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CONSTRUCT MODEL OF THE KNOWLEDGE-BASED ECONOMY INDICATORS

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ABSTRACT. ***While some research institutes and countries have proposed knowledge-based economy (KBE) indicators in recent years, the various KBE indicators often differ from one another. Thus, this study tries to use the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) to propose a construct model of the KBE indicators. Overall, the results show that the KBE indicators can be divided into five categories in order: information infrastructure, business environment, human resources, innovation system, and performance indicators. In detail, the number of components of these categories is 2, 2, 4, 2, and 2, respectively. After all, the large-scale KBE indicators can offer more information than other short-form ones; however this work suggests that the simple and efficient indicators for measuring the KBE competitiveness should be further developed.***

KEYWORDS: Confirmatory Factor Analysis (CFA), Exploratory Factory Analysis (EFA), Knowledge-based Economy (KBE), economic competitiveness.

JEL classification: D8, D4.

Introduction

As noted by OECD (1996), because of the innovative applications of information communication and technology (ICT), the knowledge instead of the land and capital has become the major driver for a country's competitiveness in the past decades. Notably, after the United States created the longest economic expansion in the 1990s, called the new economy paradigm, many countries have drafted the various KBE development plans to enhance the country's competitiveness. Thus, some research institutes and countries have proposed the various KBE indicators in recent years. Overall, these indicators can be divided into the following two categories:

First, the indicators focus on the knowledge innovation and proliferation ability. For example, "*Science, Technology and Industry Scoreboard: Benchmarking Knowledge-based Economies*" of OECD; "*The State New Economy Index*" of Progressive Policy Institute of the US (PPI); "*European Innovation Scoreboard*" of Commission of the European Community (CEC); "*Indicators on the New Economy*" of Ministry of Trade and Investment of Singapore (MTI); "*Knowledge-based Activities: Selected Indicators*" of Department of Industry, Science and Resources-Knowledge Based Economy Branch of Australia.

Second, the indicators involve other political economy measures, such as the transparency of government policy, degree of economic opening, soundness of banking system, and entrepreneurship of administrator. For example, "*Towards Knowledge-based Economy*" of APEC; "*Knowledge Assessment Measurement*" of World Bank (WB); "*National Knowledge Assessment*" of National Academy of Science of the US (NAC); "*The Competitiveness Indicators*" of Department of Trade and Industry of the UK (DTI); "*Information Society Index*" of Information Data Corporation (IDC); "*Innovation Index*" of Michael Porter and Scott Stern (MPSS).

While the various KBE indicators as noted above are available, these indicators often differ from one another. Thus, this work firstly revises and integrates the various KBE indicators. Then, use the EFA to extract some components from each category of the overall KBE indicators. Afterwards, use the CFA to propose a construct model of the KBE indicators.

Finally, this work tries to propose some conclusions and recommendations for future research.

1. Literature Review

1.1 The KBE Theory Development

As OECD (1996) describe the knowledge economy that the economic activities and systems that directly established in creation, circulation, and application of the knowledge and information. Owing to global environment fast vicissitude, Cowan and Gert (2000) considered that the focus of economy development had shifted from emphasizing on knowledge-based economy to centering on knowledge-driven economy, that is, the knowledge played an important role in promoting the national employment, production, and wealth. Thus, the new economy, the information economy, and the digital economy were thought of the knowledge economy to date. Overall, the implication of the KBE meant "positive feedback," "return of scale increase," and "the survival of the fittest, winning all take." In practice, the application of the KBE involved open and effective political economic environment, innovative entrepreneurship, educational human resources, and excellent information infrastructure.

According to the traditional macro-economic production function, Y=f (L, K, A, N), where L is the labor, K is the capital, A is the technology, and N is the institution. Because of slow capital accumulation, inactive production technology, and rigid political economic

institution, the labors played an important role in agricultural economy. As "*The Principle of Population*" in Malthus (1798) introduced the economic growth model that the capital, technology, and institution are assumed fixed. This theory clearly reflected the specialty of agricultural economic society. Moreover, "*The Wealth of Nations*" in Adam Smith (1776) proposed that the innovative technology that implied the knowledge accumulation significantly contributed to the economic development. Similarly, Ricardo agreed with this proposition that the innovative technology, the brand-new resources, and the excellent labors were essential in promoting economic development.

