Public Policy and Administration Research
ISSN 2224-5731(Paper) ISSN 2225-0972(Online)
Vol.7, No.4, 2017

The Impacts Of Regulatory Regimes And Science & Technology Policy On Innovation Performance：Based On China's National Hi-Tech Industry Development Zone

Xin WANG (Corresponding author)
School of pubilc affairs, University of Science and Technology of China,Hefei China
Tel.:086+15055171862 E-mail:wang1990@mail.ustc.edu.cn

Xiang-ze XIAO
Zhejiang Economic Information Center, Hangzhou China
Tel:086+15855131245 E-mail: xxze@mail.ustc.edu.cn

Nan ZHOU
School of Law and Politics, Tianjin University of Science & Technology, Tianjin China
Tel:086+13524019823 E-mail: nzhou@tust.edu.cn

Abstract
Along with the internal environment of China's National Hi-tech industry Development Zone becoming more complicated, it's difficult to show the advantages of their original resources. And internal institutional environment has gradually become more importance on innovation performance. Based on the existing studies, this paper tries to do a regression analysis of Hi-tech zone's regulatory regimes, policy, and innovation performance, aiming to find out the key institutional factors which influenced the High-tech zone's innovation performance.

The results showed that: (1) the more Municipal administrative privileges Hi-tech zone has, the better its performance will be. (2) The national level policy has a significant positive correlation with innovation performance; but the policy from provincial and municipal governments has a significant negative correlation. (3) The nature of management agency has negative regulation in the relationship between the power of provincial and municipal policies and the innovation performance. This research tries to provide a new revelation for the hi-tech zones, which will help them get more scientific management operations and development policy.

Keywords : National Hi-tech Industry Development Zone, regulatory Regimes, Science & Technology policy, innovation Performance

1. Introduction

Innovation ability is the core driving force of a country or a region in the global competition. Since the birth of Silicon Valley Science Park in the 1950s, most countries have been setting up similar parks to improve their innovation ability. Science park is defined as an area must include three components: a real estate, an organizational program of activities for technology transfer and a partnership between academic institutions, government and the privatesector, which is seen as a generic term includes science park, technology park, research park, business park, industrial park, etc (Link and John, 2003). Although the its name have a slight gap in different countries and regions, but their connotations are similar as is mentioned above. These science parks have been proved to enhance enterprise's innovation ability, cultivate entrepreneurial talent, impove high-tech industry development and regional economic growth (Martínez-Cañas et al., 2011; Sadeghi and Sadabadi, 2015; Zeng et al., 2010; Jongwanich et al., 2014). Especially in China and east Asian countries, the science park has brought them dramatic growth (Bustos, 2011, Guadalupe et al., 2012). So the new technology and its industriy become the focus of attention of all countries in recent years.

In order to realize the strategy of rejuvenating the country through science, technology and education, China began to build the National High-tech Industrial Development Zone ("NHIDZ" or "Hi-tech zone") since 1988 in some areas with better economic basis or talents, to focuse on high-tech and its industrialization (Bai et al., 2015). There are now more than 140 zones. At present, its R&D spending and new product revenue has respectively accounted for 39.7% and 32.8% of all the enterprises in nationwide, and it has more than 50% of R&D personnel and invention patent (MOST, 2016). After nearly 30 years development, the NHIDZ has become the core carrier

of regional development and industrial transformation and upgrading. However, the total economic volume of less than 26% zones accounts for more than 60% of all national high-tech zones (THTIDC, 2014), which explains there is a significant difference in development and innovation capability between high-tech zones.

What factors can influence the innovative ability of a region or a science park? The existing researches found that intellectual capital, human capital, structural capital and relational capital factors can play a positive role on innovation performance (González-Loureiro and Figueroa Dorrego, 2010; Zerenler et al., 2008; Dakhli and De, 2004); R&D expenditure can effectively enhance the productivity and value of enterprises, and promote the development of new enterprises (Wakelin, 2001; Kirchhoff et al., 2007). However, the the role of these fators depends on the absorptive capacity of the enterprise itself (Laursen and Salter, 2010; Lau and Lo, 2015). The better the absorptive capacity is, the innovation output with the same input factors will be more effective, which leads to the difference of the regional innovation output. In addition, scholars increasingly found out the effect of regional institutional environment factors on innovative performance: on the one hand is the hardware conditions, such as regional economic conditions (Bigliardi et al., 2006), ownership of regional enterprises and industrial structure(Li et al., 2014); on the other hand is the soft environment factor, such as regional U-I-R cooperation mechanism (Li et al., 2013; Stuart, 2000;), government service ability and the innovation policy and support funding (Capello, 2013). And because having influence on the the input factors and absorptive capacity of enterprises, the importance of institutional environment is more and more highlights (Rodríguez-Pose and Di Cataldo, 2014; Acemoglu et al., 2005).

