Large-scale Scientific Instruments Opening and Sharing Mechanism

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ABSTRACT

This thesis has shaped ideas to research the importance of resource sharing in the technological support supply-side structural reform and propose solutions of releasing scientific research personnel’s enthusiasm, implementing innovation voucher mechanism and balancing the “facing enterprises and the actual demand” input model to deal with inadequate participation of universities and research institutes in our province and low virtual technology monetary effect of innovation voucher and so on, based on the large-scale scientific instruments opening and sharing in Shandong Province and guided by the technological support supply-side structural reform and the technological system mechanism reform.

INTRODUCTION

Since 2005, China has stressed technological resources integration, speeding up opening and sharing management model and support system and so on in many documents on research infrastructure construction, technological advance, deepening organizational reform and national medium & long term technological development program and so on. Especially in recent years, technological resources sharing represented by large-scale scientific instruments sharing has become a key part of technological support supply-side structural reform—efficient technological supply concerns technological input and its market-oriented allocation and so on and therefore attracts attention all over the country.

Despite Shandong Province has played a positive role in providing technology sources and reducing innovation cost for enterprise technological innovation by issuing “innovation voucher” to promote large-scale scientific instruments opening and sharing throughout the province since 2014 after many years’ exploration and practice as an active respond to the national policy, yet the problems of inadequate participation of universities and research institutes and low virtual technological monetary effect of innovation voucher are still not resolved.

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Main Operation Models of Large-scale Scientific Instruments in China

Mechanism construction is a key section in large-scale scientific instruments sharing\textsuperscript{[2]}. Domestic scholars have proposed many sharing models based on industry and sharing peculiarities. On one hand, they emphasize resource opening of instruments holders; On the other hand, they propose to turn to intermediary agencies. Wang Yi and some other scholars have concluded 4 scientific instruments sharing models: university resources opening, industrial resources gathering, incubation and resource integration by intermediary agencies\textsuperscript{[3]}. This thesis proposes four large-scale scientific instruments operation models in view of institutional system.

The first model is “Policies Integration” of large-scale scientific instruments policy and innovation voucher policy. It has extended large-scale scientific instruments sharing service by covering various technological resources and services in the scope of subsidies and is represented by the Capital Technological Support Platform in Beijing and technological innovation vouchers in Shanghai. From 2009 to 2015, the Capital Technological Support Platform had accumulatedly promoted opening and sharing of over 38,000 sets instruments and equipment valued 19.2 billion yuan in 676 key laboratories and engineering centers of national level and Beijing municipal level in the capital region and this promoted transfer and transformation of 559 natural scientific research achievements.

The second model is “Policies Concurrence” by promoting the large-scale scientific instruments sharing service and implementing the innovation voucher policy in Shandong and Jiangsu and so on. Jiangsu Province has propelled “outer intelligence”, “outside brainpower” and other technological resources to gather in all regions. The “outside brainpower” serves local enterprises in innovation by purchasing technological service.

The third model is an in-between model exploring to transform into “Policies Integration”----

“Policies Progressive” model based on large-scale scientific instruments sharing. And it is typical in Shandong Province.

The fourth model is a “single-track model” merely implementing large-scale scientific instruments sharing. The above polices in different areas are summarized as follows:
| Policy; Platform | Subsidies for Customer Units | Whether Requiring to be Technological Business | Support Range |
|-----------------|-----------------------------|-----------------------------------------------|----------------|
| Capital Technological Support Platform | Micro and small enterprises and entrepreneurial teams in the city | No | Test and detection, cooperative research and development, commissioned development, research and development design, technical solutions or purchasing new technology, products (services) and other scientific research activities |
| Shanghai Technological Innovation Voucher Policy | Micro, small and medium enterprises in the city and entrepreneurial teams in the municipal technological incubation entrepreneurship park | No | Test and detection, cooperative research and development, commissioned development, research and development design, technical solutions and so on |
| Guangdong Large-scale Scientific Instruments Opening and Sharing Policy | Micro, small and medium technological enterprises in the province | Yes | Carry out research and innovation activities of developing and improving new technologies and products with large-scale scientific instruments in the provincial network. |
| Guangdong Innovation Voucher Post-subsidy Policy | Micro, small and medium technological enterprises in the province | Yes | Support enterprises to purchase technological achievements or technological innovation service from universities, research institutes and technological service institutions and to purchase research and development equipment for establishing R&D departments. |
| Jiangsu Large-scale Scientific Opening and Sharing Policy | Incubations of or above provincial level or medium and small technological enterprises registered in the park | Yes | Test and detection fees in innovating new technologies, new products and new crafts and other scientific and technological innovation activities |
| Jiangsu Innovation Voucher Policy | Enterprises in northern Jiangsu | Specific policy implementations are subject to the local. | |

Table 1. Summary Table of Policies in Different Areas.
Policy Orientation and Development Strategy

In essence, large-scale scientific instruments opening and sharing in China is to resolve technological input problems in technological support supply-side structural adjustment, in which the government releases some technological researches financial input and “financial production means” (technological research equipment and facilities) and conduct them to tilt to medium and small enterprises; The innovation voucher system aims at expanding the effects of the said policy and resolving the mis-allocation in supply and demand in technological support supply-side structural adjustment by expanding the scientific equipment supply to technological resources and services supply. They play an important role in promoting technological innovation in China together in a progressive relation as showed in the following form.

