

December 2003

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Recommended Citation

Passerini, Katia, "Knowledge Assessment in Developing/Developed Economies: Frameworks and Implementation Examples" (2003).
AMCIS 2003 Proceedings. 337.
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KNOWLEDGE ASSESSMENT IN DEVELOPING/DEVELOPED ECONOMIES: FRAMEWORKS AND IMPLEMENTATION EXAMPLES

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Abstract

This research in progress critically presents established methodologies recently adopted by international development institutions to assess knowledge maturity at the macro-economic level of a nation. It evaluates the advantages of specific measurement methodologies, but also contrasts the underlying assumptions of the measurement models. A more comprehensive assessment framework that integrates scorecards models with in-country workshops and culture nurturing is proposed. An example of its implementation at the country level is presented. Next steps include comparisons of the proposed methodologies with selected knowledge assessment initiatives in specific industries/organizations.

Keywords: Knowledge assessment, benchmarking, scorecards models, knowledge-based economy

Introduction

Assessing the capability of a country to create, share and effectively use its knowledge is an important macro-economic development task, and one to which several international organization have devoted much attention and resources since the mid-nineties [Macdonald, 1999; World Development Report, 1998/99]. The efforts and results achieved at the macro-level of developing and developed nations [Dahlman and Aubert, 2001; World Bank Institute, 2001; Dahlman and Andersson, 2000] are interesting to review and compare with those undertaken at the firm level. Although the subjects of the analysis (and the measurement models) differ, there are important lessons and insights that can be gained from the numerous examples of worldwide knowledge-based initiatives. K-sharing processes have displayed similarities both at the macro-level of national alliances (trade, global business / political linkages) [Arthur, 1996], and at the level of firms' strategic partnerships [Choi, 1997]. These similarities could also feed industry strategies for internal knowledge growth and for inter-organizational knowledge sharing, which will be part of future analysis.

The purpose of this research in progress is to review efforts conducted by selected international organizations that have paid particular attention to benchmarking countries' knowledge potential. The goal is to evaluate differences and gain insights from the lessons learned which are applicable also at the micro-economic level of the individual firm. In addition, the refinement of the preliminary research framework for knowledge assessment presented in this paper is expected to make a contribution to understanding the role that the infrastructure, incentives, HR policies, innovation and leadership may play in promoting knowledge-based growth in multiple sectors (governmental, non-profit and private sectors).

A Noteworthy Effort in Knowledge Assessment

A noteworthy example of a knowledge benchmarking effort is the Knowledge Assessment Methodology (KAM) established by the World Bank [World Bank Institute, 2002]. The KAM uses 'knowledge assessment scorecards' to evaluate how a country compares to other nations, particularly in its use of knowledge for its overall social and economic development.

The KAM consists of 66 variables (Appendix 1) that are used as proxies for the key four areas regarded as critical components in the development of a ‘knowledge-based economy’ – a concept drawing from traditional theories of economic development [Boulding, 1971]. The four areas are listed in Table 1.

Table 1. Key Areas for K-Economies Development

AREAS	DESCRIPTION
Incentives System (Economic & Institutional Regime)	The economics and institutional regime provide resources and necessary freedom for the efficient use of existing and new knowledge, and the support of entrepreneurship
Innovation System	The affluence of research centers, universities, and other R&D opportunities enable leveraging the global codified knowledge, and creating knowledge-intensive new product and services
Information Infrastructure	The existence of an efficient communication infrastructure facilitates the sharing, dissemination and processing of data, information, and knowledge
Education	The skills of the population and the formal education levels enable the effective use, creation and sharing of knowledge

Adapted from World Bank Institute, 2002

Although the 66 variables are grouped within the four areas, and conclusions may be reported by groups, the model is nevertheless complex and not conducive to direct comparative feedback. To simplify the model, the number of variables used in the benchmarks is reduced to fifteen in the ‘knowledge assessment scorecards.’ The scorecards consist of a subset of the crucial variables, normalized to represent key performance measures along the above-mentioned four areas for k-economies development. The variables and sources of the most recent implementation of the KAM exercise (2002) are illustrated in Figure 1. Macroeconomic performance indicators are also included in the model to benchmark country size / resources levels.

