ANCHORING AND WEIGHTING KNOWLEDGE ECONOMY AND KNOWLEDGE INDICES AS IMPROVED MEASURES OF A COUNTRY'S READINESS FOR THE KNOWLEDGE ECONOMY: A CASE STUDY OF KENYA

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Abstract: This study sought to develop a set of indices better able to track a country's readiness for the knowledge economy. The new indices, the Anchored Knowledge Index and the Anchored Knowledge Economy Index are based on the World Bank (WB) knowledge economy framework. The rationale for the introduction, and the procedures to calculate the new indices are presented. The WB indices provide for rank-ordered normalization based on the latest data available for a benchmarking group of countries. The proposed anchored set of indices, however, provides for a relative ordering of the data. Relative-order (weighting) determines by how much each country, along a particular indicator, is better (or worse) than the others. The new indices address the short-coming of rank-order where as long as the relative positions of the benchmarking countries remain the same, the indices do not change even though the gaps between countries could be decreasing (desired) or increasing (cause for alarm). Further, the subject country now appears twice, based on both the latest data available, and a baseline (anchor) from the World Bank Knowledge Assessment Methodology 2009 data. Using Kenya as a case study, a basic scorecard for Kenya is proposed and used for the calculation of the indices for Kenya and five benchmark countries, Singapore, South Africa, Japan, South Korea. The results clearly illustrate the efficacy of the proposed approach in tracking a countries readiness for the knowledge economy.

Keywords: Kenya, Knowledge Economy, Knowledge Index, Knowledge Economy Index

Abbreviations and Acronyms: (a) AKI: Anchored Knowledge Index (b) AKEI: Anchored Knowledge Economy Index (c) APEC: Asia Pacific Economic Commission (d) EU: European Union (e) GDP: Gross Domestic Product (f) ICT: Information Communication Technology (g) ILO: International Labour Organization (h) IMF: International Monetary Fund (i) KAM: Knowledge Assessment Methodology (j) KEI: Knowledge Economy Index (k) KI: Knowledge Index (l) OECD: Organization of Economic Development and Cooperation (m) R&D: Research and Development (n) RDI: Research & Development and Innovation (o) UN: United Nations (p) WB: World Bank

INTRODUCTION

The uniqueness of the information revolution is that the basic economic resource is no longer capital, natural resources, nor labour. Knowledge as value is the new basic resource that is now created by productivity and innovation (OECD, 1996). The economic challenge of the post industrialist era will be the proper creation, dissemination and utilization of knowledge as a competitive edge and a key factor that countries should take advantage of (Grewal et al., 2002). Knowledge may be defined as the application and productive use of information (Davis and Botkin, 1994). A broad comprehensive definition of the knowledge economy is one where the use of knowledge is manifested in technologies; where better processes and workforce skills are applied to a broad range of traditional and new economic sectors; and where knowledge is the main driver of productivity improvements and growth across all industries (Sheehan and Grewal 2000; OECD 2002;

APEC 2003; World Bank 2004; Al Rahbi 2008).

There has been a recent upsurge in the knowledge economy due to several broad trends and factors that include technological advancement, particularly in communication, computing, transportation and information exchange; globalization and integration of the world economy; the shift in the awareness that knowledge has become a distinct factor of production; and the creation of potential solutions to sustainable economic growth as well as new jobs generation (OECD, 1996; APEC, 2003).

The Organization of Economic Development and Cooperation(OECD) and the World Bank (WB) have provided a set of guidelines for selecting the appropriate and relevant factors and indicators for measuring the knowledge economy. Specifically, the factors and indicators should be easily interpreted; be supported by reliable and timely data; be of relevance to the characteristic it is intended to describe; be sensitive to the underlying phenomenon which it purports to measure; be available for several time periods including recent periods; and to allow for international comparison (OECD, 1996; World Bank 2004). These guidelines were used to inform this study.

LITERATURE REVIEW

Although several knowledge economy frameworks exist in the literature, three dominate: the OECD, the Asia Pacific Economic Commission(APEC) and the World Bank frameworks. A brief discussion of each follows (Al-Rahbi 2008).

The OECD framework was