Form 2. Process Schematic of Large-scale Scientific Instruments and Equipment Opening & Sharing and Innovation Voucher System in Technological Support Supply-side Structural Reform.
AN INTRODUCTION TO LARGE-SCALE SCIENTIFIC INSTRUMENTS
OPENING AND SHARING IN SHANDONG

Currently, large-scale scientific instruments opening and sharing in Shandong has experienced four stages in general.

Policy-based Technological Input Stage (2006-2012)

In 2006, the Important Document Regarding Large-scale Scientific Instruments Opening and Sharing in Shandong Province by General Office of People’s Government of Shandong Province took the first step in large-scale scientific instruments opening and sharing in Shandong. By the end of 2012, the large-scale scientific instruments cooperation network of Shandong Province had integrated 4,117 sets instruments, which originally valued 3.461 billion yuan including 2,586 sets instruments originally valued over 300,000 yuan each and 1034 sets large-scale precision instruments and equipment.

Transition from Policy-based Input to Market-oriented Allocation Stage (2013-2014)

In 2014, Shandong Province first proposed to make subsidies for technological micro and small enterprises as large-scale scientific instruments and equipment using fees by implementing innovation voucher, making it transform to the market-oriented technological input stage from the passive policy-based technological input stage. By the end of 2014, large-scale instruments and equipment in the network had increased by 56%, to over 7,800 sets from 5,000 sets before the policy and the instrument value was over 7.1 billion yuan, over 2,200 universities, research institutes and enterprises including 585 micro and small enterprises were involved in the network.

In this stage, the policy guidance was implicit, the “government-free” reform intention was clear and the efficiency in short period was significant. However, the innovation voucher policy was limited to micro and small enterprises in national high-tech zones, that is to say it was only a small-scale trial.

Stage of Expanding Market-oriented Free Allocation (2015-2016)

In June 2015, the Science and Technology Department of Shandong Province expanded the policy range, improved and perfected the policies by expanding innovation voucher subsidy scope, raising subsidy standards, reforming capital subsidy approaches and adding post-subsidies and rewards. By December 2015, large-scale scientific instruments and equipment originally valued 7.2 billion yuan and 3,338 micro and small enterprises had entered the network, innovation vouchers had been used for 10,838 times through platform appointment and the online registered innovation voucher subsidies had been over 34,700 thousand yuan.

Stage of “Integrating” Technological Resources (Years ahead)

In July 26, 2016, the Important Document Regarding Deepening Technological System Reform and Accelerating Innovation Reform by the CPC Shandong Provincial Committee and People’s Government of Shandong Province was passed in the Fourteenth Plenary Meeting of the Tenth CPC Shandong Provincial Committee. It required enhance effectiveness of “innovation voucher” and expand the provincial technological “innovation voucher” subsidy scope to fees rising from technological micro, small and medium enterprises in receiving technological services. The “innovation voucher” in trials applies negative list system.
The document has pointed out direction for technological resources opening and sharing in Shandong Province for years ahead.

EXISTING PROBLEMS IN LARGE-SCALE SCIENTIFIC INSTRUMENTS OPENING AND SHARING IN SHANDONG PROVINCE

“Post-subsidy” Resulting in the Innovation Voucher Lost Credit Monetary Value

In order to promote micro and small enterprises to adopt large-scale scientific instruments in scientific researches and motivate service units, Shandong Province has designed a “Pre-appropriation and Post-clearing, Real-time Subsidies” incentive mechanism (“appropriations in advance—real-time subsidies—final clearing”) for equipment opening with innovative voucher. In theory, this kind of incentive mechanism scheme is novel, considering both flexiblity of “real-time” reducing research and development cost for micro, small and medium enterprises, and resolving the potential worries of service units. But in practice, the regulatory cost and credit risk assessment is found insufficient in policy designing, and the financial capital appropriations is not supported with strong regulatory and credit guarantee. Eventually, it resulted in innovation voucher had become a “record list” and lost its due value of virtual credit money.

Highlighted High Regulatory Cost and High Institutional Cost

To take Yantai municipal subsidies in 2015 for example, a total of 105 micro, small and medium enterprises got the subsidies, among them, some enterprises only got 68 yuan’s subsidies, 43 enterprises gained subsidies below 2,000 yuan and 88 enterprises received subsidies below10, 000 yuan. Thus it can be seen that for most micro, small and medium enterprises, the testing cost in scientific research is not high, but application materials for subsidies is quite heavy and complicated for sake of the safety of subsidies. The application materials for some micro and small enterprises need more than 4000 pages of A4 paper. It is clear that on one hand, a large amount of system cost is needed to ensure the safe use of financial funds and reduce the credit risk and regulatory costs; On the other hand, the micro, small and medium enterprises management cost for application materials of the subsidies is very high, increasing their management costs.