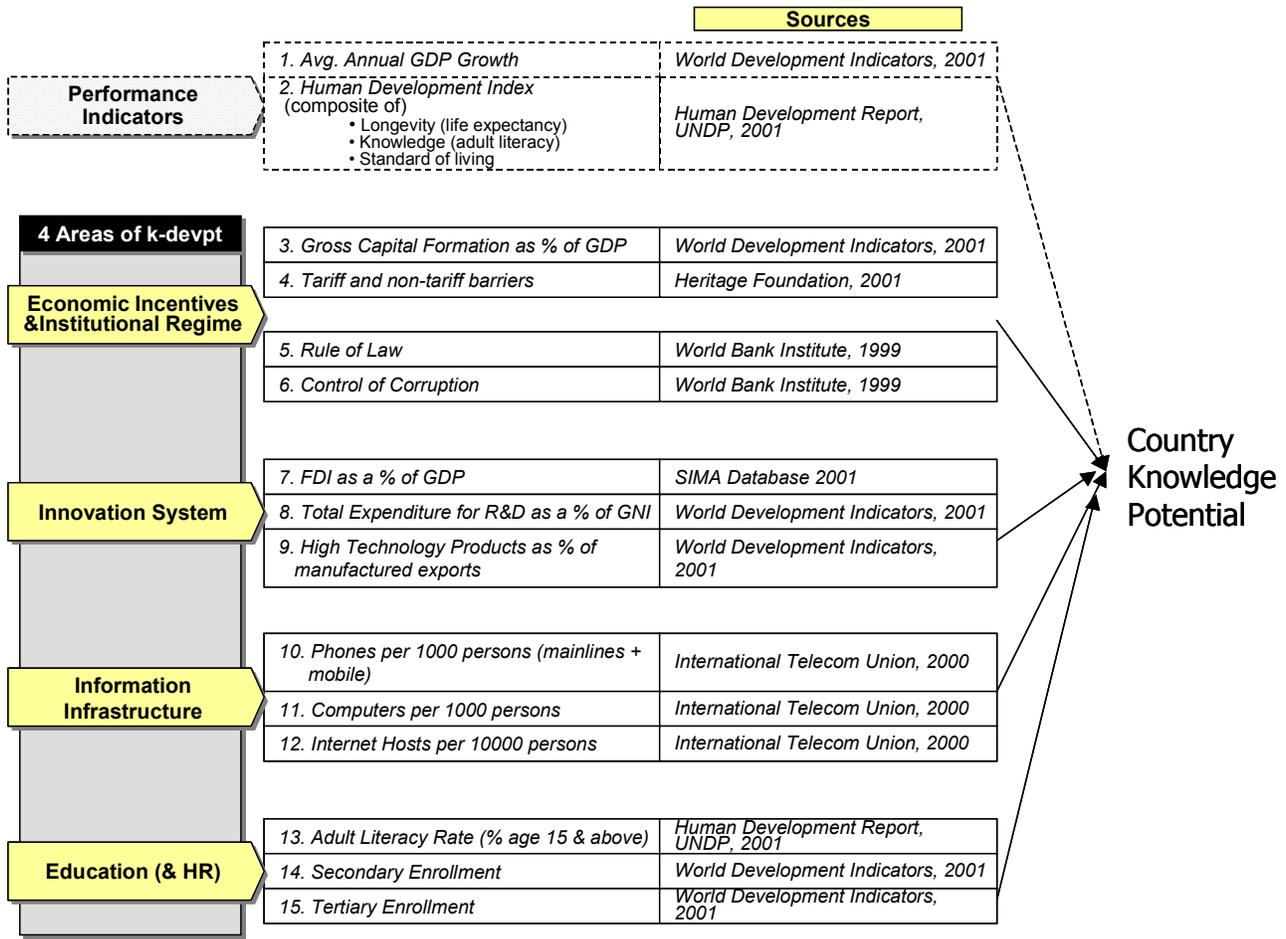
In the 2002 KAM implementation, the scorecards are used to compare 98 countries, which include most of the developed economies and about sixty developing economies. The results are keyed in radar graphics that allow, for example, direct identification of the countries relative positioning compared to the G7 countries.

The described framework represents a structured approach for a quantitative overview of the countries knowledge potential. However, the review of the measurements chosen does not directly account for several other factors - such as citizens’ culture and local attitudes towards knowledge sharing - that play an important role in guaranteeing the flow of information, and the creation of new and re-usable knowledge. Although the authors agree that the selected variables represent a large spectrum of factors that facilitate (or hinder) information and knowledge flows in a given country, they doubt that the presented methodology would capture or nurture the full potential of a nation’s ‘knowledge-citizens.’

