Chapter 2
Background of National Intellectual Capital

Intellectual capital, the source of the competencies and capabilities deemed essential for national economic growth, human development, and quality of life (Malhotra 2003), have been attracting an increasing amount of attention. Particularly, the results of national level intellectual capital studies and ranking provide a direction for nations to benchmark and to make wise decisions in the effective investment of national intangible assets and their development in the era of the knowledge economy. This chapter first describes the motivation for writing and publishing this book and the national intellectual capital models that are currently in use; this is followed by the obstacles that hinder the measurement of national intellectual capital, and then a presentation of the measurement framework proposed in this book.

Motivation for Writing This Book

Although intellectual capital (IC) has held the world's attention for over a decade, it still remains at concept promotion, measurement, and valuation mostly at the micro-organizational level and mainly discussed in academic or management consulting circles. Linkage between the value of an intangible asset and how to quantify it or benchmark it is still tenuous, not to mention easily misunderstood by a layman for guiding better decision making. With the belief that numbers talk and statistics hide valuable information, this book serves to present our research findings covering 14 years of intellectual capital information for 40 countries to the general public. Readers are invited to see their own world through the lens of this set of macro environment. Hopefully, by putting their own concerns in the national level intangible context, readers may be able to generate knowledge for better future decision making and for a more meaningful life.

The impetus for pursuing organizational level IC is for the reasons that although the traditional balance sheet provides the historic costs and assumes that the cost reflects the actual value of the asset, it does not, however, account for the hidden value inherent in intangible assets and does not provide effective future implications. As traditional financial resources, lands, and buildings can no longer fully

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represent corporate assets in the knowledge economy, managers of business enterprises have endeavored to understand and to find reliable ways to assess intangible knowledge assets for creating corporate competitiveness. Consequently, many models of IC measurement and valuation have been proposed at the organizational level (Bontis et al. 1999; Bontis 2001; Petty and Guthrie 2000; Sveiby 2002; Andriessen 2004). In other words, a key focus has been on metrics as well as innovations. Major accounting firms have come together to form the WICI – World Intellectual Capital Initiative (http://www.worldici.com), while the European Financial Analyst Association has published a special guide on how to report on IC (http://www.effas.com).

As intangible assets are important to private enterprise organizations, they should also be important in increasing the productivity and competitiveness of the public sector, the nation, and the region. Measuring national intangibles assists nations in diagnosing and benchmarking their competences and capabilities, as such assessments can facilitate the adoption of good policies and practices for a holistic national development.

Current National Intellectual Capital Measurement Models

Recognizing the importance of intangible assets, a number of national governments have launched national knowledge initiatives to develop measurement models and their own intellectual capital indicators for creating and sustaining national competitiveness. Declaring 1996 as the Year of Innovation, the Swedish government together with Stockholm University modified the Skandia Navigator at the national level to quantify Sweden's critical success factors (Spring Project 2002). Rembe (1999) examined the components of national attraction from the viewpoint of foreign investment in Sweden and proposed a strategic plan for the future development of Sweden's human capital, market capital, process capital and renewal capital. Israel identifies its hidden values and the key driving success factors along its 60 years of existence in different areas such as education, patents, the number of scientists engaged in research and development, international openness, the computer and its communication infrastructure (Pasher 1999; Pasher and Shachar 2007). Four accounting firms were invited to conduct a practice-oriented study of Netherlands' intangible assets. The Danish Agency for Trade and Industry sponsored the development of comprehensive intellectual capital indicators based on several Nordic and Danish companies' experiences; and the Norwegian government sponsored the development of a competence capital model including intellectual capital (Malhotra 2003). Furthermore, Bontis (2004) analyzed data of several Middle East countries and published a study of the national intellectual capital of the Arab Region.

In addition to national governments, several world development organizations such as the World Bank, the OECD and various United Nations agencies have proposed a variety of knowledge asset measurement models as well. These models were originally developed for industrial and agricultural economies, and focus on tangible

assets and structural assets. Nevertheless, some of these models have also been used to assess national growth in terms of investment (using a scale of 1–10 rather than objective quantitative data), describing input- and process-related measures and allowing assessment, comparison and benchmarking of individual national economies (OECD 2001; UNDP 2000; World Bank 2001). This book summarizes below several of the previous national intellectual capital models.

