

Knowledge Assets in the Global Economy: Assessment of National Intellectual Capital

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“Our government is filled with knowledge... We have 316 years' worth of documents and data and thousands of employees with long years of practical experience. If we can take that knowledge, and place it into the hands of any person who needs it, whenever they need it, I can deliver services more quickly, more accurately and more consistently.”

From “Knowledge Management: New Wisdom or Passing Fad?” in *Government Technology*, June 99

Abstract

This article has the following objectives: developing the need for assessing knowledge capital at the national economic level; review of a national case study of how intellectual capital assessment was done in case of one nation state; suggesting implications of use of such assessment methods and needed areas of advancement; and highlighting caveats in existing assessment methods that underscore the directions for future research. With increasing emphasis on aligning national information resource planning, design and implementation with growth and performance needs of business or nation, better understanding of new valuation and assessment techniques is necessary for information resource management policymakers, practitioners and researchers.

Keywords: National Intellectual Capital, Information Resource Management, Knowledge Capital, Intangible Assets, Structural Capital, Human Capital

Introduction

Emergence of the service society after the last world war brought increased realization of role of employees' knowledge and creativity in adding value to the company. Attempts to capitalize company investments in people on the balance sheet in the 1970s failed because of measurement problems. The subject gathered increased interest more recently in the 1990s, with the rapid emergence of information and communication technologies (ICT). As business processes became increasingly 'enabled' by large-scale information systems, information systems designers attempted to capture employees' implicit and explicit knowledge in “corporate memory” by means of intranets and other similar applications (Malhotra, 2000a, 2000b).

It was recognized, that in contrast to the knowledge of individual employees, such corporate memory does form part of a company's capital. Accordingly, “knowledge” has become a key production factor, however the financial accounts are still dominated by traditional factors of production, including buildings and machinery. Hence, there is an imperative need for developing an understanding of “knowledge capital”, or the so-called intangible assets. The topic is not only pertinent to individual enterprises, but also to national economies that are making a rapid transition to a society based on knowledge work. This article develops the case for assessment of national intellectual capital by drawing upon existing research, practice and a recent study of an Asian nation representative of countries making a transition from ‘developing’ to ‘developed’ status. The issues discussed herein are important for information resource management policymakers, practitioners and researchers for assessing their contributions in terms of new measures of performance. More importantly, as the world economies transition from the world of “atoms” to world of “bits,” they would be expected to plan, devise and implement information and knowledge management systems that provide differential advantage in terms of ‘intellectual capital.’

Knowledge Assets and Intellectual Capital

Traditional assessment of national economic performance has relied upon understanding the GDP in terms of traditional factors of production – land, labor and capital. Knowledge assets may be distinguished from the traditional factors of production – in that they are governed by what has been described as the ‘law of increasing returns’. In contrast to the traditional factors of production that were governed by diminishing returns, every additional unit of knowledge used effectively results in a marginal increase in performance. Success of companies such as Microsoft is often attributed to the fact that every additional unit of information-based product or service would result in an increase in the marginal returns. Given the changing dynamics underlying national performance, it is not surprising that some less developed economies with significant assets in ICT knowledge and Internet-related expertise are hoping to leapfrog more developed economies.

Despite increasingly important role of knowledge-based assets in national performance, most countries still assess their performance based on traditional factors of production. Today's measurement systems are limited in their capability to account for tacit knowledge embedded in the human resources, although there is some agreement on measuring other categories of knowledge, including patents and trademarks. However, the emerging knowledge economy is characterized by industries that are more knowledge intensive and by goods and products that are more intangible than they were in the post-industrial economy. Knowledge assets or intellectual capital may be described as the “hidden” assets of a country that underpin its growth, fuel its growth and drive stakeholder value. There is increasing realization about knowledge management as the key driver of national wealth, the driver of innovation and learning, as well as that of the country's gross domestic product (GDP). Increasing importance of knowledge assets and intellectual capital have been drawing greater attention of not only company CEOs, but also national policymakers, to non-financial indicators of future growth and performance.

Knowledge asset measurement relates to the valuation, growth, monitoring and managing from a number of intangible but increasingly important factors of business success. In the context of knowledge assets, knowledge represents the collective body of intangible assets that can be identified and is measurable. This interpretation of knowledge differs from the notion of knowledge as knowing and learning, which concerns how organizations acquire, share and use knowledge – either helped or hindered by technology and organizational processes. In contrast, the notion of knowledge assets is about the identifiable aspects of the organization that although “intangible” can be considered as adding some kind of value to it. Knowledge capital is the term given to the combined intangible assets that enable the company to function. Examples of such knowledge assets could include shared knowledge patterns and service capability and customer capability.

Assessment of Knowledge Capital and Intellectual Assets

The worth of knowledge assets, taking the difference between market and book values as a proxy, is hidden by current accounting and reporting practices. However, as evident from current valuations of many Net-based enterprises, one observes a significant widening gap between the values of enterprises stated in corporate balance sheets and investors' assessment of those values. The increasing proportion of intangible vis-à-vis tangible assets for most industrial sectors has been affirmed by various other observations (Edvinsson and Malone, 1997; Hope and Hope, 1997; Stewart, 1995). In case of major corporations, often such high market valuations are attributed to brands. Recent business history has shown that huge investments in human capital and information technology are the key tools of value creation that often do not show up on company balance sheets as positive values themselves.