After the industrial revolution in the eighteen century, machinery instead of population greatly affected the economic development, that is, the focus of economic development shifted from the labor to the capital. As the neo-classical growth theory introduced by Solow (1956), emphasizing that the economic development finally depends on the technological progress. Put differently, the capital and technology were central to the industrial society; however the technology still be considered as exogenous variable. Afterwards, Romer *et al*. (1990) proposed the new-growth theory, namely the endogenous growth theory, focusing on the knowledge and technological progress. This theory proposed the following propositions: The technological progress that implies the new and non-rivalry knowledge application was not an exogenous variable and held the specialty of returns of scale increase; A higher the stock of the human capital implied a stronger the research and development ability. Whereas mastering the innovation specialty of the knowledge economy, the new-growth theory did not perfectly portray the knowledge economy intension.

In fact, as reviewed above, this work esteemed that the traditional economy was significantly different from the knowledge economy. While referring the advanced country's development experience like OECD members, the theory model of knowledge economy could be differentiated into three dimensions (i.e., input, process and output) and two aspects (i.e., the *ex ante* and the *ex post*). In detail, the *ex ante* meant the cause driven approach in assessing the national competitiveness. In contrast, *the ex post* meant the result driven approach. In any case, the result driven approach was easily observed more than the cause driven approach. While predicting the national competitiveness, the cause driven approach was better than the result driven approach. In contrast, while assessing the current national competitiveness, the result driven approach was better than the cause driven approach. Thus, this work integrated three dimensions and two approaches to construct the KBE theory model as shown in *Figure 1*.

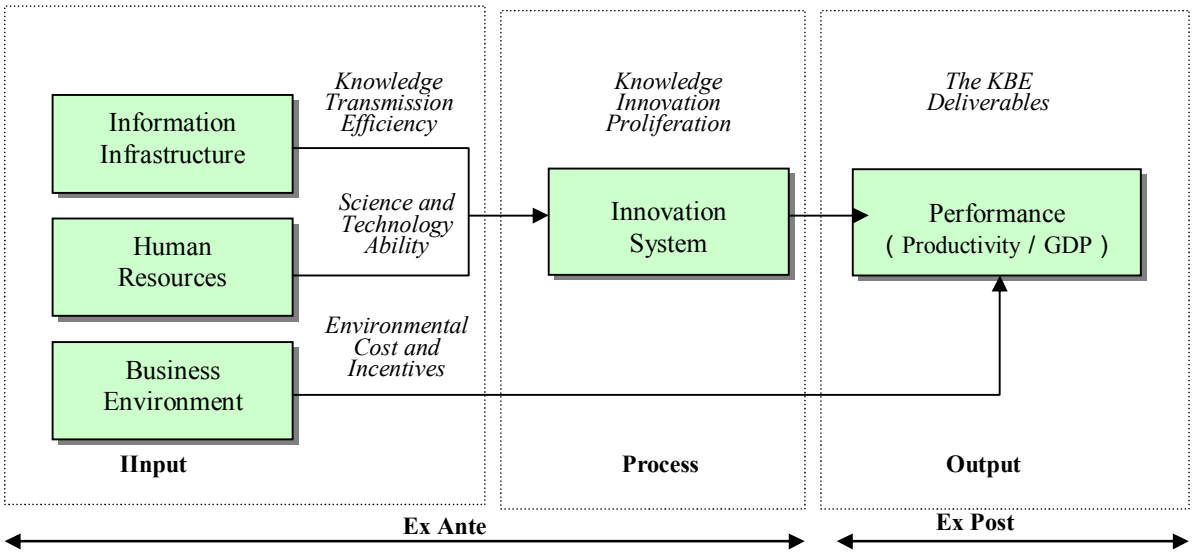


Figure 1. **Theory Model of the Knowledge-based Economy**

1.2 Comparison of Various KBE Indicators

For a long time, the economists usually argued how to precisely measure a country's economic performances. In fact, the popular traditional economy indicators like GNP and GDP often suffered from much critique because ignoring the environmental protection and social culture factors. Notably, many flaws of assessing a country's KBE competitiveness by the traditional economy indicators were available: lack the knowledge input-output function and the knowledge account in the traditional GNP or GDP indicators; lack the systemic, quantitative knowledge pricing database. Thus, measuring a country's KBE performances by the traditional economy indicators not only would face many challenges, but also could suffer from much critique.