Therefore, it is crucial to re-evaluate the results of the most recent international assessments (KAM-2002) to clearly map the direct and indirect relationships of the variables in the achievement of the country knowledge potential (specifying which level or function of k-creation the variables impact). When looking at the different levels of k-creation activities – such as access, use, dissemination, and creation of new knowledge – it is clear that additional variables must be considered. The authors suggest that more comprehensive approaches (such as few already undertaken by the World Bank in previous knowledge assessment exercises) have a more effective role in nurturing knowledge creation in a nation. This calls for the adoption of the KAM framework only within the context of a multi-faced k-assessment process, which does not limit itself to data extraction from annual reports [World Development Indicators, 2001; Human Development Report, 2001] but integrates more comprehensive interview / dialogue efforts. This approach is available in the National Knowledge Assessment Framework (NKA).

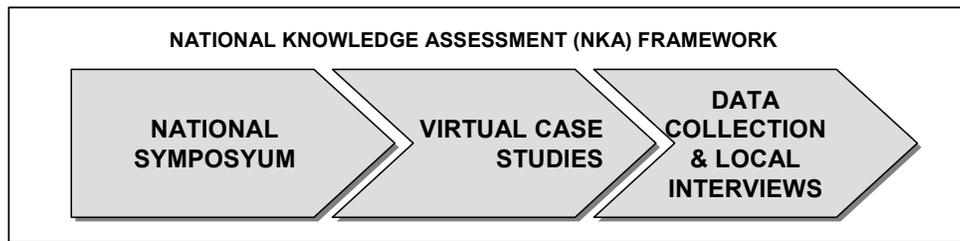
More Comprehensive Approaches: The Prospectus for the National Knowledge Assessment (NKA Methodology)

In 1996, the National Research Council in Washington DC was commissioned, by the World Bank, to define a framework for designing interventions to improve the use of knowledge for social and economic development. This framework (**Figure 2**), better known as the National Knowledge Assessment methodology [National Research Council, 1996], became the reference point for a series of pilot studies in developing economies (i.e. the South Pacific Islands, Panama, Mexico) that contributed to the diffusion of the concept of ‘knowledge management’ in these nations.



Adapted from World Bank Institute, 2002

Figure 1. Knowledge Assessment Scorecard Variables



Adapted From: National Research Council, 1996

Figure 2. NKA Framework

The National Knowledge Assessment (NKA) prospectus is based on three components:

- A national symposium for motivating local investors and entrepreneurs in launching knowledge-based activities, and creating new knowledge (through new products and services);
- A series of virtual case studies of "sentinel enterprises," an exercise to identify opportunities and barriers to the creation or expansion of knowledge-based enterprises. Local stakeholders and entrepreneurs meet and elaborate potential market opportunities;

- Selected *data collection & interviews* with experts, potential actors, and stakeholders. Interviews target key players in government, academia, and the private sector. The data (used for benchmarking) and the interviews clarify and quantify the problems that may be encountered, and help validate the recommendations.

These three initiatives are preliminary steps for mapping the formal and informal knowledge flows and knowledge transfers (the latter defined as the transfer of either expertise - i.e. skills and capabilities - or external information of strategic value [Gupta and Govindarajan, 1991] within the selected economy). They favor understanding which actions promote the wider diffusion of knowledge among the population as well as lower barriers to knowledge assimilation and use. The strength of this approach is that it requires extensive discussion and involvement of key stakeholders, who act as champions of knowledge-based initiatives identified in the virtual case studies. Although benchmarks are collected through data gathering and analysis, they are discussed with local populations that are active participants in the process, thus are willing to contribute to it.

The comprehensiveness of this approach consists in its reliance on people as dynamic actors of the knowledge creation process, not exclusively on general data used as proxy for defining a country static knowledge assets and status. In addition, the NKA model matches specific knowledge drivers with the knowledge functions they perform (Figure 3). The NKA is based upon six fundamental functions, which present similarities with the ‘knowledge spiral’ concept [Nonaka, 1994]:

- (1) **motivation** for undertaking knowledge-based activities,
- (2) **creation** of knowledge, both local, theoretical, and applied,
- (3) **access** to knowledge, the infrastructure for obtaining knowledge from internal and external sources,
- (4) the capacity for **assimilation** of knowledge, its selection and understanding,
- (5) the **diffusion** of knowledge to the entire population, and
- (6) the capacity for its productive **use** for both economic and social benefit.

With this function-based approach, the NKA model clarifies the relationship between variables and their impact on making the knowledge potential explicit, a relationship that is missing in the KAM model.