Measurements Proposed by Regional or World Development Organizations

Several world development organizations have joined in the effort to help countries make better resource allocation decisions by proposing various assessment models. Among these proposed models, the following three are the most well known.

The World Bank's Knowledge Assessment Methodology

The aim of the World Bank's Knowledge Assessment Methodology (KAM) is to illustrate and identify the problems and opportunities that a country encounters for policy reference to facilitate future investment. It can also be used to benchmark "how an economy compares with its competitors or countries it wishes to imitate" (World Bank 2002). A comprehensive tool for reviewing world development, KAM consists of 69 structural and qualitative variables classified into five dimensions as indicated in Table 2.1. Four of these are considered decisive in the development of a knowledge-based economy, while the fifth tracks its overall performance. They include economic and institutional regime, education and skilled human resources, dynamic information infrastructure, and efficient innovation system. Using "standard" scorecards, 14 out of the 69 variables were compiled to capture the essence of a country's preparedness for developing a knowledge-based economy.

Table 2.1 Variables of the "standard" scorecards

Economic and institutional regime	**Education and skilled human resources**
1. Tariff and non-tariff barriers	1. Adult literacy rate
2. Property rights	2. Secondary enrollment
3. Regulation	3. Tertiary enrollment
Dynamic information infrastructure	**Efficient innovation system**
1. Telephones per 1,000 persons	1. Researchers in R&D
2. Computers per 1,000 persons	2. Manufacturing trade as percentage of GDP
3. Internet hosts per 1,000 persons	3. Scientific and technical journal articles per million people
Performance indicators	
1. Average annual GDP growth	
2. Human development index	

Source: World Bank (2002)

OECD Measurement Models

The OECD regards inputs – rather than outputs – as being of greater significance when measuring national intellectual capital (Malhotra 2003). According to the OECD, although measuring knowledge assets presents a challenge, a gross indicator may contain the following:

1. Public and private spending on higher education
2. Expenditure on R&D
3. Investment in software in terms of percentage of GDP investments

This model regards inputs rather than outputs as significant when measuring national intellectual capital (Malhotra 2003). In other words, the more a country invests in its higher education, in R&D, and in software, the more intellectual capital it has.

As the value of measurements based on investments in input resources has been called into question at the firm level because of their apparent constraints, researchers at the national level have started to shift their attention away from the amount of financial investment or financial input and toward the way that people manage and utilize these inputs (Collins 2001; Malhotra 2003; Carr 2003; etc).

United Nations Economic Commission for Europe Model

Another model proposed by a world development organization is the ECE Model developed by the United Nations Economic Commission for Europe (ECE). With the objective of facilitating the innovation and commercialization of knowledge assets, the model (United Nations Economic Commission for Europe 2003) inspects:

1. The existing practices and methodologies for valuing intellectual assets (inventions)
2. Intellectual property rights (patents)
3. The valuation of managerial flexibility
4. The stock market valuation of companies
5. R&D project valuation

This model provides a holistic view of the sustainable innovation process, focusing in particular on the valuation of intellectual property rights. Since innovation is closely linked to human resources, governments have gradually begun to provide more support for human resources development and the ongoing adaptation of institutional, information and innovation systems, realizing that the innovation and technological capabilities of a country are correlated with long-term growth and social progress.

National Intellectual Capital Models Proposed by Individual Researchers

The intellectual capital concept was promoted by Edvinsson and Malone (1997) through the illustration of the Skandia Navigator Model based on their observations of the differences between accounting value and market value as a possible basic source of competitive advantages to companies. National intellectual capital consists mainly of applications of business models translated to individual nations. Since intellectual capital has been recognized as underpinning and fueling a nation's growth, its research on the national level has recently emerged as a new area of study with the main focus on understanding and measuring the intangible factors influencing the creation of national wealth (Stähle and Pöyhönene 2005). Numerous efforts have been made by establishing formal, systematic measurement criteria to document and report progress according to key factors that under-gird the prosperity of a given nation. Table 2.2 has summarized recent works of such endeavors.

