

Game Analysis of Government Incentives to Promote Technological Innovation

Xiaolin Ma, Yadong Wang, Yue Yin

Liaoning University of Science and Technology, Anshan City, Liaoning Province Qianshan
Road 185 114051

Abstract: Technological innovation is relying on innovation-related behavior of the main propulsion, The main city of technological innovation system include; Government, enterprises, research institutions, intermediaries, etc., Encourage active participation of relevant subjects and promote technological innovation cities, Urban is sound technological innovation system, the Key to promoting innovation and development of the city, In this paper, the use of modern game theory, Consider the same level, Governance objectives in different sectors of government agencies, Discussion led government and its relevant departments have chosen to actively promote technological innovation city behavioral strategies.

Keywords: technological innovation, game model, incentives

1. INTRODUCTION

Technological innovation capability reflect the core competitiveness of the country, Become the decisive factor in the development of national science and technology, Especially for the economies in transition during the regime of China, Building a national technology innovation system is particularly critical., nowadays, Government plays an important role in guiding the planning and service support throughout the innovation system., In an increasingly globalized society, Market "invisible hand" is leading efficiency of resource allocation, But it also should be noted at the same time , No universal market, And no universal enterprise, Only the Government is in gathering resources, Production factors, Rules and other related activities and technological innovation leader, The successful experience of the countries also show, The role of government behavior for national economic development and the technological innovation capability to play is very significant. Only attain the support of the government, relying on the effective organization of resources and elements, Dominant position of enterprises in technological innovation system can really play performance.

2. DEFINING THE FUNCTIONS OF THE GOVERNMENT IN A TECHNOLOGICAL INNOVATION SYSTEM

Government in promoting industrial technology innovation process has gone through the service-oriented government and government functions, Planned economy or market economy beginning, Government funding, management and other aspects involved in more direct,, When mature innovation system functioning government needs to change its functions Directly involved into indirect guidance, Reasonable play a leading role in the market. Overall, Government in the Technical Innovation System provides a variety of innovative supply elements for each subject, Such as policies, resources, personnel, funds etc, Strategic guidance, policies and regulations and service platform for the construction of the body. Specific mechanisms and functions as follows:

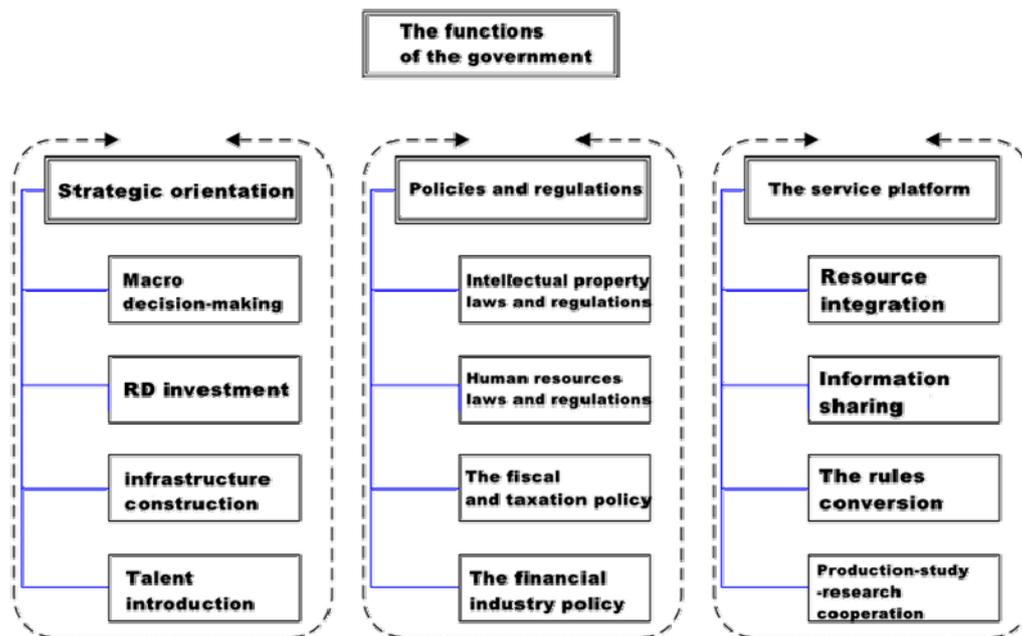


Figure 1.1 Function of Government in Technology Innovation System

As can be seen from Figure 1.1, Technological innovation system is a complex system engineering, Government should take macro-control, and improve the functioning of markets, to create an environment to provide service-oriented, Balanced, Prioritize, Capitalize on the trend, From the establishment of the strategic objectives of the boot, Operation mode selection, The construction of social service system and other aspects into account, Ensure the behavior of enterprises, government departments, universities and research institutions, social service agencies and other coordinated, Give full play to the role of government incentives and promoting.

