Empirical Study on Differences of Effects of Flower Industry Cluster Networks to Various Enterprises' Technical Innovative Performance------Taking Guangdong as an Example

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Abstract. The paper analyzed and compared whether and how flower enterprises' network structure and entities' behaviors influence different enterprises' technical innovation performance according to 'network structure-entity behavior-technical innovative performance' theory model. The conclusions are: there is no remarkable and direct influence of resource utilization to technical innovation performance in the supply enterprises; Network centrality do not exert indirect influence to technical innovation performance by using enterprises' compete-and-collaborate direct action in supply and small-scale enterprises; network density and intensity indirectly influence enterprises' technical innovation performance by direct effects to enterprises' co-petition and resource utilization; enterprises' co-petition can exert a direct and remarkable influence to technical innovation performance; and network centrality does no exert an indirect effect on technical innovation performance by utilizing resource. The paper also accomplishes discrepancies analysis based on different enterprises, enriching theories of network and of technical innovation. The conclusions can help local government and flower enterprises to formulate and establish relevant measures and strategies to improve technical innovation performance.

Introduction

The flower industry has made a great progress by thirty years' development and gradually become an emerging industry in China. According to the statistics, the flower production total area is only 14000 hectare, amount of sales is RMB 60 millions, and amount of exports is $0.2 millions in 1984. In 2010 year, the flower production total area is 917600 hectare, amount of sales is RMB 8619.6 millions, amount of exports is $46.3 millions. Comparing with these in 1984,the flower production total area, amount of sales and exports respectively have been increased 68 times,143 times and 231 times. China has become the largest flower production base, more important flowers' consumer and flowers exports trading nation, and the flower production area and output all take the first place in the world.

In the increasing development of China's flower industry, cluster phenomena are emerging remarkable. Typical flower industry clusters in Yunnan, Guangdong, Shanghai, Zhejiang, Jiangsu and so on are developing fast. The flower industry clusters' development are continuously enhancing. At the same time, we find the phenomenon: the enterprises technical innovative performance is uplifting with development of the flower industry cluster network. Then, we perceive the essence through the appearance. We think that it is undoubtedly necessary to the research of the flower industry cluster network impacting the enterprises technical innovative performance, especially under the lack of study on this problem in our country at present.

The main factors of the flower industry cluster network impacting the enterprises performance are the network structure (network density, network centrality and network intensity) and network body

behaviors (enterprises competition and cooperation,network resource utilization).The interrelation, interweave, interdependence of these factors influence jointly and decide the enterprises technical innovative performance, that has been proved by correlation theoretical and empirical study. However, with the deep theoretical research, the study show: the industry cluster network impacting the enterprises technical innovative performance is distinguishing because the difference of the enterprises. Based on the related research in hand, although these study outlined the clusters' network characteristics and the enterprises' competitive advantage provided by the clusters' network, the research of the relationship on the mechanism of action, differentiation factors and the enterprises technical innovative performance are still insufficient, and the existing results have still certain divergence. Therefore, the paper will proceed more deeply and more carefully analysis from the aspects of the relationship of the differentiation and the enterprises technical innovative performance.

This paper chooses the flower industry cluster network in Guangdong province as the research objectives, analyzes the mechanism of interaction based on the industry cluster theory and network theory, explores more deeply and more carefully from the aspects of the relationship between the different enterprises and the enterprises technical innovative performance, compares whether and how flower enterprises' network structure and entities' behaviors influence different enterprises' technical innovation performance according to 'network structure-entity behavior-technical innovative performance' theory model. The paper also accomplishes discrepancies analysis based on different enterprises, enriching theories of network and of technical innovation. The results of the research hope to provide the reference for the theory study and policy-making, and the conclusions can also help local government and flower enterprises to formulate and establish relevant measures and strategies to improve technical innovation performance.

