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A Research of Regional Difference in R&D Activities in GUANGDONG, PR China

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Abstract
According to the 2008 economic census yearbook in Guangdong, it explores the reasons why the development of R&D is different in different area. According to the data, it analyses the R&D activity using factor analysis and clustering analysis, the results show that R&D activity level is directly associated with the foundation and the total quantity of R&D activities, the use efficiency of R&D expenditure as well as the output ability of R&D staff. Based on the results, the countermeasures are given.

Key words
R&D activity; Regional difference; Factor analysis; Clustering analysis

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1. INTRODUCTION

The scientific research and the experiment development (R&D) activity is a system creative activity which is done for increasing knowledge quantity and using the knowledge to create new apply in the science and technology domain. The R&D activity is the important constituent and the technical activity core of the region science and technology innovation system.

Analyzing the connection between the enterprise resources (financial property/material resources/intangible asset) and the R&D investment ability function, researcher has pointed out that the intangible asset is the main determining factor in internal R&D activity (Canto, 1999).Another researcher studied that the overseas enterprise's basic research devoted to develop the vanguard technology which is influenced by the host country market size, according to analyzing Japanese Overseas Multinational corporation's R&D activity determining factor from the foundation applied research and development(Shimizutani, 2008)).Using the Probit & Tobit model, it discussed the possibility of the enterprise engaging in the R&D activity and the R&D disbursement intensity(Kumar, 1996).The university basic research's importance in enhancing the productive forces(Adams, 2000).Some researchers have studied the relations between the region R&D activity and the region economy development (Chen Zhibin, 2003 & Chen Haibo, 2008).

According to the 2008 economic census yearbook, this article researches the region R&D activity in Guangdong with factor analysis and clustering analysis discussing the region difference origin .The research hoped to provide the help in the promotion economy development.

2. REGION DIFFERENCE ANALYSIS OF GUANGDONG

2.1 Factor Analysis

2.11 Target Selection

It selects 16 economic indicators in order to analyze the region difference of R&D activities. X_1: R&D personal converted quantity(man/year), X_2: R&D funds interior disbursement(ten thousand Yuan), X_3: Doctor graduates(personal), X_4; Master graduates(personal), X_5: R&D project(piece), X_6: Technological transformations funds disbursement (ten thousand Yuan), X_7: all levels of governments tax exemption to the technical development(ten thousand Yuan), X_8: New product sale income (ten thousand Yuan), X_9: Patented claim number(piece), X_{10}: Invention number of patents (piece), X_{11} possess of the invention number of patents (piece), X_{12}: the enterprise fund (ten thousand Yuan), X_{13}: financial organ loan (ten thousand Yuan), X_{14}: Government fund (ten thousand Yuan), X_{15}: Average funds new product sale income(ten thousand Yuan/ ten thousand Yuan), X_{16}: Average per person patented claim number(piece/personal).

2.12 Factor Analysis Serviceability Examination

The factor analytic method serviceability examination may determines through the KMO statistics and the Bartlett test. The KMO statistics is a target to comparing the variable simple correlation coefficient matrix and the partial correlation coefficient, its value scope between 0-1, KMO bigger than above 0.7 is to be good. The Bartlett test examines correlation whether is the unit matrix, namely various variables whether are respective independence.

If statistics approximate $\chi^2$is big and the sig is very small, the correlation coefficient matrix is not possibly the unit matrix, the variable has the correlated dependence, it suits to make the factor analysis .The KMO statistics and Bartlett test (to see table 1).The KMO is the 0.747, Bartlett test also can satisfy the request the data suits to make the factor analysis.

Table 1

KMO and Bartlett Test		
KMO		.747
Bartlett	χ^2	969.467
	df	120
	Sig.	.000

2.13 Main Factors Determined

It calculates the principal components characteristic root and the technical progress factor using the principal components in SPSS18.0 (to see table 2).The first three factor accumulation variance technical progress factor reaches as high as 90.428%, it shows that these three factors have already contained 90.428% information content of the primitive variable .Therefore it chooses the first three factors to take the public factor, then it obtains the revolving factor load matrix using the most greatly variance revolving method(to see table 3).

Seeing from table 3, the first main factorF_1 has the big load in$X_1, X_2, X_3, X_4, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{14}$, these variables reflect the R&D activity foundation investment and the output therefore it is called the R&D activity foundation input and output factor, the first main factor reaches 58.774% completely to the initial variable variance technical progress factor, it is the principal aspect in the R&D movable index system; The second main factor F_2 has the big load in X_5, X_6, X_{13}, these three variable response resources disposition

Table 2

Explanation Total Variance			
Ingredient	The Revolving Squares Sum		
	Summation %	Variance %	Cumulate %
1	9.404	58.774	58.774
2	3.815	23.843	82.617
3	1.250	7.811	90.428

Table 3

Revolving Ingredient Matrix			
	Ingredients		
	1	2	3
X1	.959	.269	-.047
X2	.865	.489	-.052
X3	.937	.334	-.050
X4	.982	.158	-.028
X5	.512	.795	-.104
X6	.050	.936	-.130
X7	.629	.516	-.064
X8	.852	.495	-.050
X9	.970	.199	-.042
X10	.987	.115	-.028
X11	.980	.180	-.033
X12	.835	.534	-.053
X13	.518	.807	-.129
X14	.814	.551	-.070
X15	-.034	-.150	.728
16	-.031	-.029	.806
Extraction method: Main ingredient.			
Rotation method: the orthogonal rotation method with the Kaiser standardization.			

dynamics, the variance technical progress factor reaches 23.843%, the third main factor F_3 has the big load in X_{15}, X_{16}, these two variables respond the R&D resources operational efficiency, therefore it is called the efficiency factor, the variance technical progress factor reaches 7.811%.