Fortunately, after OECD (1999) issued the "*OECD Science, Technology and Industry Scoreboard: Benchmarking Knowledge-based Economies*", many countries or institutes had developed the various KBE indicators over the past years. For example, Asia-Pacific Economic Community, World Bank, Progressive Policy Institute of the US, Department of Trade and Industry of the UK, Commission of the European Community, Ministry of Trade and Investment of Singapore, Knowledge Economy Branch of Australia, Industry Analyses Branch of Australia, Ministry of Economic Development of New Zealand, National Academy of Scientific of the US, International Data Corporation, Michael Porter and Scott Stern, and Marketing Information Center of Taiwan. Overall, the various KBE indicators comparison was shown in *Table 1*.

Table 1. The Various KBE Indicators Comparison

Organization	Indices Description	Categories	Variables
Organization for Economic Co-operation and Development, 1999	Knowledge input, stock and flow of knowledge, knowledge output, knowledge network, knowledge learning	5	28
Progressive Policy Institute of the US, 1999	Industry and employment structure change, globalization, dynamics and competitiveness, information technical revolution, technological innovation ability	5	17
International Data Corporation, 1999	Computer, information, internet, society	4	23
Michael Porter & Scott Stern, 1999	Innovative construction, industry clusters, special innovative environment, connection quality	3	10
Marketing Information Center of Taiwan, 1999	Basic ability of information, information application ability, information regulation	3	12
Department of Trade and Industry of the UK, 2000	Human resources, science and technology innovation, information and communication application, business environment	4	41
Commission of the European Community, 2000	Human resources, knowledge creation, knowledge spread and application, innovative financial output and market	4	16
Knowledge Economy Branch of Australia, 2000	Structure change; knowledge output (i.e., the human capital and science and technology), knowledge proliferation (i.e., knowledge network, information infrastructure, Internet and e-commerce)	5	22
Ministry of Trade and Investment of Singapore, 2000	Enterprise's economic environment, information science and technology, innovation system, human resource development	4	15
Asia-Pacific Economic Community, 2000	Innovation system, information scientific and communication infrastructure, human resource development, business environment	4	24
World Bank, 2002	Business environment, innovation system, human resources system, information infrastructure, performance index	5	14(KAM-14) 69(KAM-69)

Note. KAM-14 means the standard edition; KAM-69 means the full edition.

As *Table 1* has shown, some indicators on knowledge competitiveness that proposed by the various institutes and countries has been developed in recent years; however these indicators were different from one another in indices description, measured categories, and measured variables. For example, OECD's indicators comprised twenty eight variables that were listed under five categories, such as knowledge input, knowledge output; stock and flow of knowledge, knowledge network, and knowledge learning. In contrast, the KBE indicators of APEC involved twenty four variables based on four clusters, such as innovation system, information scientific and communication infrastructure, human resource development, and business environment. Moreover, the IDC's indicators comprised twenty three variables based on four dimensions, such as computer, information, internet society. After all, the convergent measured categories of the knowledge economy over different KBE indicators were available, that is, the KBE indicators could be divided into the following five categories: business environment, innovation system, human resources, information infrastructure, and performance indictors. Overall, the composite KBE indicators were shown in *Table 2*.

