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The study of intellectual Capital: OB/HRM perspective-

子計畫二：國家智慧資本、結構資本、與關係資本之理論初探

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子計畫二：國家智慧資本、結構資本、與關係資本之理論初探

摘要

本年度計畫之重點在於延伸個人過去於國家智慧資本之研究，從以往針對人力資本、市場資本、程序資本、更新資本與財務資本 40 個國家之簡單排序，展延至四種資本對於 GDP per capita (ppp) 之解釋力。亦即探討人力資本對於解釋市場資本、程序資本、更新資本與 GDP per capita (ppp) 關係之中介效果，程序資本對於解釋更新資本與 GDP per capita (ppp) 關係之中介效果。結果顯示，除了人力資本對於程序資本與 GDP per capita (ppp) 關係為部分中介之外，其餘均為完全中介。再者，程序資本亦完全中介更新資本與 GDP per capita (ppp) 之關係，而市場資本只部份中介更新資本與 GDP per capita (ppp) 之關係。進一步分析亦發現人力資本與市場資本、程序資本與更新資本，亦分別顯著的影響更新資本與 GDP per capita (ppp) 之關係、市場資本與 GDP per capita (ppp) 之關係。資料分析亦顯示程序資本與人力資本對於 GDP per capita (ppp) 有較佳之解釋力。

關鍵詞： 國家智慧資本、人力資本、市場資本、程序資本、更新資本、財務資本

**The study of intellectual Capital: OB/HRM perspective -
Project 2: Exploring theories that explain the accumulation of National
Intellectual Capital, Structural Capital and Relational Capital**

Abstract

Expanding from my first-stage national intellectual capital ranking, the focus of this year examines the power of each component capital in explaining a nation's financial performance and the mediating effect, moderating effect of various capitals. Data analyses basically confirm my hunches that human capital mediates the relationship between market capital/process capital/renewal capital and GDP per capita (ppp), although one is partial mediation. The mediation effect of process capital on the relationship of renewal capital and GDP per capita (ppp) is also confirmed. In addition, the interaction effect of human capital and market capital, process capital and renewal capital are uncovered. In conclusion, process capital and human capital has stronger explaining power in predicting the success of national financial performance.

Key words: National Intellectual Capital, human capital, market capital, process capital, renewal capital

Introduction

As stated in my proposal, in year 2007 - 2008, efforts will be spent to expand my previous findings of 40 countries national intellectual capital ranking, including human capital, market capital, process capital, renewal capital, and financial capital. Causal relationships, moderating or mediating effects will be explored in order to gain more insights, in addition to the previous simple index ranking. Method to be employed is mainly panel data analysis.

In the past, different authors have had different interpretations of national intellectual capital and adopted various dimensions in their research, although most of them based on the Skandia Navigator Model. Some researchers include financial dimension, some did not; some regard it as synonymous with knowledge assets (e.g., Malhotra, 2000), and some interpret it from an intellectual property perspective (ECE model - United Nations Economic Commission for Europe, 2003). This project proposes that national intellectual capital should contain five dimensions, namely human capital, market capital, process capital, renewal capital, and financial capital, based on the Input-Process-Output model. We maintain that national intellectual capital in a particular year should be the sum of intellectual capital inventory at a certain point of time and the on-going dynamic intellectual capital creation. In the proposed model, human capital is the input, market/process/renewal capitals are process, and financial capital is output. In addition, financial capital is also an input of the following year. Our rationale to adopt this five-capital model is because Input-Process-Output is a continuum that can capture the dynamic of intellectual capital creation better and more comprehensively represent the value of national intellectual capital. In what follows, the essence of each component capital at the national level is briefly explained.

The first type of national capital, *human capital*, constitutes a population's total capabilities as reflected in education, knowledge, experience, motivation, intuition, entrepreneurship and expertise, all of which are the key success factors in creating a competitive edge in the present and the future (Pasher and Shachar, 2007). This capital lies at the crux of intellectual capital and is the most important link in the process of value creation. In other words, embedded in capabilities, expertise and wisdom of the people, human capital provides the resources for the development and cultivation of other areas of intellectual assets and functions better together with

elements of other capitals (Malhotra, 2000; Pasher and Shachar, 2007).

The second type of national capital, *market capital*, refers to the general assets embodied in the nation's relationship with the international market and is similar to external networking and social capital in a micro setting in that it represents a country's capabilities and successes in providing an attractive, competitive incentive in order to meet the needs of its international clients, as well as national loyalty and the satisfaction expressed by strategic partners and brands (Bontis, 2004; Pasher and Shachar, 2007).

The third type of national capital, *process capital*, comprises the non-human source of knowledge in a nation. Embedded in a country's infrastructure, information systems, hardware, and software, these sources facilitate the creation, accessibility, and dissemination of information. In addition, government efficiency, intellectual property rights protection, and the availability of capital are also issues of concern. Such structural assets sustain and increase the output of human capital (Pasher and Shachar, 2007)

The fourth type of national capital, *renewal capital*, refers to nation's capabilities and real investments in research and development, patents, trademarks, start-up companies in order to increase its competitive strength in enhancing the capability for innovation, future markets and future intellectual wealth that sustains a nation's competitive advantage. (Pasher and Shachar, 2007). The fifth type of national capital, *financial capital*, is most commonly represented by GDP of a nation. Indicators adopted in this project are listed in Table 1.