Chinese scholars have also studied this topic of high-tech zones, and found that besides the resource endowment such as talent foundation, capital investment and technical level (Zhou and Zhao, 2014; Cheng and Chen, 2013), the difference of city's location, political level and geographical proximity also affects the development of the high-tech zones (Jiang and Xu, 2009). Due to the latter three factors are hard to or can not change in a short time, most of the high-tech zones improve their own development through increasing investment in innovation resources. But with the deepening of the development, the marginal efficiency of promotion of innovation ability directly by the productive innovation resources investment gradually reduces under the specific institutional framework (Jiang et al., 2014). Technological innovation has an urgent need to break the shackles of the existing institutional framework, so as to make institutional innovation become more important for Hi-tech zones. But the administrative boundary of a high-tech zone is ambiguous, which is not one-to-one correspondence with the administrative regions. Therefore, the study with the institutional of provincial and municipal can not reflect its internal institutional factors. That makes the reseach of internal institution of the NHIDZ be necessary and meaningful.

This paper takes the high-tech zones as the samples, and analyzes the internal institutional environment basing on its operation mechanism. The aim is trying to explore the the quantitative method to measure internal institutional factors of the NHIDZ and find out how and to what extent the internal institutional factors affect the innovation performance? This stduy also complements the reseach of institutional economics theory in microcosmic subjects, and provides lessons for the regional innovation system.

2. Conceptual framework and hypotheses

2.1. The operation mechanism and innovation performance of NHIDZ

The establishing of China's NHIDZ should be approved by the State Council. It is ofen in one city, containing a number of sub-parks such as university science parks, research parks, technology parks and so on, and under the centralized management of a administration committee authorized by the provincial or municipal people's government. In NHIDZ, the government is the major supplier of institutional innovation through getting and integrating policy, fund and service resources (Cheng and Guo, 2014). Therefore, the reseach on institutional environment of High-tech zone should be combined with its government management departments and their relations. The government management department of NHIDZ usually including the provincial government, county (district) government and the administration committee of it (Peng et al., 2008; Zhang and Li, 2013). In general, The provincial and municipal government only has the strategic leadership; while the county government departments play a role of management when the sub-parks located within the scope of them; and the administration committee is the direct manager bu always do not have all administration authority. So the operation of the NHIDZ must rely on its direct management agency to achieve the policy of innovation and industrial development through lobbying the higher level government departments and coordinate and integrate the government departments at the same level (Chen and Gou, 2014). Therefore, how does the administration committee get and integrate and how many policy resources can it obtain, are the two key institutional factors in the development of Hi-tech zones. Based on it, this paper will divide the internal institution environment of Hi-

tech zone into two dimensions to measure the key institutional factors mentioned above, that are regulatory regimes and policy power.

According to “The Interim Measures for Administration on National hi-tech industrial Development Zone”, the main function of the NHIDZ is effectively integrating general productive elements and the high technology and accelerate the industrialization of high-tech achievements by policy support, thereby enhancing the innovation capacity and economic development. Technical progress and economic growth are the two important targets of NHIDZ. Therefore combining the original intention of high-tech zones and existing research in academia (Cheng and Chen, 2013), this article regards innovation performance as the direct innovative results produced by innovative subjects in Hi-tech zone through a certain innovation investment and innovation activities.

2.2. Regulatory regimes and innovation performance

Regulatory regimes is a management system structure and composition, including the institution setting , division of authority and the realization of coordination control function, etc. (He, 2007). The new institutional economic thinks the productive resources including capital, talent and technology are not the only determinants in the economic growth. The regulatory regimes can have a great influence on the disposition of these productive resources, and the effective configuration of resources can make the use to achieve the optimal (Williamson, 2000). Therefore, whether the regulatory regimes is reasonable directly affects the organization's ability for the allocation of resources within the jurisdiction of the region's economic development. This ability of government department is manifested in terms of government behavior and governance capacity (Lv, 2011). Government’s support and governance capability were confirmed to promote technology innovation, although this force has different significant degrees in different stages and environment (Taylor et al., 2003; Koh, 2006; Aarsaether and Nyseth, 2007; Lazaric et al., 2011). And the government nature and structure can affect the way and results of the choice of policy instruments(Seaden and Manseau, 2001).

In the broad sense, the management agencies of high-tech zones include local governments at all levels. In a narrow sense, it refers only to the direct management agency of the zone. According to the different of management agency, the regulatory regimes of Hi-tech zones is divided into different modes, and the government-led mode is deemed to the mainstream of the NHIDZ. Nearly all NHIDZs in China have established a administration committee as the direct management agency. The functions of the administration committee are divided into the following three points: take policy resources from the central government and provincial and municipal government departments; constantly coordinate the relations with the government at the same level; coordinate the innovative subjects and innovation resources from all sub-parks. However, government agency can't issue binding orders to another agency at the same level under the existing political system in China (Li and Li, 2011). It is unfavourable for NHIDZ to achieve the the above three functions, when the administration committee has low political level and few functional authority. Therefore, the realization of the three important functions depends on the regulatory regimes, including the nature, administration authority and management structure. To sum up, put forward the following hypothesises:

Hypothesis 1: the NHIDZ regulatory regimes has a significant influence on innovation performance.