Table 2. The Composite KBE Indicators

Business Environment	Innovation System	Human Resources	Information Infrastructure	Performance Indicators
1. Capital formation / GDP (W)	1. Science technology assessment (W.UK)	1. Adult's literacy rate (W.D)	1. Telephones per 1000 people (W.A.O)	1. Average annual GDP growth (W.PS)
2. Total budget deficit of central government / GDP (W)	2. FDI / GDP (W.A)	2. Secondary enrollment (W.A.O.EU.ST.D)	2. Mobile telephones per 1000 people (W.A.O.ST.D)	2. Manpower development index (W.A.UK)
3. Trade / GDP (W)	3. Royalty and license feed payments (W)	3. College enrollment (W.D)	3. Computers per 1000 people (W.A.ST.D)	3. Gender development index (W)
4. Tariff / non-tariff barriers (W)	4. Total expenditure of R&D / GNI (W.A.O.EU.ST.D.PS)	4. Primary pupil-teacher ratio (W)	4. TV set per 1000 people (W)	4. Poverty index (W)
5. Proprietary rights (W)	5. Tertiary enrollment (W)	5. Birth rate (W)	5. Radios per 1000 people (W)	5. Composite ICRG risk rating (W)
6. Regulation (W)	6. Researcher in R&D (W.A.O.D.PS)	6. Flexibility of people adapt to new challenge (W)	6. Daily newspapers per 1000 people (W.A)	6. Unemployment rate % of total labor force (W.A.UK)
7. Good protection system of intellectual property (W.PS)	7. Trade manufacturing industry / GDP (W)	7. Expenditure on education / GDP (W.D.PS)	7. Investment in telecoms / GDP (W)	7. Productivity growth % of GDP per person employed (W.ST)
8. Soundness of bank (W.A.UK)	8. Enterprise and university research cooperation (W.A.O.EU.PS.D)	8. Professional technical worker / labor force (W.A.O.US.EU.ST.PS)	8. Rating of computer processing power as % of total worldwide MIPS (W)	8. Knowledge-intensive industry exports ratio (UK)
9. Sufficient and complete monetary system (W)	9. Administrator's entrepreneurship (W.UK)	9. 8th grade achievement in mathematics (W)	9. Internet hosts per 1000 people (W.A.O.ST.D)	9. Industrial structure (UK)
10. Decree and supervision (W)	10. Number of science and technical journal articles per thousand people (W)	10. 8th grade achievement in science (W)	10. International telecommunication: cost of call to U.S.A. in 3 minutes (W.O.D)	
11. Local competitive environment (W.A.PS)	11. Administrative burden for start-ups (W.EU.ST)	11. National culture is open to foreign influence (W)	11. Information society index (W)	
12. Proprietary protection (W)	12. Availability of venture capital (W.O.EU.PS.US)	12. Extend of staff training (W.US.D)	12. E-government (W)	
13. Frame of the decree (W)	13. Patent applications granted by the USPTO per million people (W.US.EU.ST.D)	13. Management education is locally available in first-class business school (W)	13. ICT expenditure / GDP (W.O.EU.ST)	
14. Government's efficiency (W.A)	14. Hi-Tech exports / manufactured industry exports (W.A.EU)	14. Well educated people do not emigrate abroad (W)	14. Population to surf the internet / total people (A.US.EU.D)	
15. Voice and Accountability (W)	15. Private sector spending on R&D (W.A.O.US.EU.D.PS)	15. University education meets the needs of competitive economy (W)	15. Adds-value of business sector (O)	
16. Politics stability (W)	16. Government sector spending on R&D (EU)	16. Graduate's number of annual natural science (A)	16. Growth rate of the nature adds-value (O)	
17. Corrupt and control (W)	17. Service exports / GDP (A)	17. Relation between manager and staff (W)	17. ICT density (O)	
18. Press freedom (W)	18. Knowledge-intensive industry add-value / GDP (A.UK)		18. Price of computer hardware (O.D)	
19. Internationalized degree (A)	19. Technological alliance of inter-enterprises (D.EU.US)		19. E-commerce revenue (A)	
20. Degree of opening of trade investment (PS)	20. Medium and small manufacturing industry of start-ups (EU)			
21. Labor market (UK)	21. Market share of new products (EU)			
22. Quality of the life (UK)				
23. Transparency of enterprises (A)				

Notes: W=World Bank; O=OECD; A=APEC; US=Progressive Policy Institute of the US; UK=Department of Trade and Industry of the UK; EU=Commission of the European Community; D=Knowledge Economy Branch of Australia; ST=Ministry of Trade and Investment of Singapore; PS=Michael Porter and Scott Stern.

