Research on Entrepreneurial Capacity Evaluation Index System of the Self-employed: Based on 603 Samples Analysis[*]

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Abstract：Based on the questionnaires of entrepreneurial capacity of 603 self-employed vendors who operating a fixed store in Wenzhou city of China, entrepreneurial capacity evaluation index system of the self-employed which contains 12 indexes on 3 factors has been constructed by exploratory factor analysis. And the results from confirmatory factor analysis show that the evaluation index system have good reliability and validity. Finally, three aspects of pioneering capacity of the self-employed i.e. innovation ,tenacity and cooperative, are preliminary evaluated.

Key Words：The self-employed; Entrepreneurial capacity; Exploratory factor analysis; Confirmatory factor analysis

1 Introduction
1.1 Literature review
Pioneering capacity is the ability of completing entrepreneurial activities smoothly, which has individual and social double attribute. Pioneering capacity is a concept very complex and vague. The individual in the business process is required to complete a variety of tasks as many participants, the belief degree of whether individual is capable of completing these activities successfully is entrepreneurial self-efficacy. Currently, there are two index systems of self-efficacy in entrepreneurship which have been tested empirically : one is that of Chen Chao C and Patricia Greene and Ann and Crick (1998) , propose entrepreneurial self-efficacy structure which can predict the possibility of individual become an entrepreneur, embodied in five dimensions: the market, innovation, management, risk, financial control [1] . Two is that of Noble et al. (1999), thinks entrepreneurship self-efficacy mainly embodied in six dimensions based on the skills needed by entrepreneurs: risk and uncertainty management skills, innovation and product development skills, interpersonal relationship and network management skills, opportunity recognition skills, processing and configuration key resources skills, develop and maintain a innovation environment skills [2] .

The typical representatives who analyze the concept of undertaking ability by the method of evaluating undertaking ability by entrepreneurs themselves are Chandler and Man. Chandler G.N. (1992) thinks that individual need to complete three roles in the whole process, namely, business role, management role and technique function role, which require six aspects of ability [3] .Man (2002) puts forward the concept of undertaking ability in six dimensions, namely, opportunity ability, relationship capacity, conceptual ability, organization ability, strategic capacity and commitment ability. But, these six dimensions are not significant in statistically when they are empirically tested [4] .

He Xiaogang (2005) testes six dimensions of entrepreneur talent empirically based on 277 valid questionnaires, namely , strategic ability, management ability, relationship capacity, learning ability, innovation ability and opportunity ability by using Mans' concept of pioneering capacity for reference. However, the results show that the influence of six dimensions to enterprise organization ability is not steady [5] . But, based on Man etc., Tang Jing, JiangYanfu (2008) analyze pioneering capacity through the concept and two big tasks in entrepreneurial process, and construct a second-order concept model of undertaking ability with six dimensions empirically based on 464 valid questionnaires. The empirical results show that the model has good validity and reliability [6] .Based on the index in rapid test table of Don Macke and Deb Markley, Huang Delin, Song Weiping and Wang Zhen (2007) think the undertaking abilities of the innovative, cooperative and tenacity are reflected in the10 indexes of the rapid test table. In the research three factors are extracted by factor analysis from the 10 indexes which reflect the undertaking abilities of innovative, cooperative and tenacity [7] .

1.2 Research ideas
However, undertaking ability evaluation index systems in existent literature are not appropriate to self-employed individuals with small scale business. The business scale of the self-employed is small,

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many various types of work don't needed to be completed while that is needed for enterprise with large scale. Therefore, undertaking abilities evaluation index systems designed in the above literatures for completing various types of work appear relatively large for the self-employed.

The indexes of the quick test table putted forward by Huang Delin, SongWeiping and Wang Zhen (2007) are relatively simple and the operation is convenient. But, the objects they aimed at in investigation are random farmers, not the farmers who are venturing. The farmers in investigation who are not venturing seemed to have a "suspicion of absence of research object". In addition, the samples are not much enough and neither reliability nor validity is tested. So, the reliability of index is suspectable. However, some of these indexes can be well used for reference theoretically.