Hypothesis 1-1: the management agency with different nature will influence the innovation performance .

Hypothesis 1-2: the greater the administration authority of the management institutions is, the higher the innovation performance of the NHIDZ will be.

Hypothesis 1-3: different management structure of sub-parks significantly effects on the innovation performance.

2.3. Innovation policy and innovation performance

Innovation policy is an important means for government intervening in technological innovation activities (Lundvall and Borrás, 2005). It is defined as a part of industrial policy, which influences the scientific and technological progress and includes R.&D. Policy, S.&T. Policy and so on (Edquist, 1999). Due to the market failure and the nature of innovation, public policy intervention is proved essential for innovation. Atkeson and Burstein (2011) revealed the importance of tax policy elements to innovation activities; Meuleman and Maeseneire (2012) found that R&D subsidy policy had the most positive influence in the process of enterprise innovation; Andrew (2012) took a study of the role of technology policy in the aviation industry and found technology policies having a significant positive impact on performance improvement; Samara, Georgiadis and Bakouros (2012) analyzed the function of innovation policy in the national innovation system (NIS), and suggested that innovation policy can influence the efficiency of the behavior of innovation actors. But some scholars believe that, with the development of innovation, the traditional single government subsidy policy and tax policy have no significant impact or even a negative impact on innovation performance (Hong et al., 2016). It

will be a better effect if combine multiple policy instruments based on the content of iregional and innovative (Borrás and Edquist, 2013).

The NHIDZ is a relatively independent policy area with the the goal of development of high-tech industry and innovation capability. Therefore, the innovation policy is the key institutional resources for NHIDZ. The administration committee of Hi-tech zone not only needs to carry out the policies from high-level governments, but also has the function of making the regional and supporting policies. Therefore, innovation policy in NHIDZ is from three levels: the national level, the provincial and municipal level and zone level. The number and power of these policies represent the ability of the administration committee to obtain and configure resources. To sum up, the following hypothesises are proposed in order to explore relationship between the innovation policy and the innovation performance:

Hypothesis 2: The policy power of NHIDZ has a significant positive influence on innovation performance.

Hypothesis 2-1: The the national policies have a significant positive effect on innovation performance;

Hypothesis 2-2: The the provincial and municipal policies have a significant positive effect on innovation performance;

Hypothesis 2-3: The zone level policies have a significant positive effect on innovation performance.

2.4. *Moderating effect of regulatory regimes*

The abilities and attitudes of implementators have a certain impact on the effectiveness of policy implementation (Qian and Jin, 2002). An effective group system can maximize the integration of resources and is the important guarantee of effective implementation of public policy (Chen, 2003). So the impact of NHIDZ policy depends not only on policy power, but also on the characteristics of personnel and institutions implementing these policies. From a horizontal perspective, the implementation of the policy involves the various functions of local governments, which needs an effective cooperation among these departments. And the administrative committee of NHIDZ is responsible for cooperating and coordinating them to promote policy implementation. So the organization setting and the authority may to a certain extent determine the efforts. From a vertical perspective, policy in the zone needs to fully implement by sub-parks in it, which makes the structure of the zone also importance on the policy effectiveness. On this basis, the paper argues that the difference of the regulatory regimes of NHIDZ can take the different policy implementation effect, and further led to the differences in innovation output. Hence, put forward the following hypothesis:

Hypothesis 3: the regulatory regimes of NHIDZ has a significant effect on the relation between the policies and innovation performance.

3. Methods

3.1. Variables

3.1.1. *Dependent variable*

Innovation performance of Hi-tech zone (PER). Scholars usually use the number of patents, new product sales revenue and technical income and other indicators to represent technology innovation performance (Prevezer and Panzarasa, 2013; Li et al., 2013). Du to the performance of high-tech zone is more reflected in the transformation of technology and industrialization capacity, this article references to Zhou and Zhao (2014), using technical income as the innovation performance to express the economic benefits in technological innovation process.

3.1.2. Independent variable

Regulatory regimes (*REG*).This variable Includes the *NAT, AUT* and *STR*. The NAT refers to the nature of administration committee of the zone: an independent government department (NAT-1), resident agency of municipal party committee and municipal government (NAT-2), resident agency of municipal government (NAT-3) and government functional departments (NAT-4). *AUT* refers to the authority and functions given by the the higher government, as well as the ability to execute authority. We use the municipal administrative privileges to indicate the administration authority of the NHIDZ. The STR is a reflection of coordination ability of the zone administration authority to the sub-parks, measured with whether it has a multi-park structure and subordination relationship.