2. Method

As this review has shown, this work divided the KBE indicators into business environment, innovation system, human resources, information infrastructure, and performance indicator five categories. In addition to using the "*2002 World Development Indicator*" of the WB including 207 countries, this work applied the following methods: Firstly, revise and integrate the composite KBE indicators as shown in Table 2 to propose the overall KBE indicators as shown in *Table 3*. Then, use the EFA to extract some components from each category of the overall KBE indicators. Afterwards, use the second-order CFA to propose a construct model of the KBE indicators by LISREL 8.2. For this reason, the latent variables and observed variables in this work were assumed as follows: ξ_1 is the overall KBE index of latent independent variable. η_1, η_2, η_3, η_4, and η_5 are business environment, innovation system, human resources, information infrastructure, and performance indicators of latent dependent variables, respectively. The observed variables are the components extracted from the various categories of the overall KBE indicators as shown in *Table 3*.

Table 3. The Overall KBE Indicators

Business Environment	Innovation System	Human Resources	Information Infrastructure	Performance Indicators
e1. Gross Capital formation/GDP	1. Science technology assessment	h1. Adult literacy rate	t1. Telephones per 1000 people	p1. Average annual GDP growth
e2. Overall central government budget deficit/GDP	2. FDI / GDP	h2. Secondary enrollment	t2. Mobile phones per 1000 people	p2. Human development index
e3. Trade/GDP	3. Royalty and license fees payments	h3. College enrollment	t3. Computers per 1000 people	p3. Gender development index
e4. Tariff / non-tariff barriers	4. Total expenditure for R&D/GDP	h4. Primary pupil-teacher ratio	t4. TV set per 1000 people	p4. Poverty index
e5. Proprietary rights	5. Tertiary enrollment	h5. Birth rate	t5. Radios per 1000 people	p5. Composite ICRG risk rating
e6. Regulatory quality	6. Researcher in R&D	h6. Flexibility of people adapt to new challenge	t6. Daily newspapers per 1000 people	p6. Unemployment rate % of total labor force
e7. Protection system of intellectual property	7. Trade manufacturing industry / GDP	h7. Expenditure on education/GDP	t7. Investment in telecoms/GDP	p7. Productivity growth % of GDP per person employed
e8. Soundness of banks	8. Research cooperation between companies and university	h8. Professional and technical worker/labor force	t8. Rating of computer processing power as % of total worldwide MIPS	
e9. Sufficient and complete monetary system	9. Administrator's entrepreneurship	h9. 8th grade achievement in mathematics	t9. Internet hosts per 1000 people	
e10. Rule of law	10. Number of science and technical journal articles per thousand people	h10. 8th grade achievement in science	t10. International telecommunication: cost of call to U.S.A. in 3 minutes	
e11. Local competitive environment	11. Administrative burden for star-ups	h11. National culture is open to foreign influence	t11. Information society index	
e12. Proprietary protection	12. Availability of venture capital	h12. Extend of staff training	t12. E-government	
e13. Decree and supervision of financial institutions	13. Patent applications granted by the USPTO per million people	h13. Management education is locally available in first-class business school	t13. ICT expenditure/ GDP	
e14. Government effectiveness	14. Hi-Tech exports / manufactured industry exports	h14. Well educated people do not emigrate abroad		
e15. Voice and accountability	15. Private sector spending on R&D	h15. University education meets the needs of competitive economy		
e16. Political stability				
e17. Control of corrupt				
e18. Press freedom				

3. Results

Firstly, this work used the EFA to test the Cronbach's α coefficients as shown in *Table 4*. These coefficients of each category and the overall KBE indicators were 0.921, 0.876, 0.825, 0.760, 0.484, and 0.950, respectively, most closed to 0.7, indicating that the reliabilities of most categories except the performance indicators were acceptable. Moreover, the KMO and Bartlett's test as shown in *Table 5* were 0.742, 0.723, 0.739, 0.813, and 0.553, respectively, all reached 0.5 and implied that the reliabilities test was acceptable.

Then, the principal component analysis with the varimax rotation was used to extract the components that the eigenvalues were lager than one from each category of the overall KBE indicators. The extracted components of the overall KBE indicators were shown in *Table 6*.