Measurement of institutional or organizational value in the current business environment using traditional accounting methods is increasingly inadequate and often irrelevant to real value in today's economy. For instance, while traditional accounting practices often treat brand as depreciable entity over time, in today's economy, intangible assets like brands and trademarks often increase in value over time, often longer than the time periods accounted for their depreciation. Even, specific kinds of valuations of intellectual capital, such as patents, copyrights and trademarks are not valued according to their potential value in use, but recorded at registration cost. Similarly, the distinction between assets and expenses is made arbitrarily on many balance sheets: an advertising campaign could be recorded in either column as evident from a case such as that of AOL. The traditional balance sheet, a legacy of last five centuries of accounting practices, provides a picture of *historic* costs, assuming that the cost of purchase reflects the actual value of the asset. However, it does not account for the hidden value inherent in people's skill, expertise and learning capabilities, the value in the network of relationships among individuals and organizations or the structural aspects relevant to servicing the customers. These hidden values or intangible assets assume increasingly important role in an economy that is characterized by a transition from 'programmed' best practices to 'paradigm shifts' that characterize the new business world of 're-everything' (Malhotra, 2000c). Such factors are assuming greater importance in assessment of the potential for future growth of an enterprise or a national economy.

This issue is compounded by an apparent paradox: the more a company invests in its future, the lesser is its book value [although the recent astronomical caps for various Net-related stocks suggest increasing realization about intangible assets]. Extrapolating the case of such companies to the organizations within a national economy, one may understand the implications for accounting for intangible assets that do not show up in accounting reports, but may underpin their future success or failure.

Valuation from the perspective of intellectual capital and knowledge assets takes into consideration not only financial factors, but also human and structural factors (Stewart, 1997). Stewart defines intellectual capital as the intellectual material that has been formalized, captured, and leveraged to create wealth by producing a higher-valued asset. Intellectual capital is defined as encompassing: i) human capital; ii) structural capital; and iii) relational capital. These aspects of intellectual capital include such factors as strong business relationships within networked partnerships, enduring customer loyalty, and employee knowledge and competencies. The compelling reasons for valuation and measurement of intellectual capital and knowledge assets include understanding where value lies in the company and the sectors of the national economy and for developing metrics for assessing success and growth of companies and economies.

Measuring Knowledge Assets and Intellectual Capital

Managers of enterprises and national economies are trying to find reliable ways for measuring knowledge assets to understand how they relate to future performance. The expectation from finding reliable measures of knowledge assets is that such measures can help managers to better manage the intangible resources that increasingly determine the success of the enterprises and economies.

The terms knowledge capital and intellectual capital are used synonymously in this article. Within the scope of subsequent discussion, such terms refer to "the potentiality of value as it exists in various components or flows of overall "capital" in a firm; the relationships and synergistic modulations that can augment the value of that capital; and the application of its potential to real business tasks... [it] includes an organization's unrefined knowledge assets as well as wealth generating assets whose main component is knowledge" (Society of Management Accountants of Canada 1999, p. 17).

One may observe that it is the application of intellectual capital to practical situations that contributes, primarily, to the translation of its potential value to financial assets. Or as observed by Stewart (1997, p. 67): "Intelligence becomes an asset when some useful order is created out of free-floating brainpower – that is, when it is given coherent form (a mailing list, a database, an agenda for a meeting, a description of a process); when it is captured in a way that allows it to be described, shared, and exploited; and when it can be deployed to do something that could not be done if it remained scattered around like so many coins in a gutter." Unless effectively utilized and applied, knowledge assets may not necessarily yield any returns in terms of financial performance measures. In other words, "knowledge assets, like money or equipment, exist and are worth cultivating only in the context of strategy... you cannot define and manage intellectual assets unless you know what you are trying to do with them" (Stewart 1997). [For instance, a detailed account of how knowledge management is relevant to e-business strategy and performance is presented in a forthcoming article (Malhotra 2000c).]

The subsequent discussion reviews the case of an Asian nation state that utilized one of the more popular methods for assessment of its national intellectual capital. Concluding discussion will highlight the existing caveats in the adopted methodology and underscore the important issues that need to be addressed in future research and practice.

Knowledge Capital of a Nation State: The Case of Israel

The nation state of Israel, having been classified as an industrialized nation in April 1997, represents an interesting case study for both less developed countries as well as industrialized nations. Having bridged this gap over its recent past, it provides a vantage point for understanding the transition from both sides of the industrial divide. Since 1950, Israel's economy has grown 21-fold resulting in overall rapid development resulting in significant growth in per capita income and an exponential increase in the number of hi-tech start-up companies. These developments have occurred despite a population growth of 330% and periodic wars that have impacted the region's economies.

A popular method of assessment of intellectual capital originally proposed by the Swedish company Skandia was recently applied to a joint Swedish-Israeli study that examined how to assess Israel's intellectual capital. The study represented the first attempt to document Israel's core competencies, key success factors and hidden assets that provide comparative advantage and high potential for growth. The study compared Israel with other developed countries, [not developing countries] since the objective was to assess the country's ability to compete with other industrialized nations in the global economy. The study aimed to develop an assessment of intellectual capital of the country, which along with the more traditional focus on financial capital, could help in an integrated and comprehensive view of the nation's assets as well as its potential for future growth. The study used Skandia's model for measuring intellectual capital, a model that had been earlier used for developing the Intellectual Capital Balance Sheet for Sweden.

Skandia Model for Measuring Intellectual Capital

In Skandia's view, intellectual capital denotes intangible assets including customer/market capital; process capital; human capital; and renewal and development capital. The value of intellectual capital is represented by the potential financial returns that are attributable to these intangible or non-financial assets.

