Abstract

Purpose – The purpose of this paper is to highlight that research on the measurement of key indicators that represent drivers of the knowledge economy still spans several different, although interrelated, directions. The results of this review call for further integration of metrics through cross-disciplinary international, multinational and organizational partnerships that could reconcile and define de facto standards for the assessment of the drivers of knowledge-based growth.

Design/methodology/approach – General review, literature review. The paper reviews extant literature and practical experiences in knowledge-based development assessments.

Findings – The review finds that many institutions are still adopting a variety of approaches which are difficult to reconcile. Additional coordination efforts are required to overcome contextual and non-replicable approaches and, thus, increase standardization of metrics.

Research limitations/implications – While the paper discusses limitations of extant approaches, it does not build (another) alternative theoretical solution. Rather it suggests actionable strategies that require a high level of international coordination.

Practical implications – The paper shows the path and examples of multi-agency approach to achieve standardization.

Originality/value – The value of the paper stems from its classification and review of selected approaches both at the country and organizational level. While it is motivated by a call for integration that is not novel to the field of knowledge management, it suggests that this coordination: needs to occur simultaneously both at the country and the organizational levels, whereby country approaches could inform and drive industry approaches; and needs to leverage international coordination models such as those of international standardization bodies.

Keywords Knowledge economy, Knowledge management, Assessment, Intellectual capital, De facto standards, Measurement

Paper type General review

An introduction to the knowledge economy

The best-selling author and New York Times columnist, Thomas Friedman, describes the current global economy as “flat” and “interconnected” (Friedman, 2006). In such an economy, sustainable competitive advantage must thrive from creative, innovative and sophisticated use of knowledge and intellectual assets as strategic factors that enable dealing with the challenges of pervasive globalization. The technological developments of information and communication technologies and the advent of global interconnected social and technical networks are key drivers of the new global and complex economy. This knowledge-driven economy is one in which the creation, transfer and application of knowledge are key drivers of wealth creation (Hepworth et al., 2005). In the development literature, the definition of a knowledge-based economy refers to “an economy that makes effective use of knowledge for its economic and social development. This includes tapping foreign knowledge as well as adapting and creating knowledge for its specific needs” (Dahlman and Andersson, 2000).
The role of knowledge is increasingly important for developing and developed economies. A knowledge-based economy stems from the transformation of information into knowledge. At the macro-economic level, countries that display capabilities to continuously adapt institutional, information and innovations systems through incentives that support human resource development are generally more effective at stimulating and reinvigorating their stock of knowledge (Teece et al., 1997; Teece, 2000).

While academic institutions, governments, businesses and societies appreciate the benefits and potential returns of investments stirring knowledge-based growth, identifying a generally accepted and replicable framework that can elicit the true value of knowledge assets remains a major challenge. Several researchers argue that it is critically important to define specific and overarching metrics that can account for the value-creation of knowledge-based work. Others (Dorothy Leonard in Chatzkel, 2004) recognize that we need some flexibility and dynamisms when we try to evaluate knowledge assets. Leonard alerts that narrow and specific definitions and operationalizations of today’s knowledge-related metrics may not offer the capabilities for renewal that are generally needed in highly changing environments, like those of the knowledge economy. This dynamic view recognizes that by defining key capabilities more generically ‘you have more room to morph, to change, and to adapt’ (Chatzkel, 2004, p. 26).

The paper starts with a broad overview of the knowledge economy and the interrelated knowledge creation processes subsiding knowledge management at the national and organizational level. It then provides examples of knowledge-driven measurements and knowledge-value assessment in selected countries, international development groups, and specific organizations. It concludes with a call for an integrated effort to achieve standardization of measurements, including leveraging lessons learned from multiple stakeholders.

Characteristics of knowledge economies and overlapping frameworks

Knowledge-rich economies are characterized by products and services that portray specific economic behaviors and patterns. Contrary to traditional resource-limited economies (agricultural and industrial economies) that display decreasing returns to scale from land and capital resources utilization, knowledge economies display increasing returns (Arthur, 1996). Knowledge is not consumed by its use, but it grows with its utilization and application. This economic pattern has implications for development as it decouples the causal relationship among the resource endowment of a country and its knowledge growth potential (see new growth theories by Romer, 1986; and human capital theories by Grant, 1991, 1996; Nonaka, 1994). A knowledge economy grows when knowledge is shared and circulated. Growth is a dynamic and fluid process that returns higher value through managing the process of knowledge identification, organization, transfer, and application (Alavi and Leidner, 2001).