The concept of pioneering capacity with six dimensions is used as main reference in this paper for theory foundation, namely, opportunity recognition ability, opportunity development ability, organization ability, strategic ability, relationship ability and commitment ability, putted forward by Tang Jing, Jiang YanFu (2008), which based on Mans' concept of undertaking ability. But in this study, only four dimensions are referred, including opportunity recognition ability, opportunity development ability, organization ability and relationship ability, because the strategic ability and commitment ability are required less important to self-employed individuals with small business, so corresponding indexes of the two dimensions are not designed. Some reasonable indexes of the quickly test table putted forward by HuangDelin, SongWeiping and WangZhen (2007) are used. The indexes designed are shown in Table 1, and the content of indexes in Table 1 is shown in Table 7.

603 questionnaires of the self-employed who operating a fixed store in Wenzhou city of China have been collected. Based on these data, these indexes are analyzed by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The scores of three factors i.e. innovation, tenacity and cooperative, can be calculated to evaluate pioneering capacity preliminary based on these indexes.

Table 1   Design Ideas of Indexes

factors aimed to be extracted	six dimensions of pioneering capacity		Index code
	dimension	Content of dimension	
innovation	opportunity recognition ability	The ability of identifying market opportunities effectively and immediately	C1; C2; C3; C4; C5
	Opportunity development ability	The ability of putting the identified chance into implement	
cooperative	Organization ability	The ability of organizing internal and external resources, including team construction, and leadership training and staff controlling	H1; H2; H3; H4
	relationship ability	The ability of establishing relationship of individual to the individual, or individual to the group	
none	strategic ability	The ability of establishment, evaluation and implement of enterprise strategy	
	commitment ability	The ability of running an enterprise all the time and implementing commitment for suppliers, employees, customers, venture capitalists, Various kinds of community of interests etc.	
tenacity			J1; J2; J3; J4; J5

Notes: Tenacity is defined as the traits required when facing difficulties in the course of realizing the four abilities of opportunity recognition, opportunity development, management and relationship.

2 Factor Analysis

603 questionnaires of the self-employed who operating a fixed store in Wenzhou city of China have been collected as research samples data. The indexes are representatives of the general undertaking ability of the self-employed, content of indexes is shown in Table 3. Entrepreneurs assess their pioneering capacity by self-assessment method. Five classifications are used for each index, from reverse opinion to positive opinion of 1 points (disagree completely), 2 points (disagree), 3 points (agree), four points (more agree), five points (agree completely). Sample data are putted into two halves. Exploratory factor analysis based on these indexes is done with PASW Statistics18.0 software based on 303 samples, and according to the results, two indexes are deleted and 12 indexes are retained. Then confirmatory factor analysis is done to verify the reliability of the model of evaluation index system resulted from exploratory factor analysis based on the other 300 samples.

2.1 Exploratory factor analysis

The first round exploratory factor analysis(303 samples) is aimed for 14 indexes ,and two of them are deleted because they are not very good according to the results. And then the second round exploratory factor analysis aimed for 12 indexes is done.

2.1.1 KMO statistics and Bartlett's test of sphericity

The Kaiser-Meyer-Olkin (KMO) statistics and Bartlett's Test of Sphericity are used to test whether variables are suitable for factor analysis. Kaiser thinks the value more than 0.8 is suitable for factor analysis, and here the KMO value are 0.892 (14 indexes) and 0.894 (12 indexes), as shown in Table 2. the statistics of Bartlett's Test of Sphericity is larger enough, and the corresponding probability is 0 (shown in Table 2), this can reject the null hypothesis that correlation coefficient giant array is unlikely a unit matrix .So according to the results from KMO statistics and Bartlett's Test of Sphericity, the 14 indexes and the 12 indexes of the evaluation index system are suitable for factor analysis.