Although the concept of intellectual capital has been extended from a micro-organizational level to the macro-national and regional levels, the absence of a

Table 2.2 Dimensions and nature of indicators for measuring national intellectual capital

Country/researcher	General basic model	Dimensions	Nature of indicators
Sweden (Rembe 1999)	Skandia Navigator	• Human capital • Market capital • Process capital • Renewal capital	• Financial indicators • Descriptive indicators
Malaysia (Bontis et al. 2000)	Skandia Navigator	• Financial wealth • Human capital • Market capital • Process capital • Renewal capital	• Descriptive indicators • Intangible indicators • Financial indicators
Sweden (Spring Project 2002)	Skandia Navigator	• Business recipe • Human capital • Structural capital • Relational capital	• Innovation indicators • Competence indicators • Industrial indicators • Company–universities indicators
Madrid, Spain (Pomeda et al. 2002)	Skandia Navigator	• Human capital • Organizational capital • Technological capital • Relay capital • Social capital	• Descriptive indicators • Intangible indicators • Innovation indicators
EU Countries (Bounfour 2003)	IC-dVAL Approach	• Resources • Processes • Outputs	• Financial indicators • Descriptive indicators • Innovation indicators

(continued)

Table 2.2 (continued)

Country/researcher	General basic model	Dimensions	Nature of indicators
Arab Region (Bontis 2004)	Skandia Navigator	• Financial wealth • Human capital • Market capital • Process capital • Renewal capital	• Descriptive indicators • Intangible indicators • Financial indicators
Finland (Stähle and Pöyhönene 2005)	Skandia Navigator	• Human focus • Market focus • Process focus • Renewal & development focus	• Industrial indicators • National indicators • Financial indicators
Israel (Pasher and Shachar 2007)	Skandia Navigator	• Financial capital • Human capital • Market capital • Process capital • Renewal & development capital	• Financial indicators
EU Countries (Weziak 2007)	Skandia Navigator	• Human capital • Relational capital • Structural capital • Renewal capital	• Financial indicators • Descriptive indicators

Source: Revised from Pomeda et al. (2002)

recognized macro model and widely accepted methodologies indicate the need for more national-level studies. In spite of the relative consensus that has been reached regarding the measurement of a few categories of intangible assets such as patents and trademarks, the measurement systems are still limited in their ability to account for tacit knowledge assets (Malhotra 2000), as several obstacles have hindered the effective measurement of national intellectual capital.

Obstacles to the Measurement of National Intellectual Capital

Several obstacles have hindered the effective measurement of national intellectual capital, including: (1) the question of whether the translation of the models from the domain of business management to the national or regional level applies; (2) most national intellectual capital measurement models analyze existing data at the input and output level (Bounfour 2003); (3) the problem of trying to undertake a systematic collection of data without a comprehensive reference framework (Pomeda et al. 2002), and (4) comparison among countries is based on different quality criteria and different regional-national statistical systems, and these differences may result in inconsistencies in comparison and analysis (Klein 2000).

Many countries have adopted their own intellectual capital measurement for creating and sustaining national competitiveness as exhibited in Table 2.3. The merit of

Table 2.3 Intellectual capital indicators of five exemplary studies

	Swedish Government and Stockholm University	Israeli report by Pasher	Israeli report by Pasher and Shachar	Israeli report by Malhotra	Luxembourg
Human capital	Quality of life, average age expectancy, infant survival rate, smoking, education, level of education for immigrants, crime rate, age statistics	Advanced degrees, equal opportunities, women in the professional workforce, book publishing, museum visits, physicians in the medical system, alcohol consumption, crime	Highly skilled labor force, availability of scientists and engineers, female labor force, culture, health (life expectancy, physicians)	Education, equal opportunities, culture, health, crime	Population, other characteristics (e.g., birth rate, marriage rate), frontaliers, education, engineers and scientists, equal opportunity
Market capital	Tourism statistics, standards of honesty, balance of service, balance of trade, balance of trade for intellectual property	International events, openness to different cultures, language skills	Openness to globalization, global competitiveness indicator, flexibility and adaptability, resilience of economy, Nobel prizes	Providing solutions to market needs, international events, openness to different cultures, language skills	Termed as *Relational Capital*: fiscal environment, European institutions, playing the "National Card," erosion of national ownership