Imperfect Large-scale Scientific Instruments Opening and Sharing System and Mechanism for Universities and Research Institutions

For colleges and universities, large-scale instruments and equipment are essential foundations for teaching and scientific researches and safeguards to cultivate innovative talents and produce good research achievements \(^{[4]}\). Compared with enterprises, equipment owned by colleges and universities are in low utilization rate, some equipment is used by only one faculty or even one scientific research team causing great resources waste. \(^{[5]}\). For example, 289 sets large-scale scientific instruments and equipment with 188 million yuan’s original value had been registered in the network by universities and research institutions in Yantai, as of August 2016. Despite of the large amount of instruments and equipment in the network, no university and scientific research institution in Yantai had conducted any outward shared service by August 2016.
| Region/Unit                                      | Instrument in the Network | Instrument Original Value (10 Thousand yuan) |
|------------------------------------------------|---------------------------|---------------------------------------------|
| Yantai University                              | 34                        | 1902                                        |
| Ludong University                               | 30                        | 2030                                        |
| Bingzhong Medical College                       | 7                         | 549                                         |
| China Agricultural University, Yantai Research Institute | 5                         | 221                                         |
| Shandong Traditional Chinese Medicine High Vocational College | 4                         | 82                                          |
| China Coastal Research Institute                | 31                        | 3222                                        |
| Shandong Provincial Sericulture Institute        | 1                         | 33                                          |
| Yantai Academy of Agricultural Science           | 7                         | 464                                         |
| Other Municipal Units                           | 170                       | 10311                                       |

Form 3. Instruments in the Network of Partial Universities and Research Institutes in Yantai by August 2016.

PROPOSALS TO LARGE-SCALE SCIENTIFIC INSTRUMENTS OPENING AND SHARING IN SHANDONG PROVINCE

Innovating Share Incentive Method, Reducing System Cost and Regulatory Cost by Introducing Market Supervisory Mechanism

Introducing professional service (advance payment) organization can firstly build a bridge between micro, small and medium-sized enterprises and laboratories to resolve difficult rent-seeking caused by lack of scientific research experience for small and medium-sized enterprises and accelerate professional scientific service organization development. Secondly, it can introduce market-oriented supervisory mechanism to reduce credit risks and regulatory cost. The related verification process shall be done by the professional service (advance payment) organization to ensure the safety of their funds so that the whole rent-seeking-service-payment course will be completed by market-oriented free allocation. Since small and medium-sized enterprises-professional service organization-laboratories are equal honesty and credit subjects, credit risks are greatly reduced. The government only needs to do pre-admission approval, later stage cashing verification and spot check. Thus the regulatory cost is effectively reduced.
Establishing Market-oriented Operation System, Releasing Universities and Research Institutions from “Small System” Restriction

To explore constructing regional integrated scientific research laboratories operated by professional organizations in market-oriented operation. To innovate the sharing management system in accordance with “the state implemented administrative assets management system providing that the administrative assets shall be uniformly owned by the state, supervised by government by classification and occupied by units”. To research and explore regional centralized management of partial large-scale scientific instruments and equipment that is strongly professional, for special purpose and with low utilization rate purchased by universities and research institutions. Based on actual situation of universities and research institutions, these instruments and equipment can be shared by classification[6]. To extend outward service by building up regional scientific research laboratories. All large-scale scientific instrument units can jointly establish a council and entrust specialized agencies to operate social service. This can make instruments and equipment purchased with the national finance jump out of the sectional “small system” and really become opening to the social “big system” through market-oriented operation.

Exploring to Establish a Reasonable Income Mechanism for Opening and Shared Knowledge Value of Scientific Researchers.

(1) To enhance the recognition that the source of innovation is “Human”. It is more of opening scientific research knowledge and experience of scientific researchers than instruments and equipment in large-scale scientific instruments and equipment opening and sharing. For micro, small and medium enterprises, favorable innovation environment does not mean supplying scientific research test and experimental data in low cost but means interpretation and innovation guidance of that data in scientific researches, “being less misguided means saving cost”.

(2) To be people-oriented and respect scientific researchers’ labor value. The first proposal is to make it implicit in administrative measures that the income shall be reserved by a certain percentage for experimental (etc.) scientific researchers’ performance incentives and regarded as a standard for service units’ integrated performance assessments; The second one is to establish experimental service personnel incentive subsidies in innovation voucher subsidies, to encourage scientific researchers, especially those enjoying financial supply to actively carry out production-learning-research cooperation, participate in social innovation activities, creating good scientific research service atmosphere with the entire society participation.

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