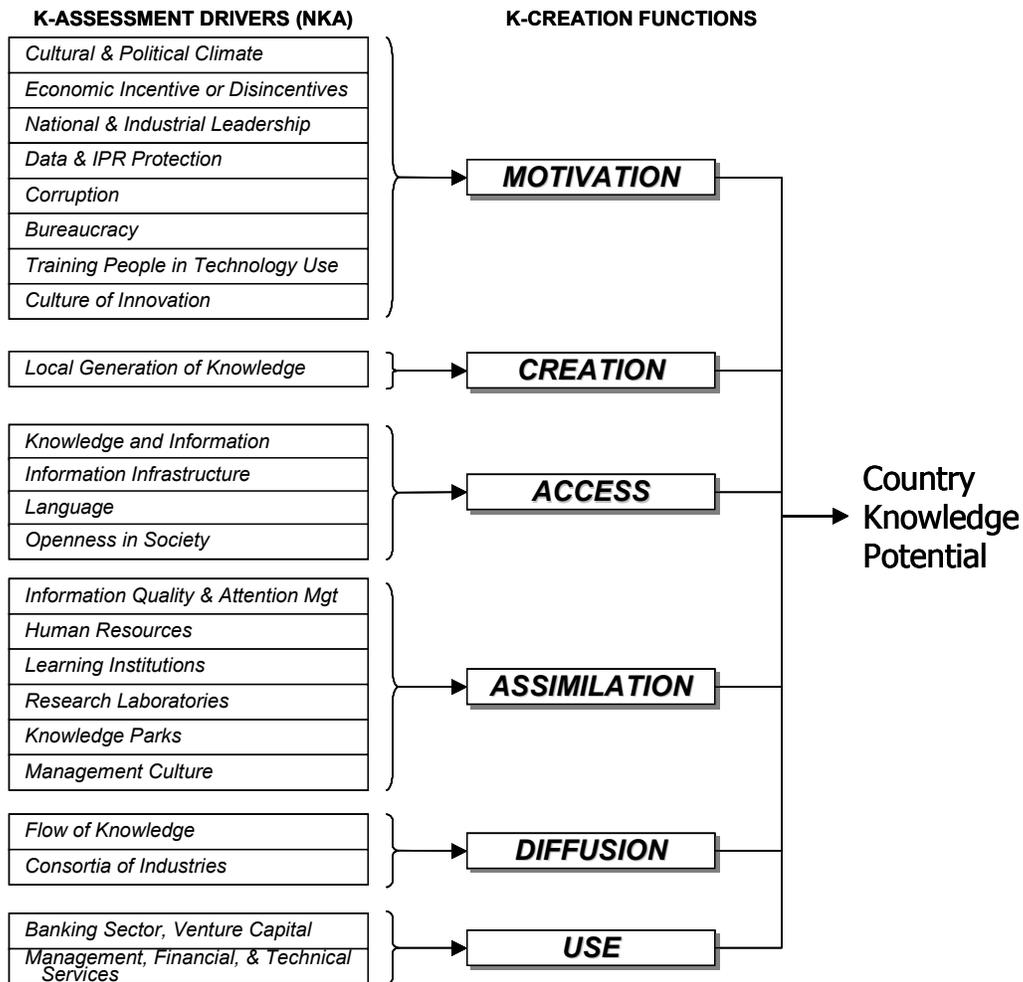
Since the KAM 2002 scorecards are based on a grounded analysis of macro-variables offering a sound analytical framework, the authors suggest leveraging both the KAM and NKA methodology. The use of a qualitative and quantitative approach that brings together the indirect data gathering techniques with in-loco interviews (Figure 4) while focusing on key local variables, such as national culture, can provide an inclusive reference method for future assessments.

The integration of the models helps to focus on a set of variables that have been recognized as representative of performance by a large number of countries (i.e. the 98 countries participating in the KAM 2002 exercise). In addition, it benefits from a more comprehensive framework that appreciates the impact of different variables on multiple knowledge functions, and the importance of a dialogue that captures countries’ unique attributes. This is a win-win scenario that overcomes precisely the limitations that earlier assessments - only based on the NKA model - had encountered, as in the World Bank South Pacific Islands exercise.

NKA Application Example: South Pacific Islands

The application of the NKA methodology enables the establishment of a sharing relationship and culture that enjoys a lasting impact in the participating economies. For example, in 1997, the World Bank applied the NKA methodology in a knowledge assessment exercise in the South Pacific Islands (specifically Fiji, Western Samoa, Tonga) [SMEC International and CarlBro, 1997]. The assessments consisted in all of the following preliminary and follow up activities:

- A Benchmark analysis of information technology usage in Pacific Islands, with the evaluation of inhibitors and enablers of better information technologies use;
- A series of “Virtual” case studies to identify opportunities for new information-intensive activities;
- An Internet conference to discuss preliminary findings with local stakeholders and international experts worldwide – evaluating the methodology and the results obtained;
- A Regional symposium to increase awareness of global trends in knowledge-intensive initiatives;
- In-country stakeholder workshops to discuss and agree on vision and action plans.



