Measuring National Knowledge Assets:
Conceptual Framework and Analytical Review

United Nations Department of
Economic and Social Affairs

Ad Hoc Expert Group Meeting on
Knowledge Systems for Development

New York, 4 - 5 September 2003

Yogesh Malhotra, Ph.D.
Martin J. Whitman School of Management
Syracuse University, Syracuse, NY 13244-2130
yogesh@syr.edu       www.KMNetwork.com
Overview

- 1. New National Wealth – Knowledge Assets
- 2. Popular Measurement Models
- 3. Models of Developmental Organizations
- 4. A Measure of National Knowledge Assets
- 5. A Measurement Model for the ‘Public Sector’
- 6. Improved Models for ‘Holistic’ Development

Section:  1  2  3  4  5  6
Overview

“For countries in the vanguard of the world economy, the balance between knowledge and resources has shifted so far towards the former that knowledge has become perhaps the most important factor determining the standard of living - more than land, than tools, than labor.”

- *World Development Report, 1998*
Overview

- National Knowledge Assets
  - What are national knowledge assets?
  - Why are they important and relevant?
  - How are they assessed and measured?
  - Existing state of theory, research, and practice?
  - Measurement models, frameworks, methodologies?
New National Wealth – Knowledge Assets

- National Knowledge Systems and K-Assets
- National K-Assets
  - Understood in terms of outcomes
  - Non-linear with respect to their effects
  - Embedded in actions of agents
  - Technology, Competence, and Capability
- Problem of ‘knowledge economy’ – “residual”
Theoretical Underpinnings

- “The wise see knowledge and action as one.”
  -- Stafford Beer

- “Knowledge resides in the user and not in the collection [of information]. It is how the user reacts to a collection of information that matters.”
  -- West Churchman

- “Access to more information and more advanced decision aids does not necessarily make decision makers better informed or more able to decide.”
  -- Hedberg & Jonsson
New National Wealth – Knowledge Assets

- Intellectual Capital and Knowledge Assets
- IC = Structural Capital + Human Capital
- Objective Metrics vs. Subjective Judgment
- Inter-temporal nature of K-assets
- Human Knowledge
  - Non-physical, non-appropriable, not measurable directly, incompatible with conventional standards
Popular Measurement Models

- Accounting, economics, human resource accounting, and intellectual property based
- Inadequate focus on social and human aspects
- Intangible assets – ‘goodwill’
- External, internal, and human capital
- Skandia Navigator, Balanced Scorecard, Intangible Asset Monitor, etc.
Popular Measurement Models

- Scorecard Methods
  - Multiple indicators, Rich Data, Judgment, Insights
- Dollar Value of Intellectual Capital
  - Separate or Composite Indices, $ and Non-$
- Market Capitalization
  - Based on ‘difference’, $, Aggregate measure
- Return on Assets
  - Based on conventional accounting standards
Popular Measurement Models

- **Skandia Navigator**
  - One of the early measurement models
  - Early application for assessing national K-assets
- **Balanced Scorecard**
  - Balances measurement and management
  - Innovation and learning, process improvement, customer relationships, and, value creation
  - Process- and action-based focus
Models of Developmental Organizations

- Governments and knowledge assessment
- Development organizations’ models & measures
- Developed for ‘energy-based’ economy
- Used for benchmarking knowledge economies
- Focus on structural and ICT aspects
- Focus on inputs and (some) processes
- Need to re-assess theory, models, and measures
World Bank’s Knowledge Assessment Methodology (KAM)

- 69 structural and qualitative variables
  - 100 countries including 60 developing economies
  - Used for national comparisons and benchmarking
- 14 variables for “standard” scorecards
  - Performance Indicators: GDP, human development
  - Economic institutional regime: trade tariffs, regulation
  - Education and human resources: literacy, enrollment
World Bank’s Knowledge Assessment Methodology (KAM)

- 14 variables for “standard” scorecards
  - Innovation System: R&D, Mfg trade, Journal articles
  - Information Infrastructure: Phones, Computers, Web
- What are these indicators ‘really measuring’?
  - Content validity – domain, selection of indicators
  - Construct validity – use of ‘proxies’ – inputs
  - Predictive validity – cause and effect
  - Do these samples represent the same population?
Developmental Models

Statistical Validity: Samples and Population

- “Deploying broadband [in South Korea] was fast and cheap because the country has just 15 million households and is only 38,000 square miles – 1/100th the size of the U.S. And 60% of the population lives in large apartment blocks rather than the sprawling suburbs where many Americans reside.”