The dynamics of the knowledge management lifecycle have been amply discussed by Nonaka and Takeuchi (1995). Nonaka introduces the concept of the knowledge spiral and defines an evolution of knowledge through concentric circles that involve individuals, groups, organizations and inter-organizational resources. Individuals’ socialization of knowledge with groups enables the combination of experiences and the codification of
personal (tacit, implicit) knowledge into explicit know-how (explicit and codified knowledge). The subsequent externalization of a firm’s codified knowledge enables knowledge transfer across organizations. The cycle returns to a new level of tacit and internalized knowledge which re-starts another knowledge creation cycle. Figure 1 builds on Nonaka’s SECI model (socialization, externalization, combination and internalization) by showing the flows and transformation of knowledge as it moves from individuals to groups, organizations and inter-organizations. It also presents key processes (grouped herein under Identification, Organization, Transfer, and Application – IOTA) of the knowledge lifecycle, highlighting key outcomes of each process step (capabilities, artifacts, knowledge-intensive products and services).

Although the concept of knowledge-spiral has been originally discussed in organizational contexts, the flows represented in Figure 1 can be seamlessly applied to a national level-analysis. While the actors at the national level may vary compared to organizations (involving citizens; groups and Communities of Practice – CoP; governmental and para-governmental entities; and international organizations), the key processes and theories of knowledge creation (Nonaka, 1994, 1995) still stand. Applying the concept of the knowledge spiral to nations, a knowledge economy identifies the resources and capabilities of the knowledge growth lifecycle. It represents systems that codify and map existing capabilities (to establish a baseline against target points). It promotes access to knowledge and motivation to share existing capabilities — for example by protecting intellectual property to foster innovation. It enables knowledge transmission and diffusion through the creation of opportunities for sharing experiences (with supportive information and communication technologies policies and investments). Lastly, a knowledge economy promotes the generation of new knowledge through learning, education and application.

Knowledge economies, knowledge assets and intellectual capital

In the knowledge economy, for knowledge to attain its value it needs to be contextualized and embedded in physical products and processes (patents, trademarks, intellectual property, but also procedures, rules and heuristics). Human capital and resources are the
key fundamental holders and drivers of knowledge creation and, therefore, need to be nurtured, recognized, trained and educated (Bartel, 1992). However, the potential value of the wealth of human interactions and knowledge creation driven by the people and their social network is hard to quantify. Knowledge is measurable only when its implicit or tacit components have been made explicit through codification and application. But the wealth, possibilities, and potential of the tacit dimensions are potentially higher than the explicit and measurable dimensions (Sveiby, 1997). This dichotomy permeates the difficulty in assessing knowledge and intangible assets and explains the eclectic list of methods and procedures that have surfaced to identify the value of knowledge management and, more specifically, identify the value of knowledge assets in nations and organizations.

Related to the notion of knowledge economy is the concept of national knowledge assets defined as the intangible assets of a country that have significant impact on a country’s potential growth and progress (Boisot, 1998; Malhotra, 2003a). Malhotra further defines knowledge assets or intellectual capital as the hidden assets of a country that underpin and fuel a country’s growth. As knowledge becomes a key production factor it is important to understand the value of knowledge capital. Many countries understand how value creation and GDP growth is spurred by service and knowledge-based output in addition to manufacturing output (Guthrie and Petty, 2000). However assessment of national economic performance is still tied to traditional factors of production (land, capital, labor) rather than a thorough understanding of the value of knowledge assets, which are assets governed by the law of increasing returns” (Arthur, 1996).

If assets can be described as physical claims to future benefits (potentially generating value or cash flows), intangibles assets represent the “non-physical” claim of future benefits and values (Value Based Management.net, 2006). These assets can lead to the production of goods and services that display a high-knowledge content and value (for example, high-technology products; consulting services, etc.). The value of knowledge assets is not elicited by current accounting practices and intangible assets continue to represent the “hidden” value of a firm (Edvinsson and Malone, 1997; Stewart, 1997) or a country. While assessing the hidden value/s is critical, this assessment presents many challenges and naturally leads to multiple approaches, as described in the next sections.