Policy power (POL). Because policy power is to illustrate the ability of integrating and making policy resources of the administration committee, the scope of the policy in this paper does not contain the policy maked by national or provincial and municipal government over their whole region-wide to promote the innovation. We divided the policy of NHIDZ into three levels (Zhang and Li, 2013), and respectively measured the policy at

different levels (Peng et al., 2008). On the basis of valuation standard in table 1 (Peng et al., 2013) , the calculation formula of high-tech zone policy power is as follows:

$$POL_{it} = \sum_{j=1}^{N} p_{ij} \qquad (3)$$

POL is the total value of policy power of i NHIDZ in t year; letter i expresses the name of the NHIDZ; N means the amount of the policies in the period of validity of i NHIDZ in t year, $j \in [1, N]$. So p_{ij} in this formula expresses the value of number j policy of i NHIDZ in t year. According to this formula, we can calculate the national level, provincial and municipal level and zone-level policy power.

Table 1. valuation standard of the policy power at different levels

Policy level	Policy document type	value
National level	The law by National People's Congress and the Standing Committee	5
	Regulations by the State Council	4
	interim regulations by the State Council	3
	Regulations by central ministries	
	interim regulations and Suggestions by central ministries	2
	Notice by central government department	1
Provincial and municipal level	Regulations and ruls bylocal people's congresses and the Standing Committee	3
	interim regulations and Suggestions by Provincial and municipal government departments	2
	Notice by Provincial and municipal government departments	1
Zone level	Suggestions by the administration committee of NHIDZ	2
	Notice by the administration committee of NHIDZ	1

3.1.3. Control variables

The control variables in this paper include the economic scale, human resource, capital input and regional condition. The economic scale is showed as the total number of enterprises in the zone; human resource and capital input are expressed by R&D personnel and R&D expenditure; the regional condition is measured by "center degrees" (Lou and Xu, 2009) of the city it located in.

3.2. Data sources

Although there are currently more than 140 national high-tech zones in China. But most of them are established in recent years, which mainly change from province level high-tech zones and have lower performance than the the early national high-tech zone (Xue et al., 2015). So they are not very good representative for the study. Therefore, this paper selects 52 NHIDZs established before 1995, and eliminates 3 NHIDZs including Shengyang, Fuzhou and Jilin zones whose policy data can not be found. Finally, 49 high-tech zones are keeped as the research sample.

This research data sources mainly through three ways: (1) technical income and control variable data all come from the "CHINA TORCH STATISTICAL YEARBOOK 2014" and "CHINA CITY STATISTICAL YEARBOOK 2014" ; (2) regulatory regimes data. First obtain the information in 2013 from the website of each NHIDZs; then search news with the keywords (NHIDZ name and the three variables) to confirm and update the information; (3) policy data. First download the policy documents from each NHIDZ website; then further search the website of the provincial and municipal people's government and relevant scientific managerial department which the NHIDZ located to supplement the policy data; finally respectively number and comb every NHIDZ's policies, and form a policy database including the policy name, the year of policy making, the validity of the policy, policy-makers and their level and the full policy document. According to this database, we extract the policies of every zones which are within the validity period in 2013.

3.3. descriptive statistical and correlation analysis

The descriptive statistical result in table 2. The unit of the PER and K is hundred million yuan; the dummy variable meaning: M_1 (1= NAT-1, 0=others), M_2 (1= NAT-2, 0=others), M_3 (1= NAT-3, 0=others); M_4 (1= having municipal administrative privileges, 0=no municipal administrative privileges); M_5 (1= multi-park structure and all subordination / single , 0=others), M_6 (1= multi-park structure and most subordination , 0=others), M_7 (1= multi-park structure and minority subordination , 0=others).

Table 2. Descriptive statistics results

Variables	PER	M_1	M_2	M_3	M_4	M_5	M_6	M_7	G.POL	S.POL	Y.POL	Q	K	L	CL
Min.	0.73	0	0	0	0	0	0	0	0	0	0	69	33.48	3921	0
Max.	40324.29	1	1	1	1	1	1	1	15	15	30	15455	4563.44	411088	7
Mean	2920.69	0.12	0.69	0.16	0.61	0.49	0.04	0.14	0.49	1.76	10.71	1164.14	612.79	45162.96	1.86

Table 3 is the results of pairwise correlation analysis of all variables. As it shows, there is a very significant positive correlation between all the control variables and the dependent variable, which further illustrates the necessity of these variable in the regression analysis model in this paper. In addition, the variables of regulatory regimes and policy power have no strong autocorrelation . And there is a high correlation between the three variables of policy power and the dependent variable.