3. BEHAVIORAL TARGETING ALL LEVELS OF GOVERNMENT BODY

Government plays an important role in urban technological innovation system, however, the government also has its own utility function. Meanwhile, the government is divided into different levels and departments, Different departments based on their governance objectives and cost-benefit analysis to select different behavioral strategies in urban technological innovation system.

Under the new system of economic point of view, State and Government Governance has a double objective, that society to maximize output and government maximize their own interests. Under the jurisdiction of the municipal government and the executive branch is also true.

3.1 The basic goal of the municipal government

City of technological innovation system is an important part of the national innovation system, Core is a powerful driver of economic development and competitiveness of the city. The basic goal of the municipal government building in urban technological innovation system process to be achieved is to improve the functioning of markets technological innovation, optimizing environment, provide related services and policy support, Promote enterprise, government departments, universities and research institutions, and social service agencies for collaborative innovation.

3.2 The basic goal of the Administration

In the technological innovation system, Relevant administrative departments under the jurisdiction of the multiple roles played by government, Perform different functions, As the city's technology innovation programs and to coordinate the macro-management authorities, On the one hand the relevant administrative departments to implement the national and provincial science and technology related to the development of policies and laws and regulations, The city put forward scientific and technological innovation strategy, The drafting of relevant local laws and regulations, It is the market regulator, on the other hand, It is a technology research and development, scientific and technological achievements of science and technology inputs and market participants and project funding budget and final accounts of the responsible authority. As a market regulator, Relevant administrative departments need to properly fulfill the "agent" role, As a representative of the public interest of the city do a good job of building a technology innovation system work, Its basic objective is to maximize the output of science and technology innovation ;As market participants, The purpose of this sectoral interests, The administration wants to improve the research and development of special funds, Reduced inputs, Thereby increasing the sources of income of the sector, To maximize their own interests.

With respect to the relevant administrative departments concerned, On the one hand, the city government by the central command and administrative guidance technology industry development plan, Hope in the region to enhance the scientific and technological innovation, Improve the technological innovation system, This is consistent with the basic functions of the administrative department, On the other hand, the city government also bear the consequences of dual identity-related conflicts of interest caused by the administration brought. Therefore, it is necessary to take the appropriate municipal government incentives or disincentives technological innovation in the region to maintain market order, actively promote technological innovation, and Rent seeking relevant administrative departments, Technological innovation system to provide a positive and healthy external environment.

4. GOVERNMENT DEPARTMENTS PUSHING TECHNOLOGICAL INNOVATION GAME HYPOTHESIS PREMISE RELATIONS

(1) Levels of government departments is the agency relationship (government and relevant administrative departments), both follow the "rational man" hypothesis, Seek to maximize their own interests, and the higher the effective implementation of policies depends on the result of government policy and the relevant administrative departments to select each other game,

(2) government regulation, there are two options Rigid control (G) - Government to strengthen control measures, Technological innovation relevant administrative departments conduct direct limited, To punish violations, severely, The regulatory effect directly linked to officials achievements, (Such as the appointment and dismissal of officials with the project or not violations linked), The quick measures, targets specific, And compliance risks department, But require higher regulatory costs, And may affect the sector stable relationship It is not conducive to long-term development; Flexible Control (R) - Local governments can adopt a flexible adjustment, Indirect policy is not directed against the relevant departments, Including financial subsidies, tax relief, etc., Lower administrative department major superior execution policy, Thus reducing the project with the relevant authorities take place directly between funds., But these policies effective slow, And the execution is not guaranteed.