The international focus on knowledge-economies

Country-specific and regional efforts

The understanding that the creation of knowledge permeates the entire economic and social environment of nations has led several countries and international development institutions to focus on strategies for enhancing knowledge management programs at the macro-economic level. For example, the regional Bureau for Arab States at the United Nations Development Programme (UNDP) supported a study of intellectual capital (Bontis, 2004) to benchmark Arab countries’ creation of national wealth based on the combination of financial capital, human and structural capital. Bontis found that national human capital, process capital, market and renewal capital explain about one fifth \((R^2 = 20.9\text{ percent})\) of the variance of national financial capital, thus establishing a link between non-monetary and monetary results (Bontis, 2004). The study also highlights the importance of cultural and
process changes that foster knowledge creation as an essential ingredient for public and private institutions in the Arab states to succeed in the knowledge-based economy.

Malhotra (2003a) explains that leaders of national economies are trying to find reliable ways for measuring knowledge assets to understand how they relate to future performance. Several international development organizations – such as the World Bank, the Organization for Economic Cooperation and Development (OECD), the United Nations, etc. – have been investing and financing knowledge management projects both internally (within their divisions and operational units) and externally, in the countries they represent. These projects span over the entire knowledge management lifecycle: from knowledge identification (definition, assessment), to knowledge organization, transfer and application. At the macro-economic level most of the efforts have started from analytical assessments of a country's knowledge endowments. For example, Malhotra (2003a, b) represents efforts from the Nordic European countries to identify knowledge assets and the value of intellectual capital. The Danish and Norwegian governments have sponsored efforts to identify a financial reporting system that would elicit companies’ intellectual capital assets to be included in firms’ annual reports.

Guthrie and Petty empirically evaluated mechanisms for reporting intellectual capital metrics in Australia (Guthrie and Petty, 2000). They concluded that reporting activities are still piecemeal efforts and are not consistently embedded in an overarching framework. They call for further developments of best practices within Australia to better compare with firms in other nations, and most notably in European countries.

In Europe, Sweden has been at the forefront of establishing formal measurement criteria to document and report on a country’s competitiveness. The local government and Stockholm University adapted the Skandia Navigator™ (Edvisson and Malone, 1997) to quantify Sweden's key indicators for success. Bounfour (2003) discusses a methodology adopted to benchmark various European countries on the basis of an instrument that assesses the dynamic value of intellectual capital (IC-dVAL™). Bounfour applies this methodology to appraise resources, processes, outputs and assets of a number of countries in Europe, compared to the USA and Japan, and argues that this approach is suitable to evaluate performance both at the micro-economic and the macro-economic level. However, he also recognizes a number of limitations related to generalizations (such as the identification of simplistic proxies for intellectual assets measurement) and recommends continuing cross-sectional process comparisons at intermediate levels (clusters, regions, public organizations or consortia of companies).

Israel, another country that focused on evaluating intellectual capital very early, implemented a measurement approach based upon the Skandia Navigator™ model developed and applied by Edvinsson (Edvisson and Malone, 1997; Pasher and Shachar, 2005). Edna Pasher, a leader in the knowledge management movement in Israel and an active participant in the community of intellectual capital researchers, identified knowledge management as a critical success factor for organizational renewal. Realizing the implications of knowledge strategy at the national level, she co-authored a report called “The Intellectual Capital of the State of Israel 1998: A look at the future” (Pasher, 1998) to consider the tangible and intangible assets of Israel, namely: financial capital, process capital, market capital and renewal and development capital. The financial and intellectual capital indicators defined in the report provide a benchmark of the progress of Israel compared to other industrialized nations of the world, and explain the top priority role that learning and education play in the country.

Ante Pulic (Pulic, 2005) led research studies on the measurement of intellectual capital performance in Croatia and other European countries. He developed a “Value Creation Efficiency Analysis,” a measurement system that links performance of key physical, financial, and intellectual capital resources to financial data. His work recognizes the value of intellectual capital by bridging the gap between the new economic drivers and the traditional accounting standards and provides a new way to look at the national economy’s...
performance. His research focuses on Croatia as a case study and compares measures of intellectual capital efficiency to other Eastern European countries (such as Slovenia, Hungary, the Czech Republic, and Poland). Pulic’s work offers important national and regional insights into measuring the value of intellectual capital.