The Skandia model attempts to provide an integrated and comprehensive picture of both financial capital and intellectual capital. Generally, the national economic indicators supported by hard quantitative data are used for examining the internal and external processes occurring in a country. However, the model questioned if such indicators provided a full and accurate assessment of the country's assets and if they provide an indication of its potential for future growth. In doing so, it developed the framework of intellectual capital as a complement of financial capital.

In this model, there are four components of intellectual capital: market capital (also denoted as customer capital); process capital; human capital; and renewal and development capital. While financial capital reflects the nation's history and achievements of the *past*; intellectual capital represents the hidden national potential for *future* growth. The value chain according to Edvinsson and Malone (1997, p. 11) expresses the various components of market value on the basis of the following model:

Market Value = Financial Capital + Intellectual Capital

The key determinants of hidden national value, or national intellectual capital, are human and structural capital, defined thus:

$$\text{Intellectual Capital} = \text{Human Capital} + \text{Structural Capital}$$

Human Capital: The combined knowledge, skill, innovativeness, and ability of the nation's individuals to meet the tasks at hand, including values, culture and philosophy. This includes knowledge, wisdom, expertise, intuition, and the ability of individuals to realize national tasks and goals. Human capital is the property of individuals, it cannot be owned by the [organization or] nation.

Structural Capital: Structural capital signifies the knowledge assets that remain in the company when it doesn't take into consideration human capital that is the property of individual members. It includes *organizational capital* and *customer capital* [also known as *market capital*]. Unlike human capital, structural capital can be owned by the nation and can be traded.

$$\text{Structural Capital} = \text{Market Capital} + \text{Organizational Capital}$$

Market Capital: In the context of the original model applied to market enterprises, this component of intellectual capital was referred to as *customer capital* to represent the value embedded in the relationship of the firm with its customers. In the context of national intellectual assets, it is referred to as *market capital* to signify the market and trade relationships the nation holds within the global markets with its customers and its suppliers.

Organizational Capital: National capabilities in the form of hardware, software, databases, organizational structures, patents, trademarks, and everything else of nation's capabilities that support those individuals' productivity through sharing and transmission of knowledge. Organizational capital consists of two components: process capital and, renewal and development capital.

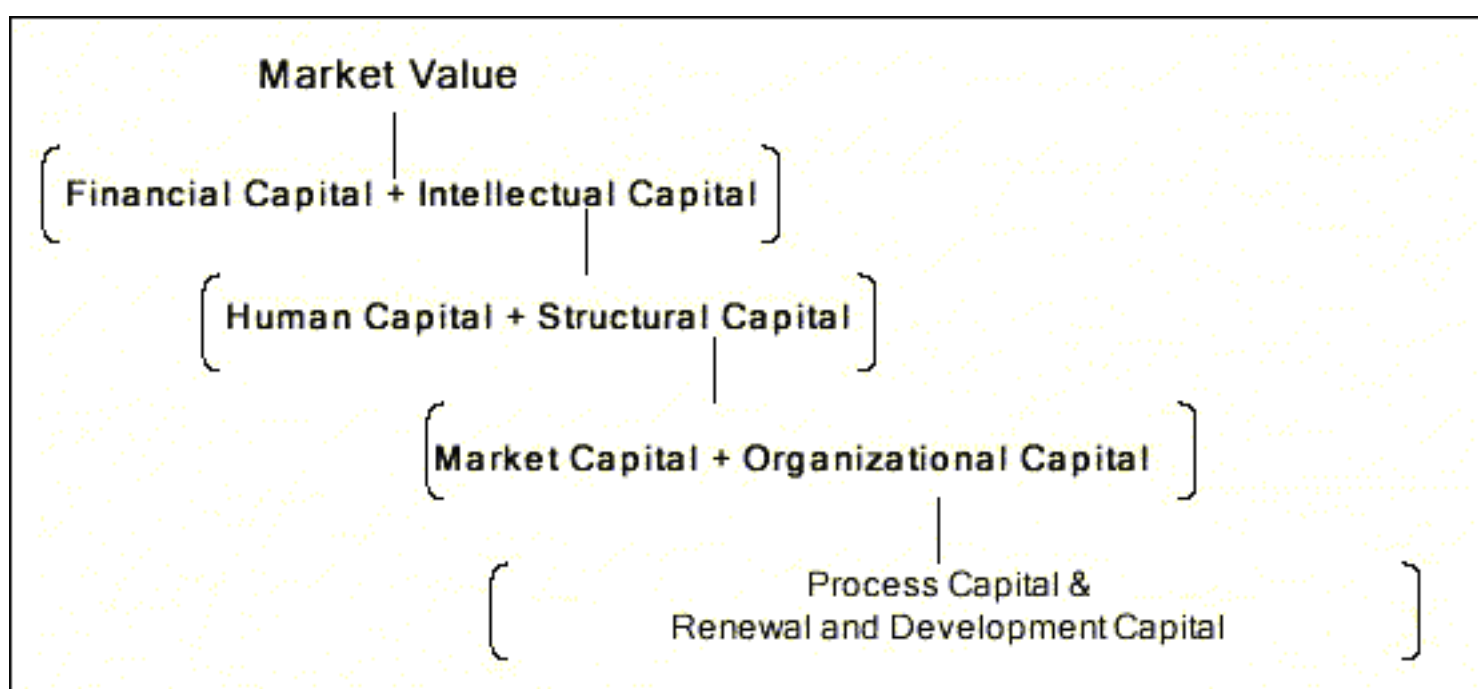
$$\text{Organizational Capital} = \text{Process Capital} + \text{Renewal \& Development Capital}$$

Process Capital: National processes, activities, and related infrastructure for creation, sharing, transmission and dissemination of knowledge for contributing to individual knowledge workers productivity.