Table 3. The correlation coefficient of variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 TEC	1														
2 M1	-.09	1													
3 M2	-.24	-.56**	1												
4 M3	.34*	-.17	-.67**	1											
5 M4	-.13	.03	.18	-.14	1										
6 M5	-.34*	.13	.21	-.32*	.10	1									
7 M6	.02	-.08	.14	-.09	-.01	-.20	1								
8 M7	.37**	-.15	-.36*	.45**	-.38**	-.40**	-.08	1							
9 G.POL	.91**	-.08	-.23	.37**	-.12	-.21	-.04	.40**	1						
10 S.POL	.47**	-.10	-.15	.11	-.20	-.27	-.02	.37**	.58**	1					
11 Y.POL	.40**	.16	-.31*	.30*	-.09	-.15	-.08	-.13	.35*	.10	1				
12 Q	.97**	-.08	-.23	.35*	-.17	-.25	.07	.36*	.93**	.43**	.43**	1			
113 K	.90**	-.10	-.34*	.44**	-.27	-.39**	-.05	.48**	.86**	.62**	.41**	.88**	1		
14 L	.95**	-.12	-.33*	.46**	-.23	-.37**	-.03	.46**	.91**	.56**	.43**	.94**	.97**	1	
15 CL	.31*	-.10	-.25	.25	-.18	-.46**	.07	.26	.16	.37**	.08	.24	.38**	.34*	1

Note:* indicates the correlation is under the significance level of 0.05; ** indicates it tis under the significance level of 0.01.

3.4. Statistical procedures

Most scholars have directly used the cobb-douglas production function to verify the relationship between the institution and innovation development (Jefferson et al., 2006). This paper use the ordinary least squares (OLS) method, and compare the modles before and after adding institutional factors, in order to get the impact. Then according to the regression analysis results, we select the variables of policy power having significant impact, and examine the regulatory effect of regulatory regimes variables on the relationship between policy power and innovation performance in turn. In addition, in order to reduce the multicollinearity among the control variables, we refer to the existing methods (Lafi and Kaneene, 1992) to extract the common factor by the principal component analysis (PCA) method, which reduce the four control variables to form a whole control variable FAC for regression analysis.

4. Results

4.1. Regression analysis

Table 4 are the results of the regression analysis. The five models are significant on the whole, and their variance inflation factor (VIF) values are less than 10. Similar to the results of previous studies, the common factor (FAC) of L, K, Q and CL has a significant positive correlation with innovation performance in all models at 1% level, and is the main factor affecting innovation. After adding the variables of regulatory regimes and policy power, the R^2 increased, which proves the two institution fators have ΔR^2 explanations for the innovation performance.

Model 2 ~ modle 4 are the results of respectively adding the dummy variables of regulatory regimes into the regression analysis. (1) the result of NAT. Though ΔR^2 is 0.016, and M1, M2 are significantly positive at the level of 10% and 5% in model 2. But because of the equivalent coefficients, M1 and M2 have the undifferentiated effects on innovation performance. And M3 has no significance. Therefore, according to the dummy variable regression theory (Liu, 2014), the NAT has no direct significant influence on innovation performance as a whole, and the 1-1 hypothesis has not been verified. (2) the result of AUT. Since the ΔR^2 is 0.011 and the coefficient is

significantly positive at the level of 5%, the hypothesis 1-2 is confirmed. That indicates the zones with municipal administration authority has a better performance. (3) the result of STR. There is no significant difference in the coefficient. Because, for most NHIDZs their sub-parks are established in different time and then form a comprehensive national high-tech zones though merging and upgrading. Finally set or accredit a agency to unified manageme. Thus led to the STR has no influence on innovation performance.

Model 5 shows: (1) hypothesis 2-1 has been confirmed. In the three variables of policy power, G.POL is significantly positive at 1% level, that indicates it has a positive influence on the innovation performance. When the national policy power is high, the innovation performance of the zone will be better. (2) Hypothesis 2-2 does not hold. But the S.POL coefficient is significantly negative at the level of 1%, which explains policy power at provincial and municipal level has a negative correlation . (3) Hypothesis 2-3 is not confirmed. The Y.POL coefficient is not significant. Policy at zone level is not related to the development of high-tech zone. Due to the zone level policy space is limited, and most are the enforcement , the implementation of the policy will not affect the innovation performance without the support of the superior policy.

Table 4. Regression analysis results

		Model 1	Model 2	Model 3	Model 4	Model 5
（constant）		-0.020**	-0.115**	-0.044***	-0.025*	0.006
FAC		0.887***	0.951***	0.918***	0.927***	0.683***
G.POL						0.342***
S.POL						-0.117***
Y.POL						-0.006
	M_1		0.098*			
NAT	M_2		0.098**			
	M_3		0.051			
AUT	M_4			0.033**		
	M_5				0.009	
STR	M_6				0.009	
	M_7				-0.029	
R^2		0.904	0.920	0.915	0.910	0.938
ΔR^2		-	0.016	0.011	0.006	0.034
F		443.883***	127.134***	247.649***	110.715***	167.317***

Note: *** indicates a significance under 0.01 level; **indicates a significance under 0.05 level; * indicates a significance under 0.1 level. ΔR^2 is the change of R^2 compared with it in model 1.

4.2. Regulatory Effect of regulatory regimes

In order to verify the regulatory effect of regulatory regimes, we choose the G.POL and S.POL as the independent variables which have significant effect on the PER. Then put the dummy variables of NAT, AUT and STR into the model respectively, while set the interactive items to verify the regulatory effect. The regression results are shown in table 5.