Many other countries have focused on projects directed at identifying measures of knowledge assets and economies for comparative purposes. In Japan and China, researchers (Masuyama, 2005) discuss an East Asian agenda for the transformation of Asian economies into knowledge-based economies (KBEs) through a strong focus on innovation and R&D, education, and the development of international production networks beyond the traditional expansion drivers represented by low-cost manufacturing. Additional studies and reports in the United Kingdom and Poland show a significant interest in micro and macro-drivers. Some case studies focus on highlighting key knowledge-creation drivers from regional communities (Karlsson and Martinez, 2005).

**International development efforts**

International development institutions (IDIs) have launched numerous assessment efforts to identify the value of knowledge in economies. Figure 2 presents a summary of the qualitative and quantitative methodologies adopted by development institutions, non-profit organizations and governments to assess countries in their capabilities as knowledge-intensive nations based on type of the evaluation and the scope of the knowledge management programmes.

Qualitative methods with regional and national symposia have been implemented by the World Bank in the late 1990s based on the national knowledge assessment model elaborated by the US National Research Council (National Research Council *et al.*, 1996). The World Bank and developmental organizations that have since then undertaken large scale initiatives in knowledge management and measurement, mostly focused on international benchmarking and the use of comparative scorecards (Malhotra, 2003a; Passerini, 2003). For example, the World Bank uses the KAM (Knowledge Assessment Model) a widely available knowledge management measurement framework thanks to its accessibility and ease of use online. The KAM evaluates countries based on their relative

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**Figure 2** International and national approaches to knowledge and intellectual capital evaluation

<table>
<thead>
<tr>
<th>Scope of the KM implementation</th>
<th>Qualitative</th>
<th>Scorecards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focused</td>
<td>Regional Symposia</td>
<td>Analysis by cities, regions, nations</td>
</tr>
<tr>
<td></td>
<td>Virtual Case Studies</td>
<td>- Pacific Islands</td>
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<td></td>
<td>Specific Studies</td>
<td>- Croatia</td>
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<th>Score of the KM implementation</th>
<th>Quantitative</th>
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<tbody>
<tr>
<td>Focused</td>
<td>Benchmarking</td>
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<tr>
<td></td>
<td>Swedish &amp; Danish Gvt. Studies</td>
</tr>
</tbody>
</table>
standing and structural/qualitative indicators of performance on four areas that drive
knowledge development. The model synthesizes drivers into scorecards and indexes such
as a Knowledge Economy Index (KEI) – the average of the performance scores of a country
or region in all four KE pillars (Economic Incentives Regime, Education, Innovation, and
Information Communications & Technology) – and the Knowledge Index (KI) – the simple
average of the performance of a region or country in Education, Innovation and Information
Communications & Technology. In addition to the quantitative evaluation methods
embedded in the KAM model, the World Bank has also led qualitative and case study
research in knowledge benchmarking with local projects and regional symposia in several
countries, for example in the Pacific Island economies (Aubert, 2005).

The Organization for Economic Cooperation and Development (OECD) is focused on
definitions of knowledge-based economy and knowledge assets that include a particular
attention to human capital. OECD (2003) defines human capital as the “knowledge, skills
and attributes derived from education, training and experience that represent some our
most valuable resources.” It also extends the human capital into social capital, a more
recent perspective on the importance of “established social relationships, norms of
behaviors and mutual trust in many kinds of social and economic endeavors.” The OECD
supports efforts for the development of a unified model for measuring social capital.

The European Union undertakes multiple initiatives to define measurement models for
knowledge management. Veugelers (2005) reviews the set of policy actions and indicators
that European Union nations have agreed to monitor to track the performance of member
states towards “the most dynamic and competitive knowledge-based economy in the world
capable of sustainable economic growth with more and better jobs and greater social
cohesion” as well as “an increasing respect for the environment”. The EU indicators were
identified at the European Council of March 2000 in Lisbon, when the EU launched a
ten-year long comprehensive set of integrated structural reforms to become the most
competitive knowledge-based economy by 2010. However, the EU assessment model is
only a benchmark that needs to be preceded by profound reforms addressing the
challenges of an aging population, enlargement and globalization of the European Union.