Renewal and Development Capital: This component of intellectual capital reflects the nation's capabilities and actual investments for future growth such as research and development, patents, trademarks, and start-up companies that may be considered as determinants of national competence in future markets.

Figure 1: Components of Intellectual Capital

(Based upon Edvinsson & Malone, 1997)

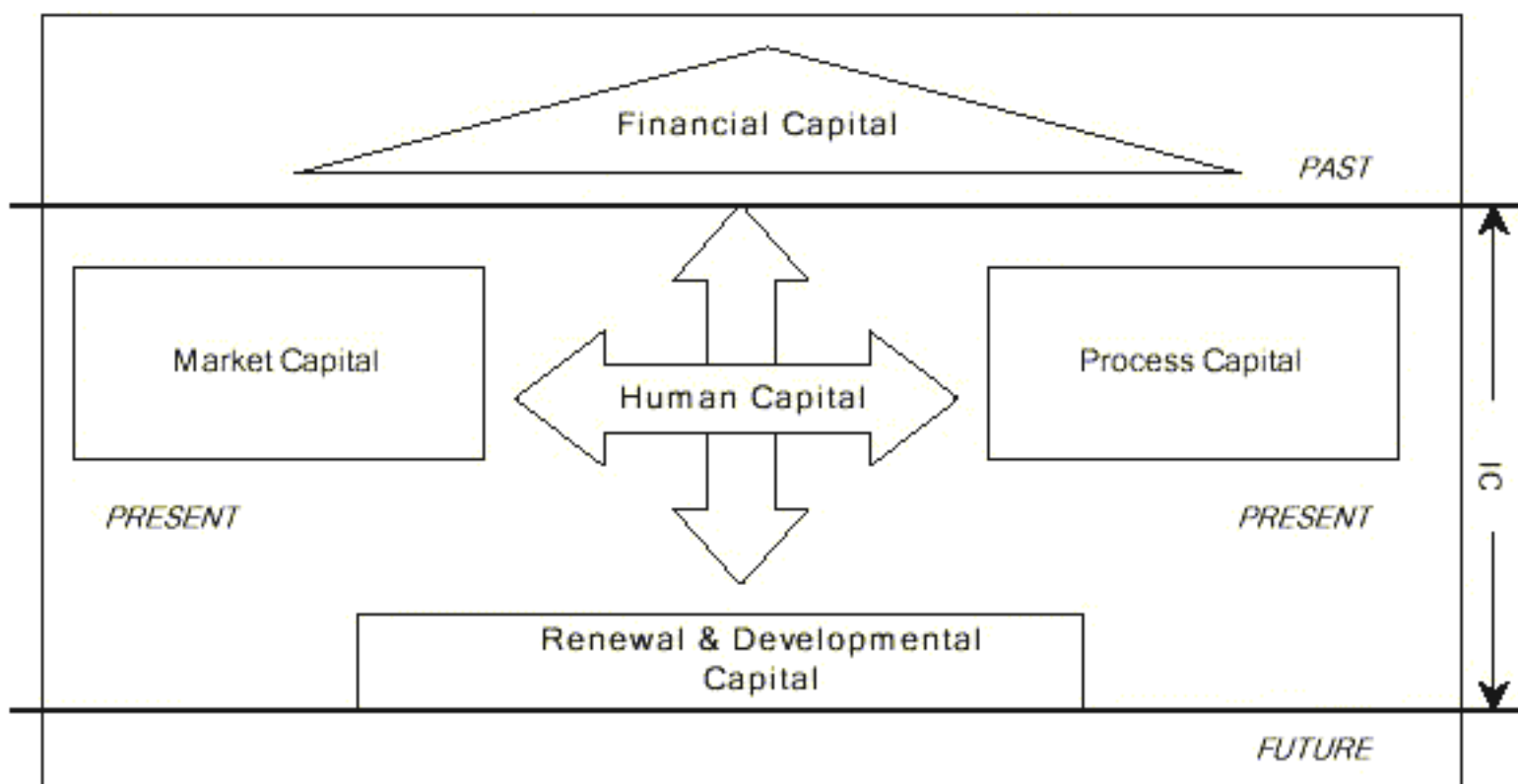


In the context of the national intellectual capital assessment, while financial capital reflects the nation's history and achievements of the *past*,

1. Process capital and market capital are components upon which nation's *present* operations are based;
2. Renewal and development capital determines how the nation prepares for the *future*; and,
3. Human capital lies at the crux of intellectual capital. It is embedded in capabilities, expertise and wisdom of the people and represents the necessary lever that enables value creation from all other components.

Figure 2: Financial Capital and Intellectual Capital

(based upon Edvinsson & Malone, 1997)



Process of Measuring Intellectual Assets:

This article covers an overview of the various factors that were taken into consideration for assessing national intellectual assets for Israel. The details about the study and related statistical data about Israel are the subject of the report *The Intellectual Capital of the State of Israel* (Pasher, 1999). In this article, discussion will focus on only key aspects of the national intellectual capital assessment process with the motivation of providing a general framework that could be adapted for similar assessment for other national economies and businesses.

The process of assessment of national intellectual assets as applied in the case of Israel was made of four phases: developing a vision of the nation's future; identifying core competencies needed to realize the vision; identifying the key success factors for such competencies; and, identifying the key indicators for the key success factors. The vision for the country's future was identified through brainstorming sessions and interviews with national leaders in various fields relevant to country's future growth and performance as well as young leaders whose views were relevant to the country's future progress. The

core competencies devolved from the above process and its participants. These competencies were mapped in the form of clusters along each of the dimensions of intellectual capital based on Skandia's model discussed earlier. The key success factors, or the most important determinants of the respective competencies needed for future performance, were identified. Specific indicators that were considered reliable measures for the critical success factors were then determined based on analysis of historical data as well as the analysis of the results of brainstorming sessions and interviews.