(continued)

Table 2.3 (continued)

	Swedish Government and Stockholm University	Israeli report by Pasher	Israeli report by Pasher and Shachar	Israeli report by Malhotra	Luxembourg
Process capital	Service-producing organizations, public consumption as a percentage of GDP, business leadership, information technology, survivors in traffic accidents, employment	Extent of internet use, software use, teaching effectiveness, freedom of expression, agriculture added-value, entrepreneurship and risk-taking, venture capital funds, immigration Absorption	Information technology skills, technological readiness and telecom services, personal computers, cellular subscribers, cyber security, quality of scientific research institutions, knowledge transfer, legal environment for entrepreneurship, number of days to start a business, ISO quality management system, agricultural productivity	Communications and computerization infrastructure, extent of internet use, circulation of daily newspapers, extent of software use, agriculture, management, top management international experience, entrepreneurship and risk taking, venture capital funding, employment Development of the service sector, immigration and absorption	Termed as *Structural capital*: information and communication technology, innovation and intellectual property, education and research institutions

Renewal capital	R&D expenses as a percentage of GDP, number of genuine business start-ups, trademarks, factors important to high school youth	Civilian R&D, scientific publications, biotechnology companies	Number of scientific publications, Israel's world share of science patents, university/industry research collaboration, number of patents, ICT-related patents, utility patents, biotechnology patents, total expenditure on R&D, national expenditure on civilian R&D, foreign investment in Israel, venture capital availability, entrepreneurship and start-up companies, capacity for innovation, entrepreneurship	National expenditure on civilian R&D, scientific publications in the world, registration of patents, work force employed in R&D, start-up companies, biotechnology companies	–
Financial Capital	Per capita GDP, national debt, the mean value of the US dollar	Dollar exchange rates, external debt, unemployment, sector productivity rates, exports by industry, inflation	GDP, external debt, labor market (ICT employment, employment and unemployment), industrial production by major branches, exports by industry, inflation	Gross domestic product (GDP), dollar ex change rate, external debt, unemployment, productivity within various economic sectors, breakdown of exports according to industries, inflation	–

Summarized by the authors based on the following sources: (1) http://www.entovation.com/whatsnew/ic-nations.htm, (2) http://info.worldbank.org/etools/docs/library/235909/s4_p1.pdf, and (3) Pasher and Shachar (2007)

such measurement development is that each country determines the indicators that suit its own characteristics and needs. The downside is that those indicators do not provide a framework for cross-country comparisons. For instance, Luxembourg's human capital has an indicator of *frontaliers*, because each working day more than 115,000 *frontaliers* cross national borders to their jobs in Luxembourg. This indicator may not apply to other countries. In addition, the number of indicators varies with respect to each type of capital, e.g., process capital has the largest number of indicators and market capital has the fewest indicators as exhibited in Table 2.3. With such variance, the representativeness of each component capital in the total intellectual capital measurement model will be somewhat skewed. Furthermore, some indicators are given, such as tourism statistics in market capital will be biased toward the countries with geographical wonders and bountiful cultural heritages; statistics for some indicators, such as "international events," may not be easily obtained or reliable in every country. In addition, some countries adopt a qualitative description rather than indicators, such as the use of Intellectual Capital Statements in Denmark. Therefore, consistency is a problem. Taking the IC of Israel as an example, three different groups of researchers conducted three studies, with each utilizing a different set of indicators as shown in Table 2.3.

Summary

All of the above-stated endeavors attempt to leverage the private sector's experience in measuring intangible assets to the macro level and increase the nations' wealth. However, the level of complexity involved makes it impossible to simply transplant micro models to the national level and thus, some measurement changes are needed. Despite the aforementioned problems and inconsistencies, the proliferation of relevant studies has enabled researchers to crystallize the core components of national intellectual capital. For instance, Table 2.2 indicates that national intellectual capital mainly consist of five components – human capital, market capital, process capital, renewal capital, and financial capital as the basis for a more comprehensive coverage. As a result, in Chap. 3, we will present a national intellectual capital measurement model comprised of 29 indicators that has been statistically validated and easy to replicate for cross-country comparisons and follow-up trend analysis.