Different agencies within the United Nations are focusing their efforts in defining and
identifying drivers for knowledge development in the countries they serve. Parallel efforts are
being conducted with the objective to measure information and communication
technologies (ICT) development, innovation and e-commerce drivers. In this effort, a
plethora of measurement models have been proposed. Most of the time, these models
overlap drivers and indicators, and provide different synthetic formulas. Despite these
differences, they all start from the same number of factors that are key inputs to knowledge
development: connectivity, access, policy environment, usage, social and cultural
infrastructure and education/literacy. The United Nations Conference on Trade and
Development (UNCTAD) is also an active player of an international effort to define
development indices. In the 2003 Report (UNCTAD, 2003) a list of key variables that concur
to form ICT indices are identified also based on their contribution to knowledge creation. The
UNCTAD report defines synthetic measures and attempts to identify the correlation among a
number of related indicators. It proposes a specific country ranking based on ICT
dowment (a prerequisite for the knowledge society). It relies on multiple frameworks, but
gathers the majority of the country data from the International Telecommunication Union
(ITU).

The organizational focus on knowledge evaluation

Although the focus of this paper is on knowledge-based development at the national and
international level, the eclectic panorama presented for countries and IDIs mimics the
ecclectic panorama characterizing firms and industry levels. Therefore, it is important to
briefly highlight key aspects (such as the notions of intellectual capital and intangible assets)
of organizational-level measurements. Starting from the mid-1990s, several researchers and
practitioners have tried to identify models to associate specific financial value to knowledge
assets (defined as the intangible assets) of organizations. Historically, intangible assets were classified as the “goodwill” of the firm (Malhotra, 2003a). Other views (Davenport and Prusak, 2000) have defined intellectual capital as the difference between the market value of the firm and its book value. Other researchers such as Kaplan and Norton (1996), Sveiby (1997), Bontis (1999), Stewart (1997), Brooking (1996) and Roos et al. (1997) have moved beyond tying the value of knowledge asset to financial performance and have proposed a larger set of non-monetary measurement models focused on eliciting people and processes values.

Figure 3 displays a list of measurement approaches that have been proposed to identify the value of intangible assets. Rather than being divided into qualitative and quantitative methods, these approaches are mostly quantitative (or based on qualitative judgments transformed into quantitative metrics) and have been grouped by Sveiby (2001) into monetary and non-monetary methods depending on their reliance on traditional and emerging accounting/financial standards. While for a comprehensive review of the measurement mechanisms, we refer to Sveiby (2001) and Malhotra (2003a), some of these measures are briefly discussed in more details as they are the basis for many national level adaptations.

The Intellectual Capital Index (IC-Index) is a broad and higher-level non-monetary approach that attempts to consolidate different indicators into a single index and correlate the changes in intellectual capital with changes in the market (Roos et al., 1997). The IC-Index value lies in its measurement of changes in IC stocks. Bontis et al. (1999) suggest that changes in an IC-Index reflect changes in the underlying drivers of future earnings potential.

Among other non-monetary methods, the Skandia Navigator™ (Edvisson and Malone, 1997); the Balanced Scorecard (Kaplan and Norton, 1992, 1996, 2000); and the Intangible Assets Monitor (Sveiby, 1997) have been widely utilized. The Balanced Scorecard approach is largely implemented in other areas beyond knowledge management. The Balanced Scorecard (BSC) is a reporting model that focuses on assessing organizations on multiple elements that can also be related to the firm’s knowledge endowment. The BSC includes a customer perspective; a growth and learning dimension; a business processes perspective; and a financial perspective.

**Figure 3** Organizational approaches to knowledge and intellectual capital evaluation

<table>
<thead>
<tr>
<th>Type of Evaluation</th>
<th>Non-Monetary Methods</th>
<th>Monetary Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual Capital Index</td>
<td>...[...]...</td>
<td>Market-to-book value</td>
</tr>
<tr>
<td>Balanced Scorecard</td>
<td>...[...]...</td>
<td>Tobin’s Q</td>
</tr>
<tr>
<td>Skandia Navigator</td>
<td>...[...]...</td>
<td>Earned Value Added (EVA)</td>
</tr>
<tr>
<td>Intangible Assets Monitor</td>
<td>...[...]...</td>
<td>Calculated Intangible Value</td>
</tr>
<tr>
<td>Value Chain Scoreboard</td>
<td>...[...]...</td>
<td>Accounting for the Future</td>
</tr>
<tr>
<td>Human Capital Intelligence</td>
<td>...[...]...</td>
<td>Technology Broker</td>
</tr>
<tr>
<td>HRC Accounting</td>
<td>...[...]...</td>
<td>Citation-Weighted Patents</td>
</tr>
<tr>
<td>Intellectual Assets Valuation</td>
<td>...[...]...</td>
<td>Intellectual Assets Valuation</td>
</tr>
</tbody>
</table>