The study found the vision of Israel has the substantiation of its position as a developed, modern, democratic and pluralistic nation attractive to world Jewry, investors, tourists and its citizens. Two key areas that were determined relevant to Israel's future growth and progress included – enhancement of quality of life of the citizens, and, making it attractive for future generations by improving its standing among developed nations. While the former goal could be achieved through cultural and regulatory interventions, the latter goal was to be achieved through economic growth fuelled by knowledge-based industries. It was also determined that both these growth related areas would depend upon the country's capability in nurturing peaceful relations in the geographical region that has been characterized by periodic inter-country wars.

The study identified the key competencies necessary for nation's current and future performance and clustered them along the five components of a nation's balance sheet: financial capital, market capital, process capital, human capital, and, renewal and development capital. The specific indicators identified for each of the components represent the criteria that represent long-term competitive strength of Israel in comparison with other countries. As noted earlier, the specific criteria that are used as indicators of each of the components may differ for other countries.

Financial Capital: As noted before, financial capital is an indicator of a nation's *past* success and achievements. The valuation of the assets as they appear on a traditional balance sheet does not reflect the nation's real value as assessed by the global market. This component of the nation's balance sheet is based upon past performance and statistical data that express the rate of change in tangible assets. Such factors include gross domestic product (GDP), dollar exchange rate, external debt, unemployment, productivity rates within various sectors of the national economy, breakdown of exports according to industries, and inflation.

Gross Domestic Product (GDP): This indicator represents the total value of all services and goods produced in the country. The change in the GDP per capita (in real terms) represents the change in the citizens' well-being and in the country's economic strength. Since its origin, Israel has enjoyed rapid economic growth: its GDP per capita (in real terms) has grown from \$3,500 annually in 1950 to \$17,200 in 1995, although interrupted by a stagnation and recession in 1996. In terms of purchasing power, this change amounts to an increase of 370% reflecting a narrowed gap in the standard of living between Israel and the developed countries.

Dollar Exchange Rate: As with other national economies, an inflationary process leads to increase in the cost of domestically produced goods and services, a relative decrease in the prices of imported products and services, and a devaluation of the domestic currency. Israel's high level of inflation has resulted in the devaluation of its currency in the past, although inflation has been in control in recent years.

External Debt: Due to the financial crisis of 1980's, Israel's net external debt rose to 75% of GDP in 1985. This indicator showed a decrease until 1993 when it rose again due to loans taken by a large wave of immigrants. Finally, these loans showed an increase in production and restored the country's external debt-to-GDP ratio to about 25%.

Unemployment: Higher employment enables a national economy to increase production efficiency to maximum by using its existing resources. Until 1985, unemployment levels in the Israeli economy were below 5% when they started rising due to an influx of immigrants. After peaking to 11.5% in 1992, these levels had been falling again and in 1997 were lower than most industrialized nations.

Productivity within various Economic Sectors: Over the decade 1986-1996, Israel's agricultural productivity grew at an annual growth rate of 8%. In the post-90s era, the productivity of industrial sector has been growing at a moderate average annual growth rate of 1.5% as a result of slowdown because of structural changes in the industry. In the commercial and services sector, the average annual growth rate has been about 2% with greatest growth in the financial and business services as production has shifted from traditional sectors to more sophisticated, knowledge-based sectors.

Breakdown of Exports According to Industries: The exports have reflected production in various economic sectors. Coming from an agriculture-intensive background, in 1950, out of \$50 million in exports, agricultural products accounted for 70% of exported goods. The transition from a developing economy to a developed nation has been characterized by a shift in production and exports to the knowledge-intensive economic sectors such as electronic products, computer software, and pharmaceuticals. In 1994, agricultural products accounted for only half-a-billion dollars of \$25 billion in exported goods and services. In 1997, hi-tech exports constituted 33% of Israel's total exports.

Inflation: 1980s were characterized by very high inflation rates in Israel that reached a magnitude of 450% in 1984 and caused economic imbalance. Concerted efforts to reduce inflation thereafter have resulted in dramatic decreases bringing the inflation rate to about 20% in 1986, to 10% in 1996 and to 7% in 1997.

The study asserts that Israel's economic history and economic picture of mid-1990s does not provide an accurate assessment of the country's true growth potential. Hence, there is need for considering the country's core competencies and key success factors in the form of intellectual capital that provides it with long-term advantage in terms of future growth and performance. Such core competencies are delineated in the form of market capital, process capital, human capital, and renewal and development capital.

Market Capital: Market capital reflects the intellectual capital embedded in Israel's relations with other countries. The intellectual assets in this area derive from a country's capabilities and successes in providing attractive and competitive solutions to the needs of the international clients. Israel's investments and achievements in foreign relations along with its export of quality product and services significantly contribute to the intangible assets that comprise its market capital. Indicators of market capital include outgoing tourism, openness to foreign cultures, and, international events and language skills. Such core capabilities create a basis for assessing the country's attractiveness from the perspective of international clients.

Providing Solutions to Market Needs: Given a dynamic business environment characterized by changing customer needs, a country's capability in meeting such needs represents a competitive edge in the global marketplace. Israel is ranked amongst the top countries that are considered as having the fastest time for introduction of new products and services and their penetration in the market.