Due to the F test of model 9 and model 11 failed, and the coefficient of interaction of M4, M5, M6, M7 and policy variable are not significant, the municipal administrative authority and zone structure do not play a significant regulatory effect. But R^2 in model 7 significantly increased 0.016 compared to it in model 6, and both two models passed the F test, which shows that the NAT has a significant regulatory effect on the relationship between policy and innovation performance.

Among the interaction item of NAT, only the coefficient of S.POL* M_3 has significance. The influence of provincial and municipal policy on innovation performance is negative. Therefore regulatory role of NAT can be interpreted as: when the nature of the management agency of high-tech zone is resident agency of municipal government, the negative impact of the policy from provincial and municipal government departments on the innovation performance is lower than it of the other types.

Here the other types include NAT-1, NAT-2 and NAT-4· In the sample zones, only Shenzheng Hi-tech zone belongs to the last kind, so the first two are the main of the "other types". According to this, we can say that most of the "other types" tend to be an agency with more complete management authority. Therefore, under the context of the "other types", it is more possible to be plagued by multiple administrative problems if the provincial and municipal governments have moer functions in the Hi-tech zones. It further leads to a lower innovation performance with more policies maked by provincial and municipal governments.

Table 5. the validating results of Regulatory effect

	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
（constant）	0.064	-0.011	-0.015	-0.013	0.013	0.003
FAC	0.700***	0.754***	0.726***	0.755***	0.666***	0.735***
G.POL	0.393***	0.488***	0.309***	0.297***	0.367***	0.316
S.POL	-0.154***	-0.066	-0.113***	-0.154***	-0.110***	-0.095
M_1	-0.057	0.011				
NAT M_2	-0.053	0.003				
M_3	-0.099**	-0.049				
AUT M_4			0.024**	0.024*		
M_5					-0.011	-0.001
STR M_6					0.011	0.014
M_7					-0.026	-0.017
S.POL* M_1		0.002				
G.POL* M_2		-0.018				
S.POL* M_3		-0.025***				
G.POL* M_4				-0.004		
S.POL* M_4				0.005		
G.POL* M_5						0.006
S.POL* M_6						0.011
G.POL* M_7						0.001
S.POL* M_7						-0.006
Adjust R^2	0.944	0.960	0.939	0.937	0.934	0.930
ΔR^2	-	0.016	-	0.001	-	0.003
F	135.102***	141.612***	184.222***	184.694	113.327***	113.844

Note: ΔR^2 in the table represents the contrast between the model and the previous one; and among the interaction items, the G.POL* M_1、S.POL* M_2、G.POL* M_3、S.POL* M_5 and G.POL* M_6 are eliminated during calculating.

5. Discussion and conclusion

This paper test the relationship between variables of regulatory regimes and policy power and the innovation performance of high-tech zones through the regression analysis. On the basis of the results we can see that, in each regression model, the control variables of production factors such as talents and R&D expenditure account are for the largest share of innovation performance. It is consistent with the long-term view：the Increase of innovation performance can not be separated from the input of innovative production factors. However, how to improve the allocation efficiency of innovative resources is the key problem to be explored when production resources are certain.

The paper verified that Hi-tech zones with municipal administration authority have better innovation performance than others (Hypothesis 1-2). The delegation of the municipal administration authority especially the economic authority involved in the high-tech zone into the zones themselves is the approach taken by most high-tech zones. It can effectively improve the efficiency of the enterprises in the zone, and reduce administrative levels. So having it can promote the innovation performance.

Innovation policy for Hi-tech zones can promote their innovation performance to some extent, but policy at different levels have different effect (Hypothesis 2). The difference of policy effects at different levels is also an indirect reflection of administrative system in China. According to the empirical results, the national policy has a positive significant in the innovation performance (Hypothesis 2-1). The policy at the national level is relatively scarce resources for one zone. It not only lets the high-tech zones benefit from taxes and others, but also give them more subjective initiative, which is conducive to form a better institutional environment and further bring more resources from outside of zone.

On the contrary, due to easily lead to the problems of multiple management, the provincial and municipal policies have negative significant influence on innovation performance (Hypothesis 2-2). However, this kind of participation may cause multiple management, and hinder the innovative performance. While this negative impact reduced when the administration committee is resident agency of municipal government (Hypothesis 3). It shows that policy making of the high-tech zone should according to the its management characteristic.

References

Link, Albert N., and John T. Scott, 'US science parks: the diffusion of an innovation and its effects on the academic missions of universities', 2003, International Journal of industrial organization, 21, p. 1323-1356.

Martínez-Cañas, R., Ruiz-Palomino, P., & Sáez-Martínez, F. J., 'A literature review of the effect of science and technology parks on firm performance: A new model of value creation through social capital', 2011, African Journal of Business Management, 5, p.11999.