Table 2　KMO Statistics and Bartlett's Test of Sphericity

		14 indexes	12 indexes
Kaiser-Meyer-Olkin of Sampling Adequacy		.892	.894
Bartlett's Test of Sphericity	Approx. Chi-Square	2537.737	2523.256
	df	91	66
	Sig.	.000	.000

2.1.2 Factors extracted and named

Factors whose eigen values over 1 are extrated by extration method of principal component analysis and rotation method of varimax with Kaiser normalization. The concise results of rotated component matrix and total variance explained are shown in Table 3.Firstly, according to the results of first round factor analysis based on 14 indexes, the indexes of H4 and J5 are deleted because whose loading coefficient on three factors are far less than 0.5.secondly,the results of the second round factor analysis based on 12 indexes are better than the first round, because the variance contribution reached 75.647 than 65.499 of first round, the loading coefficient of the indexes are greater than 0.7 except J4 index of 0.577. Factors are explained by indexes whose loading coefficient more than 0.5 by method of varimax. As shown in Table 3, factor 1 is explained well by indexes from C1 to C5, named innovative factor. Similarly, factor 2 is explained well by indexes from J4 to J1, named tenacity factor. Indexes from H3 to H1constitute are explanation for factor 3, named cooperative factor. Therefore, the evaluation system of 12 indexes 3 factors is more reasonable.

Of course, J4 index is not very good, its loading coefficient is 0.577 and the communality value is merely 0.469, but here in exploratory factor analysis, it is retained, until the results of confirmatory factor analysis to the model of evaluation system are obtained, when to make a choice whether or not J4 index should be retained.

Table 3　Rotated Component Matrix and Total Variance Explained

NO.	Content of index	Component（14 indexes）			Component（12 indexes）		
		1	2	3	1	2	3
C1	Do you like difference in pioneering works	.838	.253	-.022	.842	.226	.167
C2	Do you often find good profitable originality or ideas	.839	.267	.092	.801	.254	.290
C3	Can you quickly grasp the business opportunities when they appears with larger risks	.887	.197	.049	.872	.174	.245
C4	Do you dare to do better business projects with bold innovation which are large scale and may produce more income.	.873	.225	.023	.866	.199	.217
C5	Do you have some ways to make your own career, family and business move towards better development	.821	.295	.073	.799	.276	.254
J1	Do you have summary the reasons when business failures take place	.082	.829	.183	.062	.840	.141
J2	Do you have good faith　that you can do well, even more better when every time you started to venture	.252	.850	.030	.259	.849	.051
J3	Can you keep going with confidence	.315	.799	.157	.281	.805	.198

	when run into difficulties						
J4	Can you promote your work or business without depending on others	.356	.572	.111	.322	.577	.181
H1	Can you always find good ways for your career or resources through good interpersonal relationships	.417	.163	.683	.223	.208	.757
H2	Can you cooperate well with other fellow and colleagues	.517	.026	.708	.262	.086	.873
H3	Can you get along with managers, subordinates, customers	.490	.109	.667	.246	.166	.827
J5	Whether your entrepreneurial confidence and perseverance are effected when business failure occurred	.124	-.030	-.395			
H4	Are you good at establishing work network or business network	.144	-.119	-.358			
total variance explained	Initial eigenvalues	6.231	1.573	1.366	6.228	1.570	1.280
	%of Variance	44.506	11.239	9.754	51.903	13.079	10.665
	Cumulative %	44.506	55.744	65.499	51.903	64.982	75.647

Notes: Extration Method: Principal Component Analysis.
　　　Rotation Method: Varimax with Kaiser Normalization.
　　　a. Rotation converged in 5 iterations.

2.1.3 Reliability and validity

Basic reliability and validity analysis is carried out after the structure of 12 indexes 3 factors has been determined. In this study, the overall Cronbach alpha coefficient is 0.915, and Cronbach alpha coefficients of each index and dimension are high, that is to say, the samples data has high reliability. Construct validity is measured by factor's variance contribution to the dimension by the method of principal component analysis, the larger value reflects the greater contribution to dimension, generally speaking, it should be more than 40% (Yi Danhui, 2008). As the Table 4 shows, structural validity of three dimensions is acceptable.