Scale design and test of validity and reliability

Scale design

The main variations in the model include: technical innovation performance(dependent variation), we mainly utilize the indexes of Ritter[1]as our reference while designing the scale and we establish 6 subjects. The competitions and collaborations of enterprises serve as the intermediate variation, including 3 subjects.(the competitions and collaborations of enterprises have with upper and lower corporations and complementary corporations)The resource utilization is the intermediate variation. Labor power, material resource, financial resource and information are the resource that enterprises entities need to enter[2]. We use the efficient utilization of labor power, material resource, financial resource and information to evaluate enterprises entities. The network structure serves as the independent variation, consisting of network density, intensity and centrality. The measurement of those variations is mainly based on the research survey of Yli-Renko(2001) [3] and Haitao Zhen (2010) [4]and evaluated by 12 subjects. In terms of the evaluation of observation variations, we formulate by using the seven-point of Likert-Scale. The calculation and measurement mentioned above are the combination of the suggestions of experts, the content of this dissertation and the edition of words. Meanwhile, we treat the scientific technical flower enterprises in Guangdong Province as our research subjects. We investigate by sending questionnaires to the middle and senior mangers in the flower enterprises and ultimately receive 260 effective questionnaires.

Reliability verification

Reliability reflects the stability and consistency of the measure result. In this dissertation, we gauged the reliability of variations by using the SPSS19.0 software and Cronbach a value. It is oftentimes contended that the measurement can be verified only when Cronbach a is more than 0.7. By analyzing the reliabilities of the network structure, enterprises' competitions and collaborations, resource utilization and technical innovation performance, we get the Cronbach a coefficient of these 4 variations. The biggest of the 4 coefficients is 0.921 while the least calculates as 0.871, all are more than 0.7, and thus verify the reliability of the questionnaires.

Validity verification

Analysis of exploratory factors. By using the SPSS19.0 software, we first tested the KMO values of each observant variation. The KMO value of the data is 0.961 and can pass the Bartlett Sphericity test, with the significance level smaller than 0.001. And thus the samples are suitable for factor analysis. In order to finish the main factor analysis, we extract the factor and rotate the maximum variance, found that the factors were all bigger than 0.5. Hence, the subjects of the network structure, enterprises' competitions and collaborations, resource utilization and technical innovation performance can all reach an ideal standard (shown in the table 1). When the ratio of accumulating explanatory variance is bigger than 50%, we can conclude that the variation is accordance to the requirements of the structural validity. In this article, the accumulating explanatory variances of the network structure, enterprises' competitions and collaborations, resource utilization and technical innovation performance are all more than 50% (shown in the table 1).

Table 1: The result of exploratory factors analysis

network density		network intensity		network centrality		enterprises' entity		resource utilization		Innovative performance	
observed variables	factors	observed variables	factors	observed variables	factors	observed variables	factors	observed variables	factors	observed variables	factors
D1	0.871	I1	0.869	C1	0.867	F1	0.904	R1	0.873	P1	0.706
D2	0.892	I2	0.879	C2	0.878	F2	0.874	R2	0.770	P2	0.929
D3	0.815	I3	0.670	C3	0.791	F3	0.868	R3	0.910	P3	0.832
D4	0.833	I4	0.885	C4	0.873			R4	0.907	P4 P5 P6	0.843 0.825 0.918
accumulating explanatory variances	74.9%		78.0%		77.1%		79.7%		72.8%		64.4%

Analysis of examine factors. In this dissertation, we use the structural equation model methodology to do the examine factors analysis and use the absolute fitness index, the added value fitness index and the simplicity fitness index to evaluate. Please see the simulation result of the examine factors analysis in the table 2. We find that all the final results reach the simulation requirements, which means that the data fits model well.

Table 2: The result of examine factors analysis

Fitting criterion	absolute fitness index		added value fitness index					simplicity fitness index	
	x^2/df	RMSEA	NFI	CFI	IFI	RFI	TLI	PGFI	PNFI
Standard value	$1<x^2/df<3$	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9	>0.5	>0.5
Network structure	1.778	0.055	0.959	0.982	0.982	0.947	0.976	0.741	0.758
Entities behaviors	1.711	0.052	0.981	0.969	0.992	0.987	0.992	0.607	0.614
Innovative performance	1.926	0.060	0.980	0.990	0.990	0.966	0.983	0.588	0.594

Notes: Fitting Standard values come from Minglong Wu(2012)[5]

Test of model and the analysis of discrepancies under different enterprises samples

After finishing the reliability and validity verification, we tested the model of different enterprises samples via using the AMOS17.0 Software and using the structure equation.