  - Business Week, Sep. 8, 2003
What constitutes a ‘knowledge-based economy’?

% of GDP investments in:
- Higher education, R&D, Software
- Contradictory findings in other reports
  - Focus on management and utilization of ‘inputs’
  - Focus on social capital & human capital
  - Processes and actions linked to value-creation*
OECD: Human Capital and Social Capital

- Qualification measures are weak proxies
- Diminishing returns to spending on ‘inputs’
- National well-being: 2 key aspects:
  - Human capital and social capital
- Social networks for lifelong learning
- Collective action – cooperation and collaboration
- Better sociological and behavioral understanding
Developmental Models

Limitations of Measures and Methods

- “Not everything that counts can be counted, and not everything that can be counted counts.”
  -- Sign hanging in Einstein's office at Princeton

- “As far as the laws of mathematics refer to reality, they are not certain, and as far as they are certain, they do not refer to reality.” -- Albert Einstein

- “The invalid assumption that correlation implies cause is probably among the two or three most serious and common errors of human reasoning.”
  -- Stephen Jay Gould in *The Mismeasure of Man*
A Measure of National Knowledge Assets

National Knowledge Assets
- Structural Capital
- Human Capital
- Market Capital
- Organizational Capital
- Process Capital
- Renewal & Development Capital

© Copyright 2003, Y. Malhotra
www.KMNetwork.com
A Measure of National Knowledge Assets

- 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 carry out value creating tasks and goals. Human capital is the property of individuals.”
## A Measure of National Knowledge Assets

**An Applied Measure**

### Human Capital

<table>
<thead>
<tr>
<th>Original Indicators</th>
<th>Proposed Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literacy rate</td>
<td>Organizational training and development per capita</td>
</tr>
<tr>
<td>Number of tertiary schools per capita</td>
<td>Training and development participation rates</td>
</tr>
<tr>
<td>% of primary teachers with required qualifications</td>
<td>% of GDP spent by level of education</td>
</tr>
<tr>
<td>Number of tertiary students per capita</td>
<td>Population at various age groups</td>
</tr>
<tr>
<td>Cumulative tertiary graduates per capita</td>
<td>Quality of education and standardized testing results</td>
</tr>
<tr>
<td>Percentage of male grade 1 net intake</td>
<td>Instruction time and length of school year</td>
</tr>
<tr>
<td>Percentage of female grade 1 net intake</td>
<td>Educational participation quality and results</td>
</tr>
<tr>
<td></td>
<td>Ratio of student population at each level of completion</td>
</tr>
<tr>
<td></td>
<td>Mathematics, reading, writing, and basic science</td>
</tr>
</tbody>
</table>

(Based upon Malhotra, 2000b; Pasher, 1999; Bontis, 2002)
# An Applied Measure

## A Measure of National Knowledge Assets

<table>
<thead>
<tr>
<th>Market Capital</th>
<th>Original Indicators</th>
<th>Proposed Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High-technology exports as a percentage of GDP</td>
<td>Openness to different cultures</td>
</tr>
<tr>
<td></td>
<td>Number of patents granted by USPTO per capita</td>
<td>Number of foreign spoken languages</td>
</tr>
<tr>
<td></td>
<td>Number of meetings hosted per capita</td>
<td>Volume of tourist traffic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subjective measures of honesty and trust in business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ease of launching new businesses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>International awards and recognitions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immigrant inflow and outflow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Export of magazine, books, and periodicals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>World expositions and conventions hosted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professional Olympic athlete participations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students and scholarships in foreign schools</td>
</tr>
</tbody>
</table>

