-valued data 1 appeared in analyzing categories. In accordance with the results of statistical analysis, Shanghai policy implementation of S and T innovations had achieved a comparatively high rate on the whole; besides, different types of scientific and technological policies varied in their courses of implementation just as displayed in Fig. 1. For instance, the implementation rate of high-tech industrialization policy was relatively high, reaching more than 50% while the support implementation for companies being public listed rated less than 8%. Therefore, a gap between these two kinds of policies' implementation was pronounced.

ENCODING BASED ON GROUNDED THEORY

Encoding the analytical standards stated above in three levels on the basis of grounded theory finally contributed to three crucial categories, namely platform policy support (comprising of R and D expenses' weighted deduction policy for enterprises, assistance in S and T project setting, support for companies being public listed, support for companies building engineering

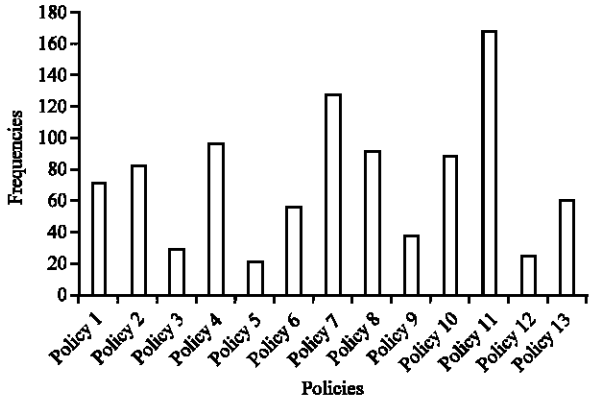

Fig. 1: Frequency distribution of Shanghai scientific and technological policy implementation, Policy 1: R and D Expenses' weighted deduction policy for enterprises, Policy 2: Innovation fund, Policy 3: Patents application fund, Policy 4: Support for S and T project setting, Policy 5: Support for companies being public listed, Policy 6: Support for companies building engineering technology center, Policy 7: Intellectual property rights protection, Policy 8: Tax privilege for high-tech companies, Policy 9: Government procurement of independent innovation products, Policy 10: personnel training, Policy 11: High technology industrialization policy, Policy 12: Loans guarantee for companies' technical innovation, Policy 13: Patents information service

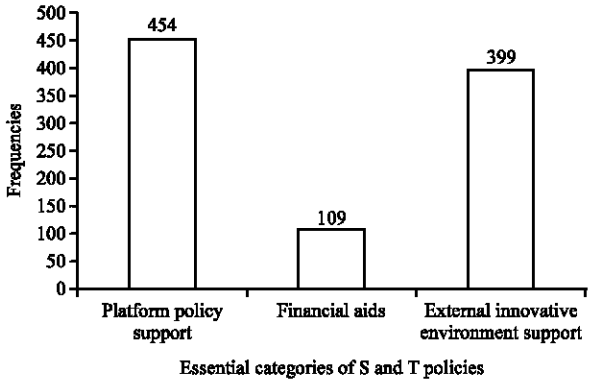

Fig. 2: Frequency distribution of essential categories: platform policy support, financial aids, external innovative environment support

technology center, government procurement of independent innovation products and high technology industrialization policy), financial aids (having innovation fund and loans guarantee for companies' technical innovation included), external innovative environment support (containing patents application grant, intellectual property rights protection, tax privilege for high-tech companies, personnel training and patents information service). The encoding process was omitted while Fig. 2 revealed the details of encoding outcomes.

Figure 2 indicated that technical policies of platform policy support and external innovative climate support were put into effect in a relatively high level which quite corresponded to the policy direction of Shanghai as well as the nation. To improve science and technology development, on the one hand, it demanded to lay a solid foundation and keep enhancing capital investment in science and technology to generate a diversified investment system; on the other hand, more emphasis should be laid on strengthening the construction and development of the platform of policy and external environment for innovation, especially a policy support system and service system ranging over personnel, information, property rights, market development etc. required to be established by the government. When it came to Shanghai, the success probability of accomplishments converting service supplied from the government throughout the whole course had approached 70% which exactly uncovered enterprises' urgent needs for servicing policies such as platform policies, external innovative environment and so on.