Sadeghi, M. E., Sadabadi, A. A., 'Evaluating Science Parks Capacity to Create Competitive Advantages: Comparison of Pardis Technology Park and Sheikh Bahaei Science and Technology Park in Iran', 2015, International Journal of Innovation and Technology Management, 12, p.1550031.

Zeng, S. X., Tam, C. and Xie, X., 'Evaluating innovation capabilities for science parks: A system model', 2010, Technological and Economic Development of Economy, 3, p.397-413.

Jongwanich, J., Kohpaiboon, A. and Yang, C. H., 'Science park, triple helix, and regional innovative capacity: province-level evidence from China', 2014, Journal of the Asia Pacific Economy, 19, p.333-352.

Bustos, P., 'Trade liberalization, exports, and technology upgrading: Evidence on the impact of MERCOSUR on Argentinian firms', 2011, The American economic review, 101, p.304-340.

Guadalupe, M., Kuzmina, O. and Thomas, C., 'Innovation and foreign ownership', 2012, The American Economic Review, 102, p.3594-3627.

Bai, X. J., Yan, W. K. and Chiu, Y. H., 'Performance evaluation of China's Hi-tech zones in the post financial crisis era—Analysis based on the dynamic network SBM model', 2015, China Economic Review, 34, p.122-134.

MOST(China), 'Work report by Wang Gang in National Conference on Science and Technology 2016', [Online] at http://www.most.gov.cn/tpxw/201601/t20160113_123696.htm, accessed January 11, 2016.

Torch High Technology Indutry Development Center (China), The innovation development report of national high-tech zone 2013, Beijing: Science and technical document press, 2014.

González-Loureiro, M., Figueroa Dorrego, P., 'Intellectual capital on regional innovation systems: toward the momentum of growth rates of business performance', 2010, International Journal of Transitions and Innovation Systems, 1, p.82-99.

Zerenler, M., Hasiloglu, S. B. and Sezgin, M., 'Intellectual capital and innovation performance: empirical evidence in the Turkish automotive supplier', 2008, Journal of technology management & innovation, 3, p.31-40.

Dakhli, M. and De Clercq, D., 'Human capital, social capital, and innovation: a multi-country study', 2004, Entrepreneurship & regional development, 16, p.107-128.

Wakelin, K., 'Productivity growth and R&D expenditure in UK manufacturing firms', 2001, Research policy, 30, p.1079-1090.

Kirchhoff, B. A., Newbert, S. L., Hasan, I. and Armington, C., 'The influence of university R.&D. expenditures on new business formations and employment growth', 2007, Entrepreneurship theory and practice, 31, p.543-559.

Laursen, K., Salter, A., 'Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms', 2006, Strategic management journal, 27, p.131-150.

Lau, A. K., Lo, W., ' Regional innovation system, absorptive capacity and innovation performance: An empirical study', 2015, Technological Forecasting and Social Change, 92, p.99-114.

Bigliardi, B., Dormio, A. I., Nosella, A.and Petroni, G., 'Assessing science parks' performances: directions from selected Italian case studies', 2006, Technovation, 26, p.489-505

Li, J., Sutherland, D., Ning, L. and Wang, Y., 'Firm ownership, industrial structure, and regional innovation performance in China's provinces', 2014, Technology Analysis & Strategic Management, 26, p.1001-1022.

Li, B., Zhang, N. and Liu, F. , Research on the effects of regional R&D cooperation among enterprises, universities and research institutes on their innovation performance in China. In 2013 6th International Conference on Information Management, Innovation Management and Industrial Engineering , Vol. 1, 2013, pp. 356-361.

Stuart, T. E., 'Interorganizational alliances and the performance of firms: A study of growth and innovation rates

in a high-technology industry', 2000, Strategic management journal, p.791-811.

Capello, R., 'Knowledge, innovation, and regional performance: Toward smart innovation policies', 2013, Growth and Change, 44, p.185-194.

Rodríguez-Pose, A., Di Cataldo, M., 'Quality of government and innovative performance in the regions of Europe', 2014, Journal of Economic Geography, lbu023.

Acemoglu, D., Johnson, S.and Robinson, J., 'The rise of Europe: Atlantic trade, institutional change, and economic growth', 2005, The American economic review, 95, p.546-579.

Zhou, J., Zhao, M., 'reseach on innovation Efficiency and influencing factors of national High-tech Industrial Development Zones', 2014, Science and Technology Management Research, 34, p.1-6.

Cheng, Y., Chen, X., 'Innovation Driven Growth:Decomposition of HIDZs Total Factor Productivity Growth', 2013, China Soft Science, 11, p.26-39.

Jiang, C. L., Xu, K. N., 'Location, central government and performance in High-tech Development area', 2009, The Journal of World Economy, 5, p.56-64.

28. Jiang, C. L., Cao, J. and Liu, W. S., 'Fluctuations of High-tech zone efficiencies and influencing factors in China: base on the stochastic frontier analysis of penal data from 1997 to 2012', 2014, Reform of Economic System, 6, p.52-56.