Table 1 Variables included in each type of capital

Human Capital index	Market capital index
1. Skilled labor*	1. Corporate tax*
2. Employee training*	2. Cross-border venture*

3. Literacy rate 4. Higher education enrollment 5. Pupil-teacher ratio 6. Internet subscribers 7. Public expenditure on education	3. Culture openness* 4. Globalization* 5. Transparency* 6. Image of country* 7. Exports & imports of services
Process capital index	Renewal capital index
1. Business competition environment* 2. Government efficiency* 3. Intellectual property right protection* 4. Capital availability* 5. Computers in use per capita 6. Convenience of establishing new firms* 7. Mobile phone subscribers	1. Business R&D spending 2. Basic research* 3. R&D spending/GDP 4. R&D researchers* 5. Cooperation between universities and enterprises* 6. Scientific articles* 7. Patents per capita (USPTO + EPO)

Remark:

- Financial capital is the logarithm of GDP per capita adjusted by purchasing power parity.
- Variables marked with an asterisk are rated qualitatively using a scale of 1–10.

Methods of the first year project

Sample and data

Data set utilized in this year was compiled from my first-stage national intellectual capital study, covering 40 countries data based on IMD World Competitiveness Yearbook from 1994 – 2005. To have a time lag effect, the criterion variable (dependent variable) used in this study is the most updated 2007 GDP per capita (ppp) (<https://www.cia.gov/>).

Method and Results

In the first year (2007-2008), based on my first-stage intellectual capital research results, I have derived the following hypotheses stated in the proposal. Since most of

the hypotheses explore the mediation effects of various capitals, I adopted the 3-step mediation regression testing. As exhibited in Table 2, data analyses of 40 studied countries indicate that human capital fully mediates the relationship of market capital/renewal capital and 2007 GDP per capita (ppp) (H1 & H3) and partially mediates the relationship between process capital and 2007 GDP (H2). Process capital fully mediates the relationship between renewal capital and 2007 GDP (H4); market capital partially mediates the relationship between renewal capital and 2007 GDP (H5); the interaction of human capital and market capital has a significant influence on the relationship between renewal capital and 2007 GDP (H6); and the interaction of process capital and renewal capital has a significant influence on the relationship between market capital and 2007 GDP (H7). In other words, summarized hereunder, all the hypothesized relationships have been confirmed, except that H2 and H5 are partially confirmed.

H1: A nation's human capital mediates the relationship between market capital and financial capital. (accepted)

H2: A nation's human capital mediates the relationship between process capital and financial capital. (partial mediation)

H3: A nation's human capital mediates the relationship between renewal capital and financial capital. (accepted)

H4: A nation's process capital mediates the relationship between renewal capital and financial capital. (accepted)

H5: A nation's market capital mediates the relationship between renewal capital and financial capital. (partial mediation)

H6: The interaction of a nation's human capital and market capital will affect the relationship of renewal capital and financial capital. (accepted)

H7: The interaction of a nation's process capital and renewal capital will affect the relationship of market capital and financial capital. (accepted)

In addition to the hypothesis testing, a step-wise regression analysis of four component capital (human capital, market capital, process capital, and renewal capital) against 2007 GDP per capita (ppp) is also employed in Model 12. The result clearly indicates that process capital has the best explaining power and human capital has the second best explaining power of a nation's financial performance.

Table 2 Results of Hypotheses Testing through Regression Analyses

Variables	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007	2007
	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP	GDP
	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model
	1	2	3	4	5 (H1)	6 (H2)	7 (H3)	8 (H4)	9 (H5)	10 (H6)	11 (H7)	12
Human Capital	.857***				.762***	.398*	.815***					.398*
Market Capital		.584***			.181				.340**		.240	.067
Process Capital			.869***			.512**		.803***				.512**
Renewal Capital				.737***			.051	.080	.599***	.261		.063
HC x MC										.639***		
PC x RC											.647***	
Total R ²	.735***	.341***	.755***	.544***	.758***	.786***	.736***	.757***	.640***	.725***	.641***	.786***
△R ²	.728***	.324***	.749***	.532***	.745***	.774***	.721***	.744***	.621***	.710***	.621***	.744***

*p<.05 **p<.01 ***p<.001

Conclusion of the first year project

Expanding from my first-stage national intellectual capital ranking, the focus of this year examines the power of each component capital in explaining a nation's financial performance and the mediating effect, moderating effect of various capitals. Data analyses basically confirm my hunches that human capital mediates the relationship between market capital/process capital/renewal capital and GDP per capita (ppp), although one is partial mediation. The mediation effect of process capital on the relationship of renewal capital and GDP per capita (ppp) is also confirmed. In addition, the interaction effect of human capital and market capital, process capital

and renewal capital are uncovered.

In conclusion, process capital and human capital has stronger explaining power in predicting the success of national financial performance.

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