Model fit and routes

Based on the theoretical model that has been set(shown in the figure 1), we modified several times and each of the fitting indexes of the different corporations samples have already reached the fitting requirements(shown in the table 3).

Table 3: Fitting results of different enterprises model

Fitting criterion	absolute fitness index			added value fitness index				simplicity fitness index	
	x^2/df	RMSEA	NFI	CFI	IFI	RFI	TLI	PGFI	PNFI
standard value	$1<x^2/df<3$	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9	>0.5	>0.5
whole enterprises	1.128	0.022	.949	.936	.994	.992	.994	0.759	0.795
size enterprises	1.108	0.030	.871	.869	.973	.973	.973	0.856	0.957
up-down stream firms	1.093	0.023	.881	.879	.984	.984	.984	0.867	0.968

Table 4 shows the routes coefficients of the final modified model under the different corporation samples: network density, network intensity can exert a direct and remarkable influence to the enterprises' competitions and collaborations as well as the resource utilization. Network centrality does not affect the resource utilization directly and notably while corporations entities impact technical innovation performance in a straight and remarkable way. Meanwhile, it is the resource utilization of other corporations samples rather than the one of the supply enterprises, influences technical innovation performance directly and critically. And by studying the samples of other enterprises we found that the centrality affects enterprises' competitions and collaborations directly and remarkably, while studying the samples of those medium enterprises and supply enterprises can not lead to this conclusion.

Table 4: The path coefficients of different enterprises

	whole firms		different size enterprises				up and down stream enterprises			
			small size firms		big & medium firms		up stream firms		down stream firms	
paths	path coefficient	results	Path coefficient	results	Path coefficient	results	Path coefficient	results	Path coefficient	results
density→ firms entities	.454	passed***	.524	passed***	.308	passed***	.817	passed***	.299	passed***
intensity→firms entities	.380	passed***	.356	passed**	.265	passed***	.418	passed**	.268	passed***
centrality→firms entities	.326	passed***	.064	unpassed	.468	passed***	.080	unpassed	.425	passed***
density→resource use	.361	passed***	.713	passed***	.300	passed***	.934	passed***	.345	passed***
intensity→resource use	.222	passed***	.271	passed**	.254	passed**	.282	passed**	.373	passed***
firm entities → performance	.455	passed***	.809	passed***	.609	passed***	.706	passed***	.648	passed***
resource→innovative performance	.234	passed***	.211	passed*	.365	passed*	.072	unpassed	.331	passed***
centrality→resource use	0	unpassed	0	unpassed	0	unpassed	0	unpassed	0	unpassed

Notes:*, **, *** respectively shows two-tailed test markedly in the level of 0. 05、0. 01 、 0. 001

Influence analysis of different enterprises samples

By analyzing the influence, we have the following findings:

(1) The direct effect of firms' competitions and collaborations to technical innovation performance is higher than 0.7, which means a remarkable and direct influence. Thus, the hypothesis H1a is corroborated and firms' competitions and collaborations with the upper and lower stream enterprises, as well as the peers can strongly improve enterprises' technical innovation performance. Aside from the supply corporations, the assistance of utilizing resource to other corporations' technical innovation performance can also be proved, and thus hypothesis H1b could be established. This conclusion implies that in order to procure and make use of resource that coming from other entities, corporations should also maintain a collaborative relationship with the colleges, academic institutions, flower guilds, financial institutions and local governments besides the one with those upper and lower stream corporations. Since the main

part of the flower enterprises network serves to be manufacture and sale while the supply enterprises have a relatively weak power and inferior connections, the available resource might be meager and the influence to technical innovation performance can be weak.

(2)The direct effects of the network density and intensity to technical innovation performance are zero while the indirect effects are higher than 0.3. What we can conclude is that network density and intensity affect the firms' competitions and collaborations as well as resource utilization directly and hence impose an indirect influence on technical innovation performance. Consequently, hypothesis H2a, H2b, H3a and H3b are all passed. Just like the hypothesis we have been tabled in the theory analysis, within the flower enterprises network, the closer the connections between corporations and their peers, as well as those non-corporations organizations, the more resource they could get and utilize, and consequently, the better the technical innovation performance can be achieved.