Table 4　Reliability and Validity

dimension	item	descriptive statistics		Cronbach alpha		construct validity
		mean	standard deviation	Cronbach alpha if item deleted	Cronbach alpha	%of variance
innovation	C1	2.548	.812	.931	.940	80.758
	C2	2.330	.878	.928		
	C3	2.314	.886	.921		
	C4	2.340	.899	.923		
	C5	2.528	.837	.930		
tenacity	J1	2.828	.573	.795	.833	67.340
	J2	2.957	.582	.751		
	J3	2.835	.655	.753		
	J4	2.822	.631	.851		
cooperative	H1	2.512	.685	.849	.829	75.695
	H2	3.050	.553	.701		
	H3	3.162	.573	.751		

2.2 Confirmatory factor analysis

Confirmatory factor analysis to the measurement model of 12 indexes 3 factors is carried out with AMOS 7.0 software, which is constructed according to the results of above exploratory factor analysis. Confirmatory factor analysis includes the reliability and validity of the measurement model and the fitting validity between measurement model and samples data.

The measurement model test is aimed to the relationships between latent variables and observed variables (or indexes), i.e. the internal structure reliability and validity of the measurement model. The measuring variances of observed variables are little, that is to say, the degree of data variation is small. Observed variable will have good reliability when its standardized loading coefficient on the corresponding factor is greater than 0.7, and in this study, the standardized loading coefficients of the indexes are greater than 0.7 except J4 index of 0.577, and the statistics test are significant (shown in Figure1). The squared multiple correlations of indexes are good except J4 index of 0.345, therefore, the explaining of indexes is good (shown in Figure 1).
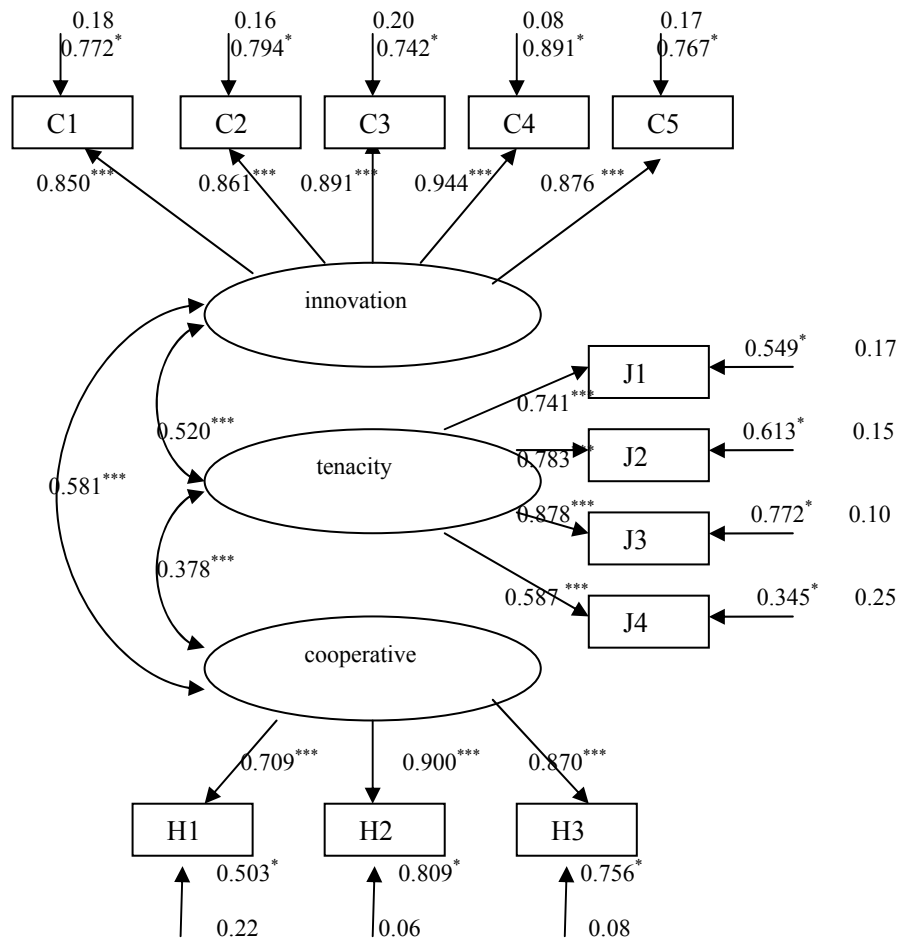