International Events: The country's level of participation in international events is an indicator of its strong desire for renewal as well its openness and willingness to gain knowledge. Given its high rate of participation, Israel is seen as having tremendous motivation to expose itself to new intellectual fronts. In addition, the high rate of hosting international conferences in Israel is an indicator of Israel's attractiveness to business people from around the world. This indicator reflects the extent of Israel's international openness and the increasing interest of international entities in Israel.

Openness to Different Cultures: People's desire to meet others, learn, see, broaden their horizons, and to develop and renew themselves may be considered another indicator of its market capital. Such openness of the Israel's citizens toward different cultures constitutes an important channel of communications in learning about trends and needs in the global village.

Language Skills: Knowledge of foreign languages alleviates problems of communications both in local culture and the global market. There is a realization in Israeli society that the willingness to learn languages contributes greatly to a country's relations with other countries. Accordingly, Israeli schools

are rated highly in professional teaching of foreign languages.

Process Capital: This component represents the country's intellectual assets that support its present activities including sharing, exchange, flow, growth and transformation of knowledge from human capital to structural capital. Such assets include information systems, laboratories, technology, management attention and procedures. A nation's long-term growth can be achieved if human capital is integrated within existing structural systems. Such integration through information and communication systems enhances the nation's capability to anticipate and translate market needs into product and service applications. Information technology serves as a key tool for the production of high-quality products and services and the opening of access channels to new markets. Indicators of process capital include communications and computerization, education, agriculture, management, employment, development of service sector and absorption of immigrants.

Communications and Computerization: Strong communications infrastructure for domestic and international communications between the nation's citizens and rest of the world facilitate rapid exchange of information and its translation into knowledge inherent in innovative processes, products and services. Some parameters that may be used for assessment of this indicator include communications and computerization infrastructure, extent of Internet use, circulation of daily newspapers, and, extent of software use.

Communications and Computerization Infrastructure: An index of *computer infrastructure* that measured variables such as the number of PC's per capita, and the number of PC's in homes and schools, ranked Israel high among developed and developing countries. Similarly, an index of *communications infrastructure* that rates the level to which the communication infrastructure meets business organizations needs ranks Israel ahead of developed countries such as Germany, Japan, Belgium and Italy.

Extent of Internet Use: Internet use makes it possible to rapidly share information and to communicate and collaborate even when isolated by geography and time zones. The report asserts that the extent of Internet use is also an important indicator for the assessment of a country's effective management of knowledge. An index that measured extent of Internet use relative to population size ranks Israel high within the list of developed nations.

Circulation of Daily Newspapers: Per capita newspaper distribution is assumed to be another indicator of the level of knowledge sharing and involvement in the happenings around the world. According to a World Bank report, Israel ranks high on the list of nations with highest per capita newspaper distribution.

Extent of Software Use: The extent of software use reflects the level of knowledge sharing and the effort to turn human capital into structural capital. The extent of software use also serves as an indicator of the quality of the country's current infrastructure that supports effective management of information and knowledge. An index based upon the relationship between the extent of expenditure for hardware and the extent of expenditure for software places Israel among the top ranks of developed nations.

Education: Education enhances knowledge sharing, and building and assimilation of mechanisms for the flow of knowledge in the society. Three indicators used for assessing Israel's investments in education included: student-teacher ratio (lower is better), PC-student ratio (higher is better) and freedom of expression in the school system. Based on available data and national surveys, Israel ranks high in all these criteria for assessment.

Agriculture: In making transition from a developing country to a developed nation, Israel – like other developed nations – has shown greater focus on knowledge and service-based industry with diminishing emphasis on agriculture. However, technological innovation in the agricultural sector has resulted in higher efficiencies resulting in higher agricultural worker's added value.

Management: The quality of management in a nation's economy is an important determinant of future health of its enterprises and long-term comparative advantage. Three criteria that were used in the study for assessing Israel's intellectual capital included: top management's international experience; entrepreneurship and risk-taking; and, venture capital funding.

Top Management International Experience: International experience of management provides the country's enterprises better ability for penetrating global markets and exploiting opportunities.

Entrepreneurship and Risk Taking: Government's support in entrepreneurship and risk-taking through financial support is necessary for technological innovation. Israel has championed such a program to support technological incubators for raising financing at early stage when the technological idea is considered high-risk for private sector funding. High success rate of the magnitude of 56% of companies that graduate from the incubator stage for Israel compares favorably with other countries such as USA, with success rate of 10%.

Venture Capital Funding: Venture capital fund is an important basis for supporting entrepreneurship and in ensuring the success of start-ups. Israel has been successful in cultivating a number of hi-tech enterprises because of its infrastructure and venture capital funds, which invest in start-up companies.

Employment: Israel owes its economic growth to its service industry that has enjoyed a high growth rate compared to other economic sectors. The financial and business sector, characterized by a relatively small number of employees and the application of advanced information and communication technologies, has been leading in production output among the various service sectors. Israel ranked high in the average annual growth rate of the service sector over the past decade or so, suggesting greater share of experience and knowledge base in the nation's economy. Also, Israel ranks high in computer skills among the developed nations, thus providing an indicator of superiority of the use of its information technologies.

Development of the Service Sector: The trend of increasing percentage of commercial services based on the development of advanced and knowledge-based sectors is common among the developed nations. The high rate of growth of Israel's service sector characterized by the GDP contributed by this sector, investments in R&D, high yield of invested capital, and productivity, wages and percentage of exports in this sector, all point to growth in knowledge-based fields.