Adapted From: National Research Council, 1996

Figure 3. NKA Knowledge Drivers and Functions

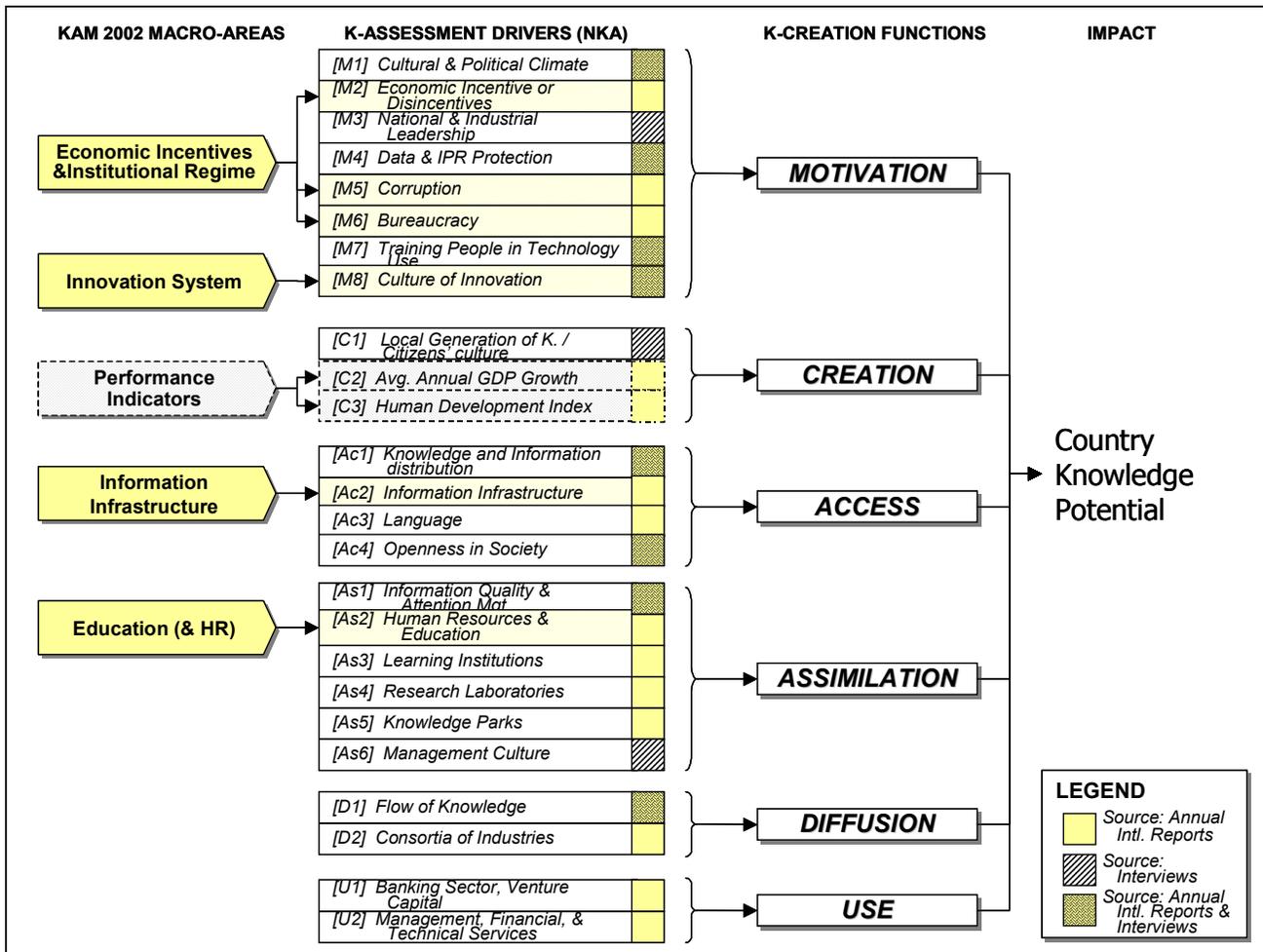


Figure 4. Integrated KAM 2002 and NKA 1996 Models

The in-country stakeholder workshops represented an opportunity to draft a vision plan for information and communication regulation changes, as well as selection of immediately actionable knowledge-based projects. The assessment answered questions on current Pacific Islands standing compared to other neighboring economies. It also assisted in drafting an intervention plan to take advantage of quick-win opportunities (i.e. the creation of a knowledge park with the University of the South Pacific, the establishment of a Kava Club for preserving traditional medical knowledge, Youth Counseling Network to prevent brain-draft, etc.).