Figure 1　Measurement Model

Notes:
*** indicates that standardized loading coefficient of the index and standardized correlation coefficient of two latent variables , significant at 1%.
* indicates squared multiple correlations.

The latent variables will have good reliability when whose Combination Reliability (CR) are greater than 0.7. As shown in Table 5, CR value of three latent variables are greater than 0.8 .Construct validity includes convergent validity and discriminant validity. The value of Average Variance Extracted (AVE) represents the degree that variance of observed variables are explained by relevant latent variables. When AVE is more than 0.5, the latent variable will have good convergent validity. And if either square root of AVE of two latent variables is greater than their correlation coefficient, then the two latent variables will have good discriminant validity. Therefore, as shown in Table 5, the latent

variables have good construct validity.

Table 5   AVE and Correlation Coefficient of Factors

factor	innovation	tenacity	cooperative	AVE	CR
innovation	0.863[*]			0.745	0.936
tenacity	0.520[***]	0.747[*]		0.558	0.832
cooperative	0.581[***]	0.378[***]	0.877[*]	0.767	0.909

Notes:* indicates square root of AVE.

*** indicates standardized correlation coefficient between two latent variables, significant at 1%.

In order to verify the results of exploratory factor analysis, the measurement model of 12 indexes 3 factors is fitted with samples data, specific fit indices are shown in Table 6, the measurement model is fitted with samples data very well ,and verify that the structure of three dimensions is reasonable which results from the second round exploratory factor analysis. The measurement model of 11 indexes 3 factors also is fitted with data, after J4 index deleted because whose factor loading is 0.587and Squared Multiple Correlations is only 0.345.Howerever, fit indices are not improved well, RMSEA from 0.075 of model with 12 indexes rose to 0.081 of model with 11 indexes, and the fitting indices are not much improved (shown in Table 6).Therefore, the measurement model of 12 indexes 3 factors is thought more reasonable.

Table 6   Fit Indices of Measurement Model

	absolute fit indices		relative fit indices					parsimonious fit indices		
	χ^2/df (CMIN/DF)	RMSEA	GFI	NFI	CFI	IFI	RFI	PNFI	PCFI	PRATIO
optimal standard	< 3	< 0.08	> 0.9	> 0.9	> 0.9	> 0.9	> 0.9	> 0.5	> 0.5	> 0.5
critical value	< 5	< 0.1	> 0.8	> 0.8	> 0.8	> 0.8	> 0.8			
model of 12 indexes	2.672	.075	.929	.949	.968	.968	.934	.734	.748	.773
model of 11 indexes	2.971	.081	.931	.953	.968	.968	.936	.710	.722	.745