(3)Effect of network centrality to resource utilization is very weak and thus the hypothesis H4b can not be founded. However, apart from the small-scale enterprises and supply corporations, the centricity exerts a direct and striking influence to firms' competitions and collaborations, and the hypothesis H4a is thereby tenable. To sum up, it is the small-medium sized enterprises, taking up a larger part within the flower enterprises network, that lack of the central position advantage. Especially, the small-scale enterprises and supply enterprises, who have an exceedingly inferior centrality and who have a relatively limited available resource, the improving mechanism to the technical innovation performance can not be conspicuously proved.

Table 5: Effects of the different enterprises models

		whole firms			small size firms			big & medium firms			up stream firms			down stream firms		
Argu-ment	depende-nt variable	direct effect	Indire-ct effect	total effect	direct effect	Indire-ct effect	total effect	direct effect	Indire-ct effect	total effect	direct effect	Indire-ct effect	total effect	direct effect	Indire-ct effect	total effect
densi-ty	entities	.398	---	.398	.524	---	. 52	. 308	---	. 308	. 817	---	. 817	. 300	---	. 300
	resource	.424	.116	.540	.713	.007	.720	. 300	. 140	. 441	. 934	--	. 934	. 345	. 086	. 431
	Perform-ance	---	.431	.431	---	.576	.576	---	. 348	. 348	. 512	---	. 512	---	. 336	. 336
Inten s-ity	entities	.323	---	.323	..356	---	. 36	. 468	---	. 468	. 418	---	. 418	. 425	---	. 425
	resource	.296	.094	.390	.271	.001	.272	. 254	. 214	. 468	. 282	0	. 282	. 373	. 122	. 495
	Perform-ance	---	.336	.336	---	.109	.109	---	. 456	. 456	. 036	---	. 036	---	. 439	. 439
Centr -ality	entities	.284	---	.284	---	---	---	. 265	---	. 265	---	---	---	. 268	---	. 268
	resource	.097	----	.097	---	----	----	0.05	---	0.05	---	---	---	0.08	---	0.08
	Perform-ance	---	.225	.225	---	.289	.289	---	. 206	. 206	---	. 296	. 296	---	. 199	. 199
entity	Perform-ance	.713	.080	..792	.809	.003	.812	. 609	. 166	. 776	. 706	. 002	. 708	. 648	. 095	. 743
resou -rce	Perform-ance	.273	---	.273	.211	---	.211	. 365	---	. 365	---	---	---	. 331	---	. 331

Conclusion and policy implication

In this dissertation, we use the structural equation model and study the action mechanism that network structure, entities behaviors to technical innovation performance in different flower enterprises. The outcomes of research show the discrepancies of them: utilization of resource do not have a remarkable and direct influence to technical innovation performance in the supply enterprises. In the small-scale enterprises and supply enterprises, the network centricity also not affects firms' competitions and collaborations directly and notably. The theory discussion and empirical study of the influence network structure and entities behavior to the flower enterprises technical innovation performance in the paper has make some contribution on the further development of the theory of technical innovation enterprises network.

The policy implication of this dissertation lies in:

The firms' competitions and collaborations play the most significant role in improving technical innovation performance within flower enterprises network. Therefore, enterprises entities should enforce

the collaborations among the firms as well as reinforce the proximate connections with the entities aside from corporations, especially with colleges and academic institutions. Enterprises should positively launch the production-study-research collaborations while laying stress in the characteristics of flower enterprises network and improving the ability of small-scale enterprises and supply corporations. And thus, the resource can be fully and efficiently utilized within the network of flower enterprises, rendering the elevation of technical innovation performance.

The flower enterprises should make use of the network platform, try to improve the density and intensity of enterprises' network and reinforce the connection with the corporation entities, non-corporations entities. The government ought to establish the local flower enterprises develop policy, begin by developing infrastructure and ameliorating network environment and provide the small-medium size enterprises with technical assistance, financial support and preferential policies, rendering them develop gradually and elevate their technical innovation performance by obtaining and using more high-qualified resource.

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