Lessons learned from the assessment, and highlighted through the feedback process of the international Internet conference, are mostly related to

- The need for a more extensive set of measurements – which had focused mainly on information & communication infrastructure variables;
- The need to focus on local culture as the one key component of a country knowledge sharing potential.

Using the KAM framework that deals with measures beyond ICT endowment, and incorporating the focus on dialogue, communication and local culture of the NKA methodology (drivers such as C1, Ac1, and D1 in Figure 4) is, therefore, a valid approach to overcome highlighted limitations. The presence of tools for information and communication support is a prerequisite. However, there must be a clear vision, understanding and appreciation for leveraging information resources to create new knowledge (driver M1 in Figure 4). This is highly related to the local culture, habits, and attitudes towards innovation (M8 in

Figure 4). In conclusion, it is important that any assessment project focuses more extensively on the issues of culture and local knowledge rather than exclusively on country performance measures.

One way of pursuing the above integration objective is by re-applying the NKA model strengthened by the use of the widely approved KAM variables. This is an approach that could be taken by upcoming assessment initiatives launched not only by the World Bank but also by the several regional development institutions working on similar projects. The importance of this methodological integration is based on the very essence of the KM-process: benefiting from the lessons learned in one experience to leapfrog into sounder implementations in other countries.

Another way of furthering the integration approach is that of comparing it to what happens in other KM-driven realities (i.e. different industry sectors). In these private sector frameworks are both qualitative and quantitative approaches implemented? Are there opportunities for drawing conclusions from selected experiences on the importance of the integration approach? Examples of possible applications, variables modification and opportunities for future research that addresses these questions are presented in the next paragraphs. Results from pilot case studies are briefly highlighted, as they will constitute the background for conducting additional investigations and gain a preliminary understanding on the actual opportunities for similar approaches across sectors.

Fine-Tuning the Integrated Framework for Application in Selected Industries/Organizations

The first step for using the integrated model in industry consists in choosing the variables that are applicable in a business context. Several of the variables in Figure 4 are closely related to similar drivers in industry. For example, **Figure 5** proposes a preliminary and draft list of organizational variables.

The next steps of the research include the verification and refinement of the integrated framework (Figure 5) in different industries. The primary goal is to identify whether the relative importance of drivers – observed through the quantitative analysis and the interview/workshop sessions at the national level - displays similar trends and ranking order (in terms of motivation and implementation of knowledge processes) of firm approaches.

Pilot studies were conducted to evaluate the applicability of the integrated model. Results of preliminary case studies and observation of k-assessments and benchmarking initiatives in two specific industries (manufacturing and tertiary services) show that more successful approaches rely to the integration of workshops, stakeholder analyses, and company culture evaluation as key components of the employees' willingness to share knowledge. The observation of knowledge-driven programs in Firm A – a leading European manufacturer – and the impact that k-assessment drivers played in consensus building and developing the firm knowledge potential show a prevalent focus on HR and industry leadership factors. However, the lack of a firm management support, the focus on maintenance rather than innovation, the infrastructure development confined to maximum efficiency primarily in the home country have made little contribution towards expanding the firm k-potential. In addition, the company industry leadership and advanced HR policies are not closely tied to KM-results.

Looking at the results of k-initiatives in Firm B – a leading service provider for multiple industries – and at the impact played by all drivers in sustaining knowledge-growth, the outlook for success is more clearly laid out. The assessed drivers are highly linked to knowledge diffusion and HR policies are re-designed to reward knowledge sharing. In turn, this impacts the culture of the organization and is fostered by numerous team cross-fertilization initiatives. K-programs are successfully implemented in the company, monitored by the KM group, and promote new performance gains and innovation opportunities. Both pilots witness the relevance of capturing raw data but also the importance of looking at cultural and local personnel issues that play a major role in the success of the launched k-programs. In addition, the integration of workshops, programs championship and follow-up activities beyond the variables assessment display a similar role as in the country experiences.