Source: Adapted from Sveiby (2001)
The Skandia Navigator™ and the Intangible Assets Monitor are closely related to (and precede) the BSC. The Intangible Assets Monitor (Sveiby, 1997) focuses more on personnel-based measures, both internal and external. Sveiby looks at growth and renewal of the external structure (market share and customers); the internal structure (IT investments, R&D, and personnel behaviors); and the personnel competence (turnover average, competency levels). For each of these variables, Sveiby proposes an evaluation of growth, renewal, efficiency and stability metrics. The Skandia Navigator™ (Edvisson and Malone, 1997) also focuses on structural, human, customer and organizational capital and it proposes a very large set of variables (91 intellectual + 73 traditional metrics) to assess the value of knowledge assets (Malhotra, 2003a).

The monetary methods, such as Tobin’s Q, the Earned Value Added (EVA), the Calculated Intangible Value (Stewart, 1997) and the market-to-book value measures are advanced financial measures that attempt to associate a specific economic value to intangible assets. However, they are limited to a financial perspective (not including social and human factors) and are based on a preliminary assumption of a direct causal relationship between the financial measures (gross margin, returns on assets, etc.) and the intangible company resources. They do not take into account contingency factors that can also impact company performance. They are broad and holistic measures that look at firms’ activities in their entirety.

More specialized and focused monetary methods include approaches such as Human Resource Capital Accounting (HRCA). According to Sackmann et al. (1989) human resource accounting enables quantifying the economic value of people in the organization based on three models: costs; human resource value; and monetary values. However this model has limited application because of issues of reliability and generalization of the measurement framework.

Annie Brooking’s model, the Technology Broker (Brooking, 1996), looks at intellectual capital as the combination of market assets; human-centered assets; intellectual property assets; and infrastructure assets. This approach starts with a diagnostic process whereby organizations answer questions that make up an intellectual capital indicator. Brooking suggests three measurement models to help calculate the value of intellectual capital:

1. the cost approach, which is based on assessment of replacement costs;
2. the market approach, which uses market equivalents to assess value; and
3. the income approach, which assesses the income producing capability of the asset.

This approach helps to quantify intellectual capital and leverages a mix of quantitative and qualitative methods whereby the questions asked in the intellectual capital audit process can be easily transformed into Likert scales.

**Graphical approaches: bridging qualitative and quantitative analyses**

Knowledge assessment researchers at the macro and micro-level of analysis continue to agree that monetary and quantitative approaches need to be supplemented by qualitative analysis and triangulation. Unstructured surveys, interviews, workshops and focus groups activities need to support quantitative data collection. The use of qualitative approaches and the collection of anecdotal evidence are particularly important at the outset of a knowledge management initiative. When exposure and competences are still low, informal interviews, and the famous “water-cooler discussions,” may in fact support a better understanding of the impact of knowledge management and the effective transfer of knowledge among employees in an organization. The Technology Broker’s IC audit (Brooking, 1996) is an example.

Knowledge assessment approaches have been criticized for lack of focus on soft factors such as organizational culture as drivers of knowledge sharing processes in organizations and countries. Qualitative approaches add a positive twist to knowledge assessment as they...
are usually dynamic and lead to further actionable initiatives. Several of the approaches discussed earlier, particularly the quantitative ones, are limited in their predictive capabilities. Graphical and belief-based analytical approaches can be applied to identify a dynamic and predictive model (Bayesian network analysis). Bayesian network has been applied, for example, to the knowledge assessment model (Passerini and Cakici, 2004). Bayesian networks and decision graphs can be used to map the relationships between the KAM variables, the knowledge drivers, and the resulting country knowledge potential (dependent variable). The network structure illustrates the relationship among variables and discovers the interactions within the underlying dataset. The power of a Bayesian simulation model is that of assessing the impact on all knowledge activities caused by country level economical, social, and political change (expressed through sets of probability distributions). Bayesian models can be used to determine the impact of a change in a variable caused by a political decision, a cultural norm shift, an economic policy decision, a trade law and educational system change on a country’s knowledge index. Extending this methodology to incorporate the time-effect on such data using dynamic Bayesian models may reveal hidden economical, cultural and political variables that play a role in a country’s knowledge-based development.