Table 4. The Reliability Test for the KBE Indicators

	Business Environment	Innovation System	Human Resources	Information Infrastructure	Performance Indicators	Overall Indicators
No. of Items	18	15	15	13	10	68
Alpha (α)	.921	.876	.825	.760	.699	.950

Table 5. KMO and Bartlett's Test for the KBE Indicators

Factor Analysis		Business Environment	Innovation System	Human Resources	Information Infrastructure	Performance Indicators
KMO Measure of Sampling Adequacy		.742	.723	.739	.813	.553
Bartlett's Test	X^2	476.444	429.820	469.699	658.150	56.435
	df	153	105	109	91	21
	Sig.	.000	.000	.000	.000	.000

Table 6. The Extracted Factors of the KBE Indicators

Category	EFA		CFA	
	Components	Indicators	Coefficient	t-value
Business Environment	E1. Trade and Capital	e1, e3	.71	7.78**
	E2. Environmental Infrastructure	e2, e4 e5, e6, e7, e8, e9, e10, e11, e12, e13, e14, e15, e16, e17, e18	.71	7.49**
Innovation System	I1. Innovative Input	i1, i2, i3, i4, i6, i8, i9, i10, i11, i12	.63	3.35**
	I2. Initiative	i5, i7	.76	5.85**
Human Resources	H1. Education Investment	h1, h2, h3, h7	.62	4.45**
	H2. Manpower Structure	h4, h5, h14	.74	3.34**
	H3. Science Endowment	h8, h9, h10, h12	.49	3.37**
	H4. Attitude toward Competition	h6, h11, h13, h15	.51	4.98**
Information Infrastructure	T1. ICT Foundation	t3 ,t4 ,t5 ,t6 ,t7 ,t8 ,t9 ,t10 ,t11, t12 ,t13	.33	9.12**
	T2. ICT Investment	t7	.22	8.69**
Performance Indicators	P1. Manpower Development	p2, p3, p4	.78	5.98**
	P2. Employment & Productivity	p1, p5, p6, p7	.76	4.89**

In detail, the number of components of business environment, innovation system, human resources, information infrastructure, and performance indicators were 2, 2, 4, 2, and 2, respectively. The results in detail were as follows:

Business Environment. This category could be divided into two components: (1) Trade and capital comprised two indicators, that is, the trade as % of GDP and the gross capital formation as % of GDP; (2) Environmental infrastructure comprised sixteen indicators, such as government effectiveness, protection system of intellectual property, control of corrupt, rule of law, regulatory quality, local competitive environment, and press freedom etc. Overall, the coefficients relating two components to business environment were 0.71, and 0.71, respectively, and were significant at 0.05.

Innovation System. This category could be divided into two components: (1) Innovative input comprised twelve indicators, such as the science technology assessment, royal and license fees payments, total expenditure for R&D as % of GDP, tertiary enrollment, research cooperation between company and university, and the availability of venture capital etc. (2) Initiative comprised two indicators, that is, researchers in R&D and administrator's entrepreneurship. Overall, the coefficients relating two components to innovation system were 0.63, and 0.76, respectively, and were significant at 0.05.