Immigration and Absorption: Successful integration of highly skilled and professional immigrants is a key factor in the country's ability to benefit from the immigration and its human capital. Sustained migration of high quality scientists and professionals into the economy of Israel and their successful absorption has resulted in consistent increase in the GDP.

Human Capital: Human capital, as noted earlier, lies at the crux of intellectual capital. It constitutes the nation's peoples' capabilities reflected in education, experience, knowledge, intuition and expertise. Human capital embodies the key success factors that provide competitive edge in the past, present, and the future. The human capital is the most important component in value creation. However, due to the "soft" nature of these assets, it is often difficult to devise measures for many of them. As noted by Pasher (1999): "The analysis is especially complex when dealing with wisdom, intellect, experience and knowledge. The attempt to assess wisdom or motivation ultimately differs from the quantitative evaluation of "hard" assets, such as the extent of personal computer use or the proportion of employees in R&D." Despite the acknowledged difficulty of measurement of such assets, the study considers the following factors as key indicators of human capital.

Education: This component is assessed in terms of percentage [and its growth] of students having, or working towards advanced degrees (including certification studies); and, the number of graduates and holders of doctorate degrees in fields considered fundamental for long-term growth – including computer sciences, life sciences and engineering.

Equal Opportunities: The study asserts that a country that grants equal opportunity for citizens to wisely utilizing their inherent human resource, generates greater human capital. The indicators that were used to measure this component included: female students at institutions of higher education and women in the professional work force, two criteria in which Israel ranks strong among the developed nations.

Culture: This factor was based on two indicators: number of published books per 100,000 inhabitants, and annual number of museum visits per capita.

Health: Maintenance of good living conditions while guaranteeing the population a decent level of health was considered important for maintaining the attractiveness of the nation for its citizens.

Crime: A low rate of crime was considered as a positive correlate of human capital given lesser resources directed to fighting crime and more positive contributions to the society.

Renewal and Development Capital: Renewal and development capital reflects the country's desire and ability to improve and renew itself in order to progress. Early identification of changes in the dynamic business environment and their translation into business opportunities contributes to the nation's future growth and performance. The six indicators used for this component of intellectual capital in the study included the following.

National Expenditure on Civilian R&D: Investments in civilian R&D are expected to facilitate incubation of innovative ideas and their translation into value-adding products and services that contribute to future economic growth.

Scientific Publications in the World: The extent of the scientific activity – represented in terms of scientific publications, and the quality of that activity – in terms of citations by other scientists, are considered another indicator of the renewal and development capital.

Registration of Patents: In terms of per capita patent registrations, Israel ranks high among developed nations.

Work Force Employed in R&D: Human capital in technological fields is considered as Israel's most important success factor.

Start-up Companies: The study reports that Israel has the third largest concentration of start-up companies in the world, led only by Silicon Valley and the Boston area.

Biotechnology Companies: Considered as one of the industries that represent progressiveness of a country's scientific and technological progress, biotech sector represents another indicator for renewal and development capital. This is an area of emerging growth for Israel.

Synopsis of Israel's Intellectual Capital Assessment:

The reported study and its assessment of national intellectual capital of Israel represented an initial attempt at presenting a holistic and organized picture of the knowledge and intellectual assets of a country. The distinction between financial capital and intellectual capital was underscored to suggest that while former is a reflection of the country's *past* progress and achievements, the latter provides a more accurate depiction of *future* growth and performance. The expectation from the study was that the report will be used by government and other policy-makers to upgrade tools for exploiting knowledge to accelerate the process of long-term economic and social growth. In addition, the focus on intellectual capital, and its key components and indicators, brings into perspective key areas in which the country has growth potential. As noted by the investigators, the national intellectual capital balance sheet needs to be updated every year with reassessment of the key success factors and related indicators.

Discussion and Issues for Future Research

The reported study used specific indicators of the various components of intellectual capital that represent critical success factors pertinent to long-term future success and growth. However, such indicators may vary across different nation states depending upon their specific national economic strengths in the global market. Also, the case study discussed one popular method for assessment of national intellectual capital and illustrated its application. This doesn't imply that there is only one method that may be used for such assessment. There are diverse methods that have been applied for the assessment of intellectual capital at the level of business enterprise, and they may be extrapolated to similar assessments at the level of nations and countries (see for instance, Society of Management Accountants of Canada, 1999, for a review of some of these methods). For national policymakers who plan to do intellectual capital assessment for their national economies, another document of interest would be the Netherlands Government's Ministry of Economic Affairs pilot project "Balancing accounts with knowledge" that provides comparison between methodologies used by four different accounting firms (Government of Netherlands Ministry of Economic Affairs, 1999).

While the presented framework of intellectual capital and the illustrative case study have merit in communicating these issues to information professionals, however, they also raise important issues for advancing the research and practice in information systems. From the perspective of information professionals and researchers interested in strategic, organizational and behavioral issues, such issues provide venues for advancing understanding of knowledge assets and intellectual capital. The following discussion provides a brief synopsis for such issues for future research.

Information, Knowledge and Performance

Several practitioners and researchers have acknowledged that tacit knowledge is a key component of intellectual capital. However, the superficial distinctions between data, information and knowledge are often criticized, as one person's data could be another person's knowledge. Or, to put in one such critics' terms (Stewart, 1997): "knowledge exists in the eye of the beholder." Does this imply that information professionals and researchers can do nothing about management of knowledge assets or intangible assets? Not necessarily so!!