3 Entrepreneurial Competence Evaluation

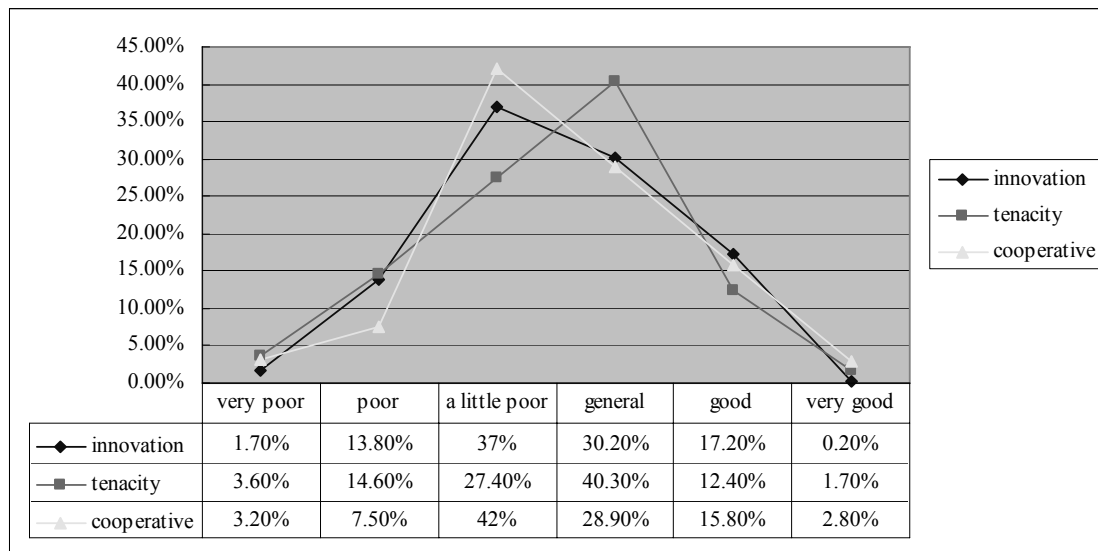|	very poor	poor	a little poor	general	good	very good
innovation	1.70%	13.80%	37%	30.20%	17.20%	0.20%
tenacity	3.60%	14.60%	27.40%	40.30%	12.40%	1.70%
cooperative	3.20%	7.50%	42%	28.90%	15.80%	2.80%

Figure 2   The Scores of Factors

The measurement model of 12 indexes 3 factors with good reliability and validity is thought more reasonable after the above two phase of factor analysis. Three factors of innovation, tenacity and cooperative are extracted and calculated by factor analysis base on all 603 samples. The scores of

factors are divided into groups according to the following criteria: very good ($2<X\leq3$), good ($1<X\leq2$), general ($0<X\leq1$), a little poor ($-1<X\leq0$), poor ($-2<X\leq-1$) and very poor ($-3<X\leq-2$), the results are shown in Figure 2.

The undertaking ability of self-employed individuals are shown in Figure 2 generally: there is great similar in distributions of factors of innovation, tenacity and cooperation. The distributions are like normal distribution very much: the number of very good and good are little, that is to say, there is few individuals with outstanding creativity, tenacity and cooperative, and the number of very poor and poor are also not much. Generally speaking, the undertaking ability of most individuals is in low level. The mean value of innovation ability and cooperative ability are both in a little poor level, and that of tenacity is in general level, therefore, among the three abilities, tenacity is stronger than innovation and cooperative according to their general distributions.

4 Conclusion

Entrepreneurial competence is a concept very complex and vague. In entrepreneurial capacity evaluation index system, the indexes should be different for different objects who complete different types of work. Therefore, trying to design a comprehensive and reasonable evaluation index system which can be applied to all types of entrepreneurs is very difficult. For entrepreneurs with small scale business like the self-employed, this study provides a more objective, simple and easy operation evaluation index system, and although this scale is not comprehensive, it contains the main features of the pioneering capacity. The measurement model of 12 indexes 3 factors has been verified reasonable with good reliability and validity after the above two phase of factor analysis. As far as pioneering capacity evaluation index system is concerned, this paper is explored preliminary in China and is aimed to the self-employed the first time. However, for the index and dimension, there is still a great space to further exploration and improvement in the future. In addition, it is founded in this study that five classifications used for each index may not reach better precision, so 10 classifications are suggested to take.

The research can make a certain contribution to the research on undertaking ability evaluation system theoretically and provide effective empirical basis for further research, it may have a significance reference both for small entrepreneurs and for enterprise managers. In addition, pioneering capacity evaluation index system also has important practical value for entrepreneurs because it can provide evaluation tools for entrepreneurs to measure and find out the existing vulnerable abilities which should be improved pertinently. Of course, it can also provide an effective evaluation tool for researchers to study entrepreneurial ability of groups in a region or the differences in different groups, or find groups bad in innovative, tenacity or cooperative, which also provide basis for the institutions such as government and relevant training institutions to make decisions.

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