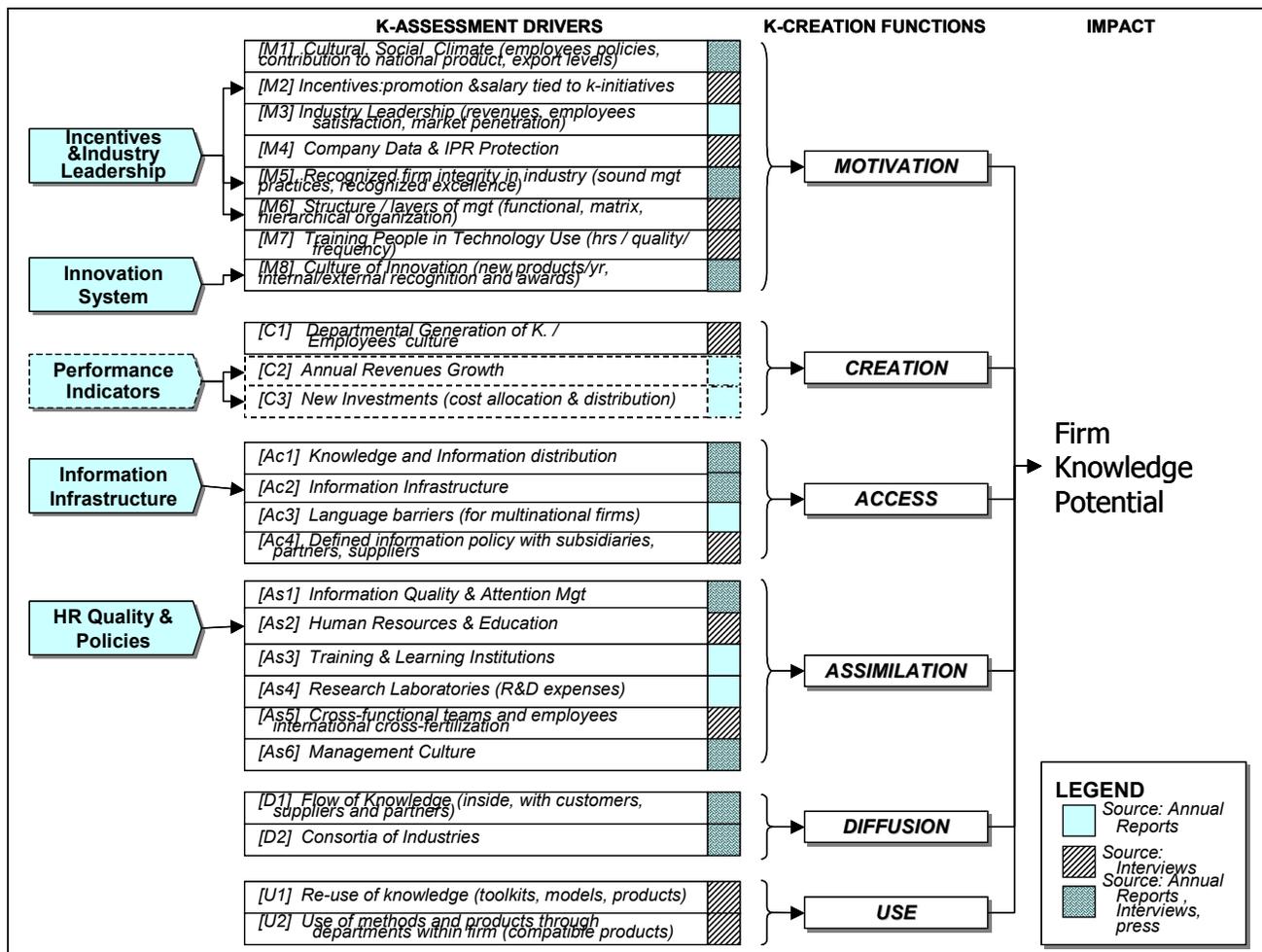


Figure 5. Firm-Based Version of Integrated Model

Forthcoming Research Efforts

Future analysis will include expanding the methodology to different industries and developing a common template for case studies analysis and assessment across companies. Case studies firms will be selected by industry sector based on their ranking in R&D spending/employee in the fiscal year 2002 (targeting one among the first top five/ten R&D firms in aerospace, automotive, biotech, chemicals, high-tech & computing, health, electronics, energy, semiconductors, telecommunication). [MIT Technology Review, January 2003]. The knowledge implementations efforts will be benchmarked and assessed against the variables identified in Figure 5, and the drivers will be ranked, through interviews with the firms' knowledge management process owners, based on their relative impact on the knowledge creation functions. This framework is expected to make a contribution to understanding the role that the infrastructure, incentives, HR policies, innovation and leadership may play in promoting knowledge-based growth in multiple sectors (governmental, non-profit and private sectors).