Cheng, Y. , Guo, W., 'Institutional Innovation of HIDZ's Management System from Perspective of Collaborative Governance', 2014, Science of Science and Management of S.& T., 2, p.011.

Peng, J. S., Zhong, W. G and Sun, W. X., 'The measurement and the coordinated evolution of politics, and economic performance: a case study on the policy for innovation', 2008, Management World, 9, p.25-36.

Zhang, Y. A., Li, C. G., 'reseach on classification on measure of cluster innovation and technology policy based on Wilk's discriminant analysis: a case study of zhongguancun', 2013, Journal of Intelligence, 32, p.194-201.

He, Z. K., 'On the necessity and significance of reforming and perfecting china's scial mangement system--part of the reseach of china's social mangemnet system reform and the development of social work', 2007, Studies on Mao Zedong and Deng Xiaoping Theories, 8, p.52-60.

Williamson, O. E., 'The new institutional economics: taking stock, looking ahead', 2000, Journal of economic literature, 38, p.595-613.

Lv, Y., Optimal Behavior of Government to Promote Enterprises' Technological Innovation. In Management and Service Science (MASS), 2011 International Conference on pp. 1-4. IEEE.

Taylor, M. R., Rubin, E. S., & Hounshell, D. A., 'Effect of government actions on technological innovation for SO2 control', 2003, Environmental Science & Technology, 37, p.4527-4534.

Koh, W. T., 'Singapore's transition to innovation-based economic growth: infrastructure, institutions and government's role', 2006, R&D Management, 36, p.143-160.

Aarsaether, N., Nyseth, T., 'The role of local government in processes of innovation in the nordic periphery', 2007, Tidsskrift for Samfunnsforskning, 48, p.5-31.

Lazaric, N., Mérindol, V. and Rochhia, S., 'Changes in the French defence innovation system: New roles and capabilities for the Government Agency for Defence', 2011, Industry and Innovation, 18, p.509-530.

Seaden, G., Manseau, A., 'Public policy and construction innovation', 2001, Building Research & Information, 29, p.182-196.

Li, K. R., Li, J. L., 'china's governing system and its impact on environmental policy implementation', 2011, Comparative Economic & Social Systems, 2, p.142-147.

Lundvall, B. Å., Borrás, S., Science, technology, and innovation policy, Oxford University Press, 2005.

Edquist, C., Innovation policy: A systemic approach.,1999,Tema, Univ., p.2-10.

Atkeson, A., Burstein, A. T., 'Policies to stimulate innovation', 2011, The Value of Outreach, 11, p.4-11.

Meuleman, M., De Maeseneire, W., 'Do R&D subsidies affect SMEs' access to external financing?', Research Policy, 41, p.580-591.

Andrew, D., 'Institutional policy innovation in aviation', 2012, Journal of Air Transport Management, 21, p.36-39.

Samara, E., Georgiadis, P. and Bakouros, I., 'The impact of innovation policies on the performance of national innovation systems: A system dynamics analysis', 2012, Technovation, 32, p.624-638.

Hong, J., Feng, B., Wu, Y. and Wang, L., 'Do government grants promote innovation efficiency in China's high-tech industries?', 2016, Technovation, 57, p.4-13.

Borrás, S., Edquist, C., 'The choice of innovation policy instruments', 2013,Technological forecasting and social change, 80, p.1513-1522.

Qian, Z. J., Jin, T. J., 'Public Policy Implementation Subjects and the Phenomenon of Occlusion during Implementation', 2002, China's administrative management, 2, p.56-57.

Chen, Z. M., policy science: Introduction to public policy analysis, 2003, Beijing: China Renmin University Press, p.258.

Prevezer, M., Li, J. and Panzarasa, P., 'Regional innovation and performance: The role of absorptive capacity, industrial structure and collaborative networks in the Chinese provinces of Hubei and Hunan', 2013, Journal of Chinese Entrepreneurship, 5, p.196-219.

Li, B., Zhang, N. and Liu, F., Research on the effects of regional R&D cooperation among enterprises, universities and research institutes on their innovation performance in China. In 2013 6th International Conference on Information Management, Innovation Management and Industrial Engineering ,Vol. 1 2013, pp. 356-361, IEEE.

Xue, Q., Wang, S., Rui, X. And Wang, Y., R., 'A dynamic contrast between the old and new national hi-tech industry development zones on the basis of the time series difference', 2015, Humanities & Social Sciences Journal of Hainan University, 33, p.46-50.

Jefferson, G. H., Huamao, B., Xiaojing, G. and Xiaoyun, Y., 'R&D performance in Chinese industry.', 2006, Economics of innovation and new technology, 15, p.345-366.

Lafi, S. Q., & Kaneene, J. B., 'An explanation of the use of principal-components analysis to detect and correct for multicollinearity', 1992, Preventive Veterinary Medicine, 13, p.261-275.

Liu, M., 'The Application of Dummy Variable Regression Model: Variance Analysis and Outlier Test', 2014, Statistics and Decision, 16, p.10-14.