Open issues and forward-looking initiatives

A number of issues emerge from the review presented in this paper. First and foremost, the understanding that while knowledge management and intellectual capital may generate competitive advantage through intangible assets, organizations do not understand their nature and value (Bontis, 1999). Carrillo (2002) recognizes that while IC has become one of the most fertile areas of KM, to what extent the basic dimensions describing knowledge-based value generations have been grasped remains an open question” (Carrillo, 2002, p. 17). All the efforts that have been developed to date seem to be far from emerging as a single common set of metrics. The high number of alternative models presented in this review shows that there is no agreement on national and organizational approaches for evaluating knowledge assets and knowledge management programs. There are no universal best tools (Bontis, 1999). While it is difficult to define which model should be followed, discussions about standardization and international measurement models should focus on providing highly accessible and user-friendly results. The World Bank interactive scorecards approach offers an example of user-friendly and accessible systems to share information about indicators relating to knowledge indexes. Making the underlying data set easily available for research and benchmarking would encourage further analysis on correlations and predictive capabilities of the indices. Such visibility and access will be difficult to achieve in the business arena (firms might not be willing to disclose internal data) but it should be an easier proposition for international development institutions (and one that should comply with their development agenda).

The United Nations has recently been progressing in the strategic planning of widespread and coordinated development, particularly in the area of (and through) knowledge management. The UN agencies are now building the right framework to replicate lessons learned in the World Bank’s internal and external knowledge management model and programmes. The “One United Nations” is a global initiative coordinated by the UN Chief Executive Board (CEB) that envisions the renewal of a united development agenda deployed using common and accessible communication platforms. Among the common objectives, the need for deepening the understanding and managing knowledge better is the first agenda item (CEB Report, 2005). Some of the actionable items include:

- defining common, more reliable, widely accessible and user-friendly country data (including strengthening data collection and analysis techniques in member countries);
- implementing a common strategy in the development and utilization of information and communication technologies; and
- promoting a common knowledge creation and learning culture.
While the last two bullet points refer to the internal management of knowledge initiatives; the first bullet clearly implies the implementation of an overarching and integrated framework for the definition of critical measurement methods. As highlighted in the Millennium Development Goals – MDGs – (United Nations, 2006), these methods will need to integrate social objectives (and frameworks) into economic decision making (CEB Report, 2005). This notion is being translated internally into the deployment of balanced scorecard approaches to organizational performance that are well underway in selected agencies, such as the United Nations Population Fund (UNFPA). If such integrated efforts are successful, macro-economic frameworks could play an important role in shaping firm-wide approaches. For example, a country-driven approach could be extended to organizations to leverage lessons learned (particularly in the area of results standardization) and define models for businesses that are aligned to national measures. It may not be useful to continue to separate the “macro” and “micro” when in fact the country knowledge assets and potential can drive (and be driven by) the local organizational framework.

In such a scenario, international development institutions could define opportunities to consolidate industry measures as piloted by the Nordic European governments. Even further, international organizations could lead the definition of a common tri-lateral research and implementation framework that brings together governments, academia and businesses. While we should continue to debate and compare distinct aspects and frameworks, it will be important to identify ways for effectively applying and standardizing these frameworks so that they can drive common results. Multilateral industry, government and academic partnerships could emerge in a similar model followed by international standardization bodies. Some examples are the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), which represent private and voluntary organizations. Other examples include US-based organizations that are developing de facto global standards that are increasingly being accepted internationally. These are usually private and public consortia in specific technical areas such as wireless telecommunications, e-commerce, Web services, etc. Such multilateral efforts in the field of knowledge management could be a step forward in a consistent and common direction.

Summary and conclusions

The evaluation efforts herein described have been focused on identifying different measurement models starting from typical and traditional performance indicators to include (from the millennium onwards) measures of human and social development. This transition has been the result of a learning process where developmental organizations have realized that social and human processes are the key factors of the knowledge growth cycle. Regardless of these developments and inclusion of human and social capital metrics in both international and organizational measurement frameworks, there is still a need for more standardization in a very eclectic panorama of measurement and approaches. Our review finds that many institutions are still adopting a variety of approaches which are difficult to reconcile. In a field that stems from the notion of leveraging lessons learned, existing models show limited capabilities for replication and propose similar, yet not generalizable, approaches. Additional coordination efforts are required to overcome contextual and non-replicable approaches and, thus, increase replicability and reliability of comparative analyses. Some of these efforts have been briefly highlighted in the paper, with the hope that they will contribute to the shaping of a common research and implementation agenda.

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About the author

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