(Based upon Malhotra, 2000b; Pasher, 1999; Bontis, 2002)
An Applied Measure

A Measure of National Knowledge Assets

Process Capital

<table>
<thead>
<tr>
<th>Original Indicators</th>
<th>Proposed Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone mainlines per capita</td>
<td>Computer literacy rates</td>
</tr>
<tr>
<td>Personal computers per capita</td>
<td>Digital storage per capita</td>
</tr>
<tr>
<td>Internet hosts per capita</td>
<td>Volumes of books in libraries per capita</td>
</tr>
<tr>
<td>Mobile phones per capita</td>
<td>Transportation statistics such as paved roads per capita</td>
</tr>
<tr>
<td>Radio receivers per capita</td>
<td>Availability and extent of software usage</td>
</tr>
<tr>
<td>Television sets per capita</td>
<td>Entrepreneurship and number of venture start-ups</td>
</tr>
<tr>
<td>Newspaper circulation per capita</td>
<td>Venture capital funding</td>
</tr>
</tbody>
</table>

**Conclusion:** Human Capital is the “pre-eminent antecedent for the intellectual wealth of a nation.”

(Based upon Malhotra, 2000b; Pasher, 1999; Bontis, 2002)
A Measurement Model for ‘Public Sector’

- Existing Models: Limited by focus on ‘inputs’
- Link between management and measurement
- Inputs-Processes-Outputs-Outcomes
- K-Asset Metrics should guide Performance
- Questions for guiding Measurement Models:
Public Sector

Inputs-Processes-Outputs-Outcomes

- Measures of KM Inputs
- Measures of KM Processes
- Measures of KM Outputs
- Measures of KM Outcomes
  - Value-Createion
- Linking K Management and Measurement
- Vision, Competencies, Success Factors

Section: 1 2 3 4 5 6

© Copyright 2003, Y. Malhotra
www.KMNetwork.com
Balanced Score Card for Knowledge Assets Measurement

**Knowledge Management**
- **LEARNING & GROWTH**
  - Objectives
  - Indicators
  - Competencies to change, improve, and innovate

**STAKEHOLDERS**
- Objectives
- Indicators
- Competencies to create stakeholder loyalty through value added services

**VISION & STRATEGY**
- Objectives
- Indicators
- Defining the national vision of the knowledge-based economy

**BUSINESS PROCESSES**
- Objectives
- Indicators
- Competencies to transform business processes

**VALUE CREATION**
- Objectives
- Indicators
- Competencies to create value – socio-economic and developmental

**PUBLIC SECTOR**
- Relationship Management
- Budget & Cost Management
- Process Improvement

Section: 1 2 3 4 5 6

© Copyright 2003, Y. Malhotra
www.KMNetwork.com
Improved Models for ‘Holistic’ Development

- From ‘inputs’ to ‘value creation’
- Beyond accounting and economics focus
- What is the ‘Knowledge Economy’?
- Fundamental theoretical concerns
- Evolution beyond ‘industrial thinking’
- Differences that make a real difference
- K-economy vs. energy-based economy
Improved Models

Inter-disciplinary View of Knowledge Assets

INTELLECTUAL CAPITAL

INFORMATION

HUMAN CAPITAL

KNOWLEDGE ASSETS (INTANGIBLE)

CULTURE

SOCIAL CAPITAL

Social Network Theories

Human Resource Theories

Intellectual Capital Theories

Section:  1  2  3  4  5  6
Summary

1. New National Wealth – Knowledge Assets
2. Popular Measurement Models
3. Models of Developmental Organizations
4. A Measure of National Knowledge Assets
5. A Measurement Model for the ‘Public Sector’
6. Improved Models for ‘Holistic’ Development
Summary

- Knowledge Assets and ‘Knowledge Society’
  - Nation's competences and capabilities – ‘intangibles’
  - Economic, human and social development – ‘holistic’
  - Existing measures – accounting, ICT, and structural
  - Human Capital and Social Capital
  - Toward better theory, models, and measures
Improved Models for ‘Holistic’ Development

- “The farm sectors of developing countries, which account for 60% of employment and up to 35% of GDP, have been devastated by rich-nation overproduction of commodities such as cotton, wheat, and corn. Because of such trade distortions, poor farmers lose $24 billion each year.”

- “Poorer nations are also wary of making concessions. India is leading the resistance to a U.S. proposal to cut tariffs on manufactured goods to zero by 2015.”
Improved Models for ‘Holistic’ Development

“Business wants poorer nations to crack down on piracy of software, entertainment, and medicine. But poorer nations want less, not more, patent protection. A case in point: African and Asian nations without their own drugmakers want to import knockoffs from India and Brazil for a fraction of what they might pay U.S. drugmakers.”