As noted earlier, knowledge assets, like money or equipment exist and are worth cultivating only in the context of strategy. Or, keeping in perspective the [future] outcomes driven focus of intellectual capital, rather than focusing upon information or information technology, one needs to focus upon 'what gets done' with that information. This shift in perspective would certainly bring the focus closer to *performance* that is the key motivation for investments in information and technology. Although one person's data may be another person's knowledge, however that distinction may spell the difference between effective use, misuse, abuse or non-use of information. Hence, it is important to understand why often the same information results in different actions [or inactions] when processed by different individuals. Seminal work in this area done by Malhotra and Kirsch (1996), Malhotra and Galletta (1999) and Malhotra (1999) could serve as a basis for developing further understanding for relating information and knowledge to performance.

Taking a Hard Look at the "Soft Issues"

Human capital lies at the crux of intellectual capital. It is embedded in capabilities, expertise and wisdom of the people and represents the necessary lever that enables value creation from all other components. Several practitioners and researchers have acknowledged that human capital, often characterized by "soft" issues such as individual motivation and commitment, is difficult to measure. The same assumption has often resulted in use of inappropriate surrogates for such "soft issues". Given the relevance of such soft issues, it is the author's recommendation that researchers and practitioners need to develop more rigorous measures of such constructs. Seminal work done by Malhotra (1998) that has tried to develop "hard" measures for such "soft" issues in the context of *effective use of information systems* could provide a base for developing better understanding of human capital. Based on this work, one may argue that many published accounts have incorrectly assumed that 'organizational capital' is what remains after the employees "go home." Based on existing research on motivation, compliance and commitment, one may argue that many employees may be on the job, but they may still be "at home," while others may telecommute from home, and yet may contribute more to the human capital. In essence, given the increasing importance of knowledge work, the post-industrial concepts of organization and work need to be reconsidered in the same hard terms of 'outcomes' and 'performance.'

Intellectual Capital Entangled with Networked Systems

Several popular accounts of the intellectual capital framework, including the one discussed in this article, have taken a simplistic view of the role of information systems. For instance, many such accounts have assumed that information systems, hardware, software and databases form a part of the structural capital or process capital. However, it is the author's argument that given the new networked economy, the advent of 'free agents' and 'knowledge intrapreneurs' (Malhotra, 2000d), individual education, knowledge and experience is more related to personal pursuits related to quality of life. In essence, as the new workers empower themselves by appropriating the networked technologies, they assume self-control and self-leadership for their own development regardless of their affiliation with a 'closed' concept of an organization or a nation. In other words, they become denizens of the global electronic village.

Similarly, with increasing automation, production processes become increasingly efficient, however, the ability to produce as such does not generate sufficient market differentiation. The focus shifts more towards excellence in marketing, product development, quality assurance and customer management as evident from the more recent popularity of e-business issues such as customer relationship management, supply chain management, selling chain management (Kalakota and Robinson, 1999). The role of knowledge management and information systems in developing new market niches, creating and distributing innovative products, and ensuring "stickiness" of 'portals' by cultivating the loyalty of customers has also been recognized (cf: Malhotra 2000c). Hence, information and communication systems also become a key part of the market capital as well as the renewal and development capital with increasing 'virtualization' of the products, processes and the delivery agents (Turban et al. 1999).

Post-Industrialization of Intellectual Capital Measures

As suggested by existing research in information systems, investments in information technologies may not necessarily correlate with increases in performance (Brown, 1996; Strassmann, 1997). Hence, in all such contexts, the emphasis should not only be on investments in relevant technologies, but effective utilization of such technologies. Large number of desktops or PCs may not necessarily correlate with higher performance in terms of outcomes. In other words, the concept of 'intellectual capital' is based on the notion of 'intangible assets,' however many of the indicators seem to be grounded in the world of 'tangible assets.' For instance, use of an indicator such as per capita distribution of newspapers needs to be reassessed given that such information is not a 'scarce good' but an 'abundant product.' Those not subscribing to any print based publications may be using more updated and multifarious push- and pull-based channels – many of which are free -- for remaining on top of what is important and relevant to them.

Similarly, the number of scientific publications and citations as an indicator needs to be assessed in terms of its relevance as an indicator in terms of 'real outcomes' in the form of economic growth or performance. As has been demonstrated by many authors (Kealey, 1996; Sobel, 1996) there is convincing evidence that the new knowledge (and its economic value) generated in the cause of technological or application-oriented research, far outweighs that of basic research. The latter is the subject of publications, while the former is not. As peer recognition is traditionally based on the number of publications and citations, the wrong conclusion is inevitably drawn that basic research adds more to the body of knowledge than technological or application-oriented research.

Conclusions

Transition of most developing and developed nations to knowledge economies has resulted in an increasing awareness of 'knowledge' as a key lever for economic growth and performance. Despite increasing importance of knowledge as a factor of production, most accounting systems are still based on the traditional factors of production. While accountants have been trying to determine how to capitalize the knowledge assets captive in the minds of the human employees, information system designers have been attempting to capture those assets into technology based databases and programmed logic.

The article discussed the framework for developing an understanding of intellectual capital and knowledge assets, and provided an illustrative case study of a nation state that has applied this assessment method. The framework of intellectual capital – popularized by a Swedish company Skandia – was described and then illustrated through its application for national intellectual capital assessment for Israel. In an attempt to bridge the gap between the accountants and the information resource management practitioners and researcher, some caveats were observed. These caveats were explained in the discussion as points deserving attention in future research and practice. One important issue that was not discussed in the article is that of fundamental and radical change that requires ongoing reassessment of all given models, frameworks, premises and assumptions. This issue is discussed in detailed elsewhere (Malhotra, 2000c). Such dynamic radical and discontinuous change seems to have significant implication about the stability of the models and frameworks that are based on a static view of the business environment.

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