Relevant administrative departments also has two strategies:, Actively implemented (J) - higher levels of government policy on decisive implementation; Passive execution (X) - partially implemented or not implemented, Including higher levels of government deception, Or pocketing and other rent-seeking behavior, Local government re-selection policy based on the implementation of the policy effects of subordinate departments, It includes a flexible or rigid regulatory controls.

(3) Participants Earnings: S represents local government revenue, S0 represents income related departments to actively perform, S1 indicates negative earnings executed (and $S1 < S0$), Z represents the cost of rent,(Relevant departments in the driver's own interests, That will be taken to the higher authorities to give up part of the city hall rental income, Cahoots to achieve

the purpose, Continue to maintain a negative charge rent execution situation), and $Z < S_1 - S_0$; C represents isolated oversight costs ;represent Regulatory intensity, Suppose punishment more severe, The greater the probability of isolated corresponding p bigger, p ($S_1 - S_0$) represent government penalties for relevant departments; ; ω represents the negative impact of the implementation of negative , ω represents the negative impact of the implementation of negative(Including welfare loss); r represents the probability that the relevant administrative departments to actively perform.

5. GOVERNMENT PUSHING TECHNOLOGICAL INNOVATION GAME MODEL CONSTRUCTION

(1) Municipal government to take control of flexible and rigid control, relevant administrative departments will get different benefits

Table 2.1 Municipal Government and relevant departments of the payoff matrix

	R	G
J	s_0, S	$S_0, S - C$
X	$S_1, S - \omega$	$S_1 - (1 - p)Z - p(S_1 - S_0)$ $S - C + (1 - p)Z + p(S_1 - S_0)$

Suppose the government to implement flexible management probability q , Probability rigid management policy is $1 - q$; Probability departments actively perform is r , the probability of a negative execution is $1 - r$; Government revenue is under flexible management:

$$E(R) = rS + (1 - r)(S - \omega)$$

Government income is under rigid control:

$$E(G) = r(S - C) + (1 - r)[S - C + (1 - p)Z + p(S_1 - S_0)]$$

According to the hybrid strategy game equivalent effectiveness principles

$$E(G) = E(R) \tag{1}$$

$$\therefore r = \frac{[-C + (1 - p)Z + p(S_1 - S_0)] + \omega}{[-C + (1 - p)Z + p(S_1 - S_0)] + \omega + C}$$

Revenue of local governments actively implemented as follows: $E(J) = qS_0 + (1 - q)S_0$

Negative earnings for the execution: $E(J) = qS_1 + (1-q)[S_1 - (1-p)Z - p(S_1 - S_0)]$

Accordinging equivalent method: $E(J) = E(X)$

$$\therefore q = \frac{[(1-p)Z + p(S_1 - S_0) - (S_1 - S_0)]}{[(1-p)Z + p(S_1 - S_0)]} \quad (2)$$

Social welfare is which under mixed strategy Nash Equilibrium:

$$Y = S_0 + S - \frac{\omega C}{[(1-p)Z + p(S_1 - S_0)] + \omega}$$

(2) If the Government of the relevant administrative departments to take incentives such as Reward Indicator, (The transformation rate or project completion rate), Department will receive additional benefits Q;

Table 2.2 Municipal Government and relevant departments of the payoff matrix

	R	G
J	$S_0 + Q, S - C$	$S_0, S - C$
X	$S, S - \omega$	$S_1 - (1-p)Z - p(S_1 - S_0)$ $S - C + (1-p)Z + p(S_1 - S_0)$

In this case the flexible regulation under government revenues as follows:
 $E(R) = r(S - Q) + (1-r)(S - \omega)$, Of constant returns, Use no difference principle, Get new equilibrium

$$\therefore r' = \frac{[-C + (1-p)Z + p(S_1 - S_0)] + \omega}{[-C + (1-p)Z + p(S_1 - S_0)] + \omega + C - Q} \quad (3)$$

Administrative departments actively perform earnings; $E(J) = q(S_0 - Q) + (1-q)S_0$

Accordinging equivalent method: $E(J) = E(X)$

$$\therefore q' = 1 - \frac{(S_1 - S_0)}{[(1-p)Z + p(S_1 - S_0)] - Q} \quad (4)$$

After the increase in incentives, social welfare becomes:

$$Y' = S_0 + q'Q + S - \frac{(\omega - Q)(C - Q)}{[(1-p)Z + p(S_1 - S_0)] + \omega - Q} > Y$$

After increasing the incentives that can make social welfare increases.