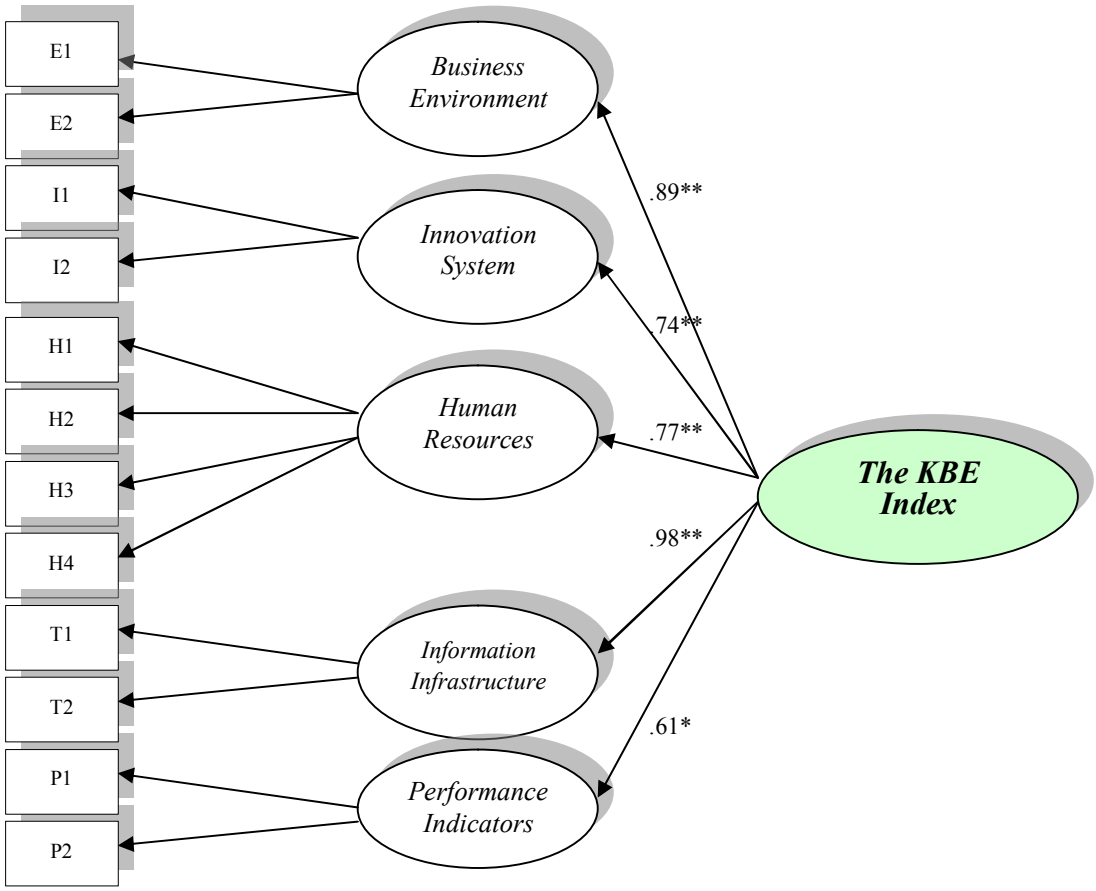
Human Resources. This category could be divided into four components: (1) Education investment comprised four indicators, such as the adult literacy rate, secondary enrollment college enrollment, and the expenditure on education as % of GDP; (2) Manpower structure comprised three indicators, such as the primary pupil-teacher ration, birth rate, and well educational people do not emigrate abroad; (3) Science endowment comprised four indicators, that is, the 8th grade achievement in mathematics, 8th grade achievement in science, the professional and technical worker as % of labor force, and the extend of staff training; (4) Attitude toward competition comprised four indicators, such as the flexibility of people adapting to new challenge, national culture opening to foreign influence, management education locally available in first-class business school, and university education meeting the needs of competitive economy. Overall, the coefficients relating four components to human resources were 0.62, 0.74, 0.49, and 0.51, respectively, and were significant at 0.05.

Information Infrastructure. This category could be divided into two components: (1) ICT foundation comprised twelve indicators, such as telephones per 1000 people, mobile phones per 1000 people, computers per 1000 people, radios per 1000 people, daily newspapers per 1000 people, internet hosts per 1000 people, international telecommunication cost, e-government, ICT expenditure as % of GDP, and information society index etc. (2) ICT investment referred to the investment in telecoms as % of GDP index. Overall, the coefficients relating two component to information infrastructure were 0.33, and 0.22, respectively, and were significant at 0.05.

Performance Indicators. This category could be divided into two components: (1) Manpower development comprised three indicators, that is, human development index, gender development index, and poverty index; (2) Employment and productivity comprised four indicators, such as the average annual GDP growth, the composite ICRG risk rating, unemployment rate as % of total labor force, and the productivity growth as % of GDP per person employed. Overall, the coefficients relating two components to performance indicators were 0.78, and 0.76, respectively, and were significant at 0.05.

The Overall Construct Model. Finally, this study used these extracted components of the various categories to propose a construct model of the KBE indicator as shown in *Figure 2*. In general, the KBE index could be divided into five categories: (1) Business environment comprised the trade and capital and environmental infrastructure two components; (2) Innovation system comprised the innovative input and initiative two components; (3) Human resources comprised the education investment, science endowment, manpower structure, and attitude toward open competition four components; (4) Information infrastructure comprised the ICT foundation and ICT investment two components; (5) Performance indicators

comprised the manpower development and the employment and productivity two components. All categories were significantly related to the KBE index at 0.05. The priority of information infrastructure (γ_{41}=0.98, t=9.89), business environment (γ_{11}=0.89 , t=9.77), and human resources (γ_{31}=0.77 , t=7.61) were over innovation system (γ_{21}=0.74 , t=6.36) and performance indicators (γ_{51}=0.61 , t=6.92).



