Measuring National Knowledge Assets:
Conceptual Framework and Analytical Review

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Economic and Social Affairs**

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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

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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

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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?

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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"

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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

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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

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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.

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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

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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

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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

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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

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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?

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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

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Organization for Economic Co-operation and Development

- 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*

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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

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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*
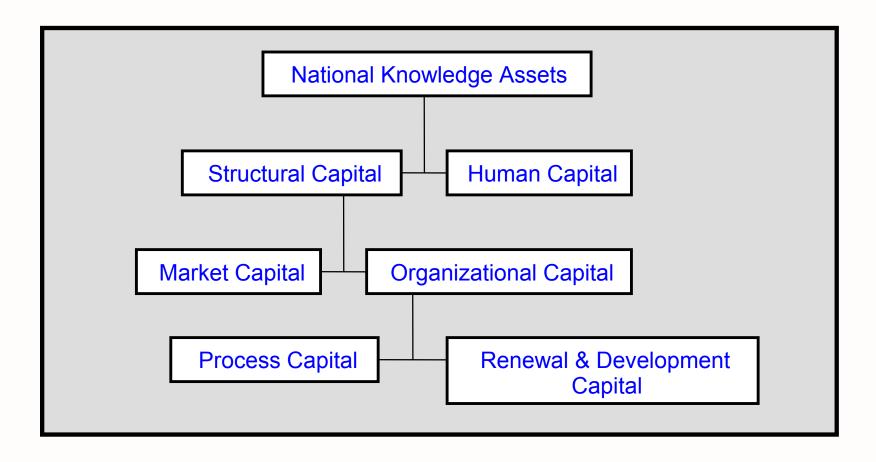
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A Measure of National Knowledge Assets

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                   ┌─────────────────────────────┐
                   │  National Knowledge Assets   │
                   └─────────────────────────────┘

   ┌──────────────────┐          ┌──────────────────┐
   │ Structural Capital│          │  Human Capital   │
   └──────────────────┘          └──────────────────┘

┌────────────────┐    ┌──────────────────────────┐
│ Market Capital │    │  Organizational Capital  │
└────────────────┘    └──────────────────────────┘

   ┌──────────────────┐      ┌──────────────────────────┐
   │ Process Capital  │      │   Renewal & Development   │
   └──────────────────┘      │         Capital           │
                             └──────────────────────────┘
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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."

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A Measure of National Knowledge Assets

Human Capital

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

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

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A Measure of National Knowledge Assets

Market Capital

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

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

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A Measure of National Knowledge Assets

Process Capital

Original Indicators

Telephone mainlines per capita

Personal computers per capita

Internet hosts per capita

Mobile phones per capita

Radio receivers per capita

Television sets per capita

Newspaper circulation per capita

Proposed Indicators

Computer literacy rates

Digital storage per capita

Volumes of books in libraries per capita

Transportation statistics such as paved roads per cap

Availability and extent of software usage

Entrepreneurship and number of venture start-ups

Venture capital funding

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

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

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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:

  - What? Why? How? When?

Inputs-Processes-Outputs-Outcomes

- Measures of KM Inputs

- Measures of KM Processes

- Measures of KM Outputs

- Measures of KM Outcomes

  - Value-Creation

- Linking K Management and Measurement

- Vision, Competencies, Success Factors

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Public Sector

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

Relationship Management

VISION & STRATEGY
Objectives   Indicators

Defining the national vision of the knowledge - based economy

BUSINESS PROCESSES
Objectives   Indicators

Competencies to transform business processes

Process Improvement

VALUE CREATION
Objectives   Indicators

Competencies to create value – socio -economic and developmental

Budget & Cost Management

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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

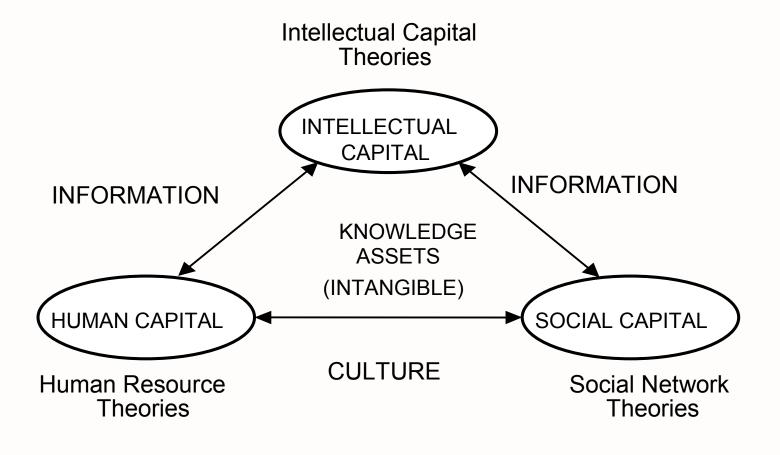- K-economy vs. energy-based economy

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Inter-disciplinary View of Knowledge Assets

Intellectual Capital
Theories

INTELLECTUAL
CAPITAL

INFORMATION

KNOWLEDGE
ASSETS

(INTANGIBLE)

INFORMATION

HUMAN CAPITAL

SOCIAL CAPITAL

CULTURE

Human Resource
Theories

Social Network
Theories

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Summary

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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

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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."

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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."

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