6. GAME MODEL ANALYSIS

According to ① seen, Ceteris paribus case, As p increases r increases, Description of government regulation measures more stringent, The relevant administrative departments malicious implementation of government policy, In the game between the Government and subordinate executive branch, When the municipal government to implement a flexible policy, Higher levels of government the executive branch no policy constraints, And it can be obtained from passive to active implementation execution obtain greater benefits, In the use of funds, for example, The administrative department of Science and Technology project approval or specify multiple channels to increase investment in science and technology policy, Or the right to approve the use of funds will make it as rational economic man in order to maximize their own interests as the starting point, And the tendency by sectoral interests, Pocketed, Inevitably produce only the immediate, local interests at the expense of considerable interest, So that is not conducive to the healthy development of science and technology innovation, The municipal government and relevant administrative departments in the technological innovation system in relation substituting dilemma game situation. The government alone will be difficult to monitor and control the flexible suppress subordinate departments to pursue their own interests, at this time chose lower administrative department is negative execution. But the central or regional economic development planning and local municipalities will command a lot of political pressure, City Hall had to rigid controls to curb violations subordinate departments, Regulation would strengthen the relevant administrative departments under pressure to perform positive political decision-making, But tough regulation will make the punishment dealt with higher costs, Bringing the total social welfare losses.

According to the formula ②, Effectiveness depends largely on the degree of government regulation with lower administrative departments, Government decision-making depends on the size J , S and $(s_i - s_o)$, Z values reflect the cost of rent-seeking and rent-seeking motives sector size, It reflects the existing institutional vulnerabilities, Including science and technology innovation fund management, oversight mechanisms are inadequate, Performance evaluation mechanism unscientific. In addition, Since the Duration is longer, which some technological innovation projects, Often longer than the term of office of officials, Therefore, the relevant administrative departments short-sighted management of the project will also lead to alienation conduct its internal staff, Size reflects its input-output in scientific and technological innovation.

According to the formula ③④ available, In the new equilibrium increase incentives under, $r' > r$, Description incentives will increase subordinate executive branch of the government's implementation of enthusiasm, And the greater the incentive Q , Probability greater sectoral implementation of government policy, Also more motivated to implement government policies, At the same time a corresponding increase in social welfare.

Therefore, Through the above analysis shows that the results of the game, Municipal government to take appropriate incentives for technological innovation related to the executive

branch, As indicators rewarded were according to the results of the completion of the conversion rate, Can effectively promote the lower sector in order to promote technological innovation and actively planning the implementation of the higher command, Provide a favorable external environment for technology innovation system, make good government guidance and support service roles.

ACKNOWLEDGEMENTS

Liaoning province social science planning projects; Path of science and technology innovation-driven strategic implementation Liaoning. (L15AJL001)2015 Anshan philosophy and social sciences key projects. Construction of its operational mechanism in Anshan Municipal Science and Technology Innovation System; (as20152009); Liaoning University of Science and Youth Fund project; Large enterprise data resources to realize the value of quantitative research; (2014QN22)

REFERENCES

- [1] Li Zhi Local Government Policy Implementation Measures to promote scientific and technological innovation [J] Scientific and Technological Achievement, 2010, (6): 12-16
- [2] Liang Yu Heilongjiang Province Technology Innovation System [D] Heilongjiang: Harbin Engineering University, 2012
- [3] Luo Yi, Wang Guohua "open government" Revelation Theory and Practice of China - Based on Cooperative Governance social innovation research perspective [J] Jiangnan academic, 2016, (3): 21-26
- [4] Mikel Buesa, Joost Heijs, Thomas Baumert. The determinants of regional innovation in Europe: A combined factorial and regression knowledge production function approach[J]. Research Policy. 2010 (6)
- [5] Xulia González, Consuelo Pazó. Do public subsidies stimulate private R&D spending?[J]. Research Policy. 2007 (3)
- [6] Kun Chen. Universities/Research Institutes and Regional Innovation Systems: The Cases of Beijing and Shenzhen[J]. World Development. 2007 (6)