Notes: *p<.05, **p<.01 ; $\chi 2$ (79) =378.88, P=.000, SRMR=.021

Figure 2. **The Construct Model of the KBE Indicators**

Discussion

This work uses the EFA and CFA to propose a construct model of the KBE indicators. To conclude, the findings and important conclusion are as follows:

In the construct model, the results show that the KBE indicators can be divided into five categories, the ranking orders are as follows: First, information infrastructure comprises two components such as the ICT foundation and ICT investment. Second, business environment comprises two components such as the trade and capital, and environmental infrastructure. Third, human resources comprise four components such as the education investment, manpower structure, science endowment, and attitude toward competition. Fourth, Innovation system comprises two components such as the innovative input and initiative. Fifth, performance indicators comprise two components such as the manpower development, and employment and productivity.

Moreover, this work reveals some implications for promoting national KBE

competitiveness:

First, construct a superior information infrastructure, such as integrating the private sector in e-business and the public sector in e-government that assists in developing an excellent e-Society help to enhance the national information competitiveness.

Second, construct an effective environmental infrastructure, such as improving the transparency of government decision and the regulation of local competitive environment, and calibrating the institution failure and the distorted resources.

Third, promote the human resources competitiveness, such as activating the rigid education system, cultivating and attracting the high-tech talents, and constructing a unique human resources policy that supports the domestic relevant industry development.

Fourth, construct an excellent innovation system, such as improving the lower ratio of domestic innovative R&D inputs and the proliferation of knowledge, adopting the necessary strategies that involve the tax concession or the credit policy, promoting the cooperative relationships between the various innovative institutions, and integrating effectively the innovative R&D resources.

Overall, while contributing much favorable reference for future study of the KBE measurement, this work is still in its infancy and is not without flaws, such as the sample size limitation. While this work uses the data selection that includes the list wise and pair wise deletion method, thereby avoiding the statistical biases owing to the missing data. However, the results may yield an improper solution while the sample size is decreasing. Thus, further work could use the other data selection approaches that can effectively increase the sample size, such as the substitution method, the dummy variable method, and the multiple imputation method.

Moreover, the alternative statistical tools (e.g. PLS) fitting to calibrate the small sample limitation should be further applied. Furthermore, because this work is a cross-sectional analysis, focusing on specific group by longitudinal analysis should be further considered. Likewise, the large-scale and elaborated KBE indicators could offer more information than other short-form ones, however considering cost and suitable and sound requirements, a simple, efficient, and substitute measurement for the KBE competitiveness should be further developed.

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ŽINIŲ EKONOMIKOS INDIKATORIŲ MODELIAVIMAS

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SANTRAUKA

Nors pastaraisiais metais tyrimų institutai bei įvairių šalių mokslininkai pasiūlė ne vieną žinių ekonomikos (ŽK) indikatorių rinkinį, bendrai juos įvertinus, ŽK indikatoriai tarpusavyje skiriasi. Todėl šio straipsnio autorius pasirinko dvi metodikas – aiškinamąją faktorinę analizę (AFA) ir patvirtinamąją faktorinę analizę (PFA) – o jų pagalba pasiūlė naują ŽK indikatorių konstruktą. Atlikus išsamią analizę, autorius suskirstė ŽK indikatorius į penkias prasmines grupes: a) informacijos infrastruktūrą, b) verslo aplinką, c) žmonių išteklius, d) inovacijų sistemą ir e) veiklos rezultatų; bei atliko jų koreliacinių ryšių paskaičiavimus.

REIKŠMINIAI ŽODŽIAI: patvirtinamoji faktorinė analizė (PFA), aiškinamoji faktorinė analizė (AFA), žiniomis grįsta ekonomika (ŽK), ekonomikos konkurencingumas.