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Appendix 1. Variables KAM Model (Excluded 15-Scorecard Variables)

Performance Indicators
1. Gender development index 1999 (Human Development Report, UNDP, 2001)
2. Poverty index 1999 (Human Development Report, UNDP, 2001)
3. Composite ICRG risk rating 2000 (World Development Indicators, 2001)
4. Unemployment rate, % of total labor force 1996-98 (World Development Indicators, 2001)
5. Productivity growth (% change of GDP x person employed) 2000 (IMD World Competitiveness Yearbook, 2001)
Economic Incentives
6. Overall central government budget deficit as % of GDP, 1998 (World Development Indicators, 2001)
7. Trade as % of GDP, 1999 (World Development Indicators, 2001)
8. Intellectual Property is well protected (WEF Global Competitiveness Report, 2000)
9. Soundness of banks (WEF Global Competitiveness Report, 2000)
10. Adequate regulations & supervision of financial institutions (IMD World Competitiveness Yearbook, 2001)
11. Local competition (WEF Global Competitiveness Report, 2000)
12. Protection of property rights (WEF Global Competitiveness Report, 2000)
Institutional Regime
13. Regulatory framework (WBI, 1999)
14. Government Effectiveness WBI, 1999)
15. Voice and accountability (WBI, 1999)
16. Political stability (WBI, 1999)
17. Press freedom 2001 (Freedom House, 2001)
Innovation System
18. Technology Assessment Index (Human Development Report, UNDP, 2001)
19. Royalty and license fees payments (millions) (1999) (World Development Indicators, 2001)
20. Scientists and engineers in R&D per million 1987-97 (World Development Indicators, 2001)
21. Research collaboration between companies and universities (WEF Global Competitiveness Report, 2000)
22. Entrepreneurship among managers (IMD World Competitiveness Yearbook, 2001)
23. Easy to start a new business (WEF Global Competitiveness Report, 2000)
24. Availability of Venture capital (WEF Global Competitiveness Report, 2000)
25. Number of technical papers per million people 1997 (World Development Indicators, 2001)
26. Patent Applications granted by the USPTO (per million pop.) 2000 (USPTO)
27. Private sector spending on R&D (WEF Global Competitiveness Report, 2000)
Human Resources
28. Primary Pupil-teacher ratio, pupils per teacher, 1998 (2001 SIMA database)
29. Life expectancy at birth, years, 1999 (2001 SIMA database)
30. Management/worker relations (WEF Global Competitiveness Report, 2000)
31. Flexibility of people to adapt to new challenges (IMD World Competitiveness Yearbook, 2001)
32. Public spending on education as % of GDP 1999 (World Development Indicators, 2001)
33. Professional and technical workers as % of the labor force 1999 (ILO, 2000)
34. 8th grade achievement in mathematics (TIMMS 1999)
35. 8th grade achievement in science (TIMMS 1999)
36. National culture is open to foreign influence (IMD World Competitiveness Yearbook, 2001)
37. Companies invest heavily to attract, motivate and retain staff (WEF Global Competitiveness Report, 2000)
38. Mgt education locally available in 1 st class business schools (WEF Global Competitiveness Report, 2000)
39. Well educated people do not emigrate abroad (IMD World Competitiveness Yearbook, 2001)
40. University education meets the needs of a competitive economy (IMD World Competitiveness Yearbook, 2001)
Information Infrastructure
41. Telephones per 1,000 people, 1999 (International Telecommunication Union, 2000)
42. Mobile phones per 1,000 people, 1999 (International Telecommunication Union, 2000)
43. TV Sets per 1,000 people, 1999 (World Development Indicators, 2001)
44. Radios per 1,000 people, 1999 (World Development Indicators, 2001)
45. Daily newspapers per 1,000 people, 1996 (World Development Indicators, 2001)
46. Investment in telecoms as % of GDP 1998 (IMD World Competitiveness Yearbook, 2001)
47. Rating of computer processing power as % total world-MIPS 1998 (IMD World Competitiveness Ybook, 2001)
48. International telecoms: cost of call to US in \$ per 3 minutes, 1999 (World Development Indicators, 2001)
49. Information Society Index 2000 (IDC 2000)
50. % of Companies that use the Internet for electronic commerce (WEF Global Competitiveness Report, 2000)
51. ICT Expenditures as a % of GDP 1999 (World Development Indicators, 2001)

Source: World Bank Institute, 2002