CONCLUSION

To sum up, the government-related policies of science and technology in this survey enjoyed a superior implementation rate in enterprises. Instead of focusing on policy making and evaluation afterwards, this study paid more attention to the process of policy implementation to the enterprises, in which way more direct understanding of the policy implementation was produced, facilitating problem discoveries in the middle of policy implementation. All these made it quite clear for the policy makers and relevant departments to realize the expectation of enterprises and fitness of policies, rather than concentrate only on policy formulation and evaluation which could result in these above two links running out of line and thus probably losing the target in policy formulation, execution, implementation etc. (Lei, 2011). In the light of content analysis, this study collected and analyzed the data supplied from questionnaires that satisfied the inclusion criteria and then structured the analyzing categories for content analysis so that the implementation analysis on scientific and technological policies could be done (Lu *et al*., 2006). Finally, through developing a three-dimensional network combined with

the use of grounded theory around core categories, the primary and secondary categories as well as all the catalogs and concepts, this thesis completed triple decoding and came into several conclusions as follows (Li, 2007; Ren *et al*., 2005; Norman, 2009).

Generally high level of S and T policy implementation with priority on platform policy and external innovative climate: Due to its own weakness of R and D capabilities in the innovation process, enterprises seemed trapped in technical achievement digestion. To deal with this problem, the nation had adopted a variety of measures to help enterprises improve their innovation abilities of science and technology and absorption of advanced research accomplishments, encouraging enterprises to carry out technological upgrading and transformation. Consequently, policy implementation stage grew into a significant point in the chain of scientific and technological innovation conducted by enterprises. Shanghai, where the technology was more developed, kept its scientific and technological activity level standing out from other regions all over the country, enjoying more amounts, higher qualities and broader ranges of technical policies. In consideration of these factors, it was widely recognized that policy implementation of science and technology for Shanghai was of great necessity and importance.

As shown in Fig. 1 and 2, policy implementation of science and technology in Shanghai reached a relatively high level in the whole. Especially, the platform policy support (e.g., high-tech industrialization policy, scientific and technological project setting assistance, etc.) and external innovative environment support (e.g., personnel training, intellectual property rights protection, etc.) achieved more amounts and higher levels of implementation. To be specific, the implementing rate of high technology industrialization policy and intellectual property rights protection each accounted for 53.3 and 41%. From these we got to know that in Shanghai the distribution of scientific and technological policies distinguished clearly what is primary from what is secondary, hence bearing obvious effectiveness.

More target-oriented policy making with efficacious communication between government and enterprises: Different kinds of scientific and technological policies in Shanghai had been accepted and implemented by enterprises, however, the amounts of policies accepted varied from policy to policy. It suggested that policy formulation and implementation process conducted by government involved a wide scope and a definite focus. Under the guidance of national policy, the Shanghai Municipal Government actively communicated with the enterprise in order to better meet the requirements of enterprises. Also, the direction of technical policy making turned to servicing policies such as platform policy, external innovative environment support etc., from relying mainly on technical funds and financial investment before. Several concrete measures had been taken to fulfill this transformation. First, Shanghai further strengthened the intellectual property construction by improving patent application and retrieval services, reducing patent application costs and reinforcing patent industrialization assistance. In addition, the rise in government working efficiency, expansion of public service platform of science and technology innovation, increase in publicity and promotion intensity and renovation of organization system worked together to enhance the construction of external environment for innovation, finally maintaining favorable social innovative culture.

As seen from the survey findings, the technical policy system dominated by platform policy and external innovative environment support won overwhelming approval and brought about a high level of policy implementation. Enterprises showed surging faith in its critical and active role in pushing scientific and technological innovation forward which claimed that policy direction was basically correct and worthy of further consolidation, strengthening and deepening.