2.14 Factors Score Points

The total factor score formula

$$F = 0.58774F_1 + 0.23843F_2 + 0.07811F_3$$

Table 4 is the score of the three ingredients F1, F2, F3 under various variables

Table 4

Ingredient Score Coefficient Matrix			
	Ingredients		
	1	2	3
X1	.136	-.080	-.010
X2	.068	.058	.023
X3	.117	-.041	-.002
X4	.166	-.141	-.012
X5	-.073	.293	.031
X6	-.199	.468	.037
X7	.014	.124	.019
X8	.064	.064	.025
X9	.154	-.119	-.017
X10	.177	-.165	-.019
X11	.161	-.129	-.012
X12	.052	.089	.029
X13	-.074	.294	.011
X14	.044	.100	.017
X15	.017	.045	.614
X16	-.010	.122	.702
Extraction method: Main ingredient.			
Rotation method: the orthogonal rotation method with the Kaiser standardization.			
Constitution score			

It may obtains various local factor score and the total factor score place(to see table 5),"P" means position

2.2 Clustering Analysis

In order to cause the appraisal result to be more direct-viewing clearly, it carries on the cluster to the synthesis factor score(to see table 6).

3. RESULTS ANALYSIS

The first kind is Guangzhou City, Guangzhou has high R&D activity Guangzhou is located in the south of Guangdong Province and the north of Zhujiang Delta, bordering on the north China sea, the geographical position is superior, Guangzhou is the important industrial base in China, the comprehensive industry manufacturing center in South China area, it is strong in scientific research technology ability and the product development ability going to a strong export-oriented modern industry system. The synthesizes places second, Guangzhou's R&D resources increase every, but it is behind other areas at the same year, it is not symmetric between the superior geographical position and the rate of economic development, it does well in the resources disposition dynamics and the use efficiency. Therefore it must enlarge the R&D resource base investment, optimizing resources disposition to promote the industrial enterprise R&D activity level.

The second kind is Shenzhen City, the vice-provincial level city, it is located in the east bank of Zhujiang Delta t, its industrialization develops very quickly, from the table4, we can see that the comprehensive factor score places first, the first main factor places first and the second, main factor places sixth, the third host factor places fifth, industrial enterprise's R&D activity is quite coordinated, therefore it need enlarge the

Table 5

Areas	F1	P	F2	P	F3	P	F	P
Guangzhou	-0.305	19	3.401	1	0.012	3	0.632	2
Shenzhen	4.313	1	0.292	6	-0.09	5	2.597	1
Zhuhai	-0.126	5	0.467	4	-0.134	6	0.026	5
Shantou	-0.143	7	-0.556	14	-0.242	7	-0.23	12
Foshan	-0.266	18	1.492	2	-0.067	4	0.193	3
Shaoguan	-0.811	21	1.154	3	-0.361	13	-0.229	10
Heyuan	-0.172	9	-0.756	21	-0.422	17	-0.314	20
Meizhou	-0.173	10	-0.684	18	-0.395	15	-0.298	18
Huizhou	-0.053	2	-0.371	10	-0.261	8	-0.140	9
Shanwei	-0.081	3	-0.601	17	2.263	2	-0.014	6
Dongguan	-0.109	4	0.283	7	-0.293	10	-0.020	7
Zhongshan	-0.208	15	0.332	5	-0.314	11	-0.067	8
Jiangmen	-0.137	6	-0.506	13	-0.40	16	-0.233	11
Yangjiang	-0.195	13	-0.141	8	3.563	1	0.1295	4
Zhanjiang	-0.246	17	-0.400	11	-0.4324	18	-0.274	14
Maoming	-0.329	20	-0.264	9	-0.324	12	-0.281	16
Zhaoqing	-0.216	16	-0.488	12	-0.46434	19	-0.280	15
Qingyuan	-0.207	14	-0.587	15	-0.380	14	-0.291	17
Chaozhou	-0.180	11	-0.596	16	-0269	9	-0.269	13
Jieyang	-0.154	8	-0.736	20	-0.479	20	-0.303	19
Yunfu	-0.190	12	-0.731	19	-0.503	21	-0.325	21

Table 6

The first kind	Guangzhou
The second kind	Shenzhen
The third kind	Zhuhai, Foshan, Huizhou, Yangjiang, Dongguan, Zhongshan, Shanwe
The forth kind	Shantou, Shaoguan, Heyuan, Meizhou, Jiangmen, Zhanjiang, Maoming, Zhaoqing, Yunfu, Chaozhou, Jieyuan, Qing yuan

input of R&D resources with steadily.

The third kind are Zhuhai City, Foshan City, Huizhou City, Yangjiang City, Dongguan City, Zhongshan City, Shanwei City, the R&D activity is coordinated in Zhuhai City and Dongguan City, the synthesis factor score and each main factor score have great difference in Foshan City, Huizhou, Yangjiang City, Zhongshan City, shanwei City, the R&D resource base input and the resources disposition are inconsistent, so they need enlarge the construction in the flaw aspect to make development economy.

The fourth kind are Shantou City, Shaoguan City, Heyuan City, Meizhou City, Jiangmen City, Zhanjiang City, Mao ming City, Zhaoqing City, Yunfow City, Chaozhou City, Jieyang City, Qingyuan City, these areas scores are quite different, The R&D activity is backward in whole, these areas locate in remote space, the economical development is slow, so it should create the R&D activity foundation condition to raise the R&D activity level.

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