Enterprises' stronger demand for indirect support and service-oriented policies from government: According to comprehensive analysis of business needs, enterprises demonstrated a stronger demand for service-oriented policies such as intellectual property protection and high-tech industrialization policy. They exerted expectations on the government for enhancing the public service platform construction of industrial innovation and indirect servicing policy introduction including patents assistance and technical personnel training. And through the introduction of service-oriented policies, government managed to play its coordinating role to the full, thus realizing government function transformation from "capital support" to "effort support". For example, only if the company had its own intellectual property, market share would be expanded. Then enough market shares could ensure more economic benefits, after that larger sums of money could be withdrawn from the benefits to fund for scientific and technological innovation, further enlarging their intellectual property. All of this process ended up with a virtuous circle as displayed in Fig. 3.

All in all, the scientific and technological policies of Shanghai that covered a wide range, owned evident characteristics and could be very practical were

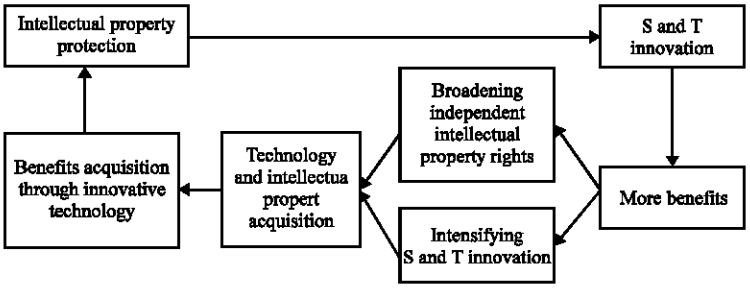

Fig. 3: Virtuous circle of enterprises' independent intellectual property rights

implemented in a generally high level. They even developed into a vigorous force to support technical activities. The policy implementation analysis of science and technology in this thesis provided references for technical policy formulation and implementation in Shanghai. First, scientific and technological financial investment should be continually increased; meanwhile the support direction of fiscal policy and tax policy required optimizing. Also, it should be essential to create a favorable external environment for innovation and train qualified personnel. In the end, strong support for serials of platform policies such as high tech industrialization policy and effective promotion of scientific and technological achievements conversion efficiency satisfied the service demands of enterprises and they definitely deserved more attention.

REFERENCES

Benz, A., S. Kuhlmann and D. Sadowski, 2007. Governance: A political science perspective. New Forms Governance Res. Organizat., 2007: 3-29.

Glaser, B.G. and A.L. Strauss, 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Transaction Publishers, Chicago, IL., USA., ISBN-13: 9780202302607, Pages: 271.

Lei, J., 2011. Estimate on the Policy of Economy and Science-Technology: Methods and Case. Tsinghua University Press, Beijing, ISBN: 9787302242413.

Li, Z., 2007. Grounded theory analysis of scientific research. East Forum. J., 4: 90-94.

Lu, X., C. Wu and H. Donehoe, 2006. Conceptualizing ecotourism from a distinct criteria approach by using content analysis. Acta Ecol. Sinica J., 4: 134-146.

Ma, W., 2000. Application of content analysis method in the social and scientific information science. Inform. Sci. J., 4: 346-349.

Norman, W.G., 2009. A Grounded Theory of Software Process Model Adoption. VDM Verlag, Germany, ISBN-13 :9783639134247.

Ren, Z., H. Zhu, T. Guan and F. Hu, 2005. The temporary organizational model based on grounded theory. Yinshan Acad. J., 5: 106-109.

Suddaby, R., 2006. What grounded theory is not. Acad. Manage. J., 49: 633-642.

Vedung, E.O., 1997. Public Policy and Program Ealuation. New Brunswick University, Transaction Publishers, USA., NJ., ISBN: 0-7658-0258-9.

Zhang, J. and D. Ma, 2009. Grounded theory method and alpha management study. Modern Manage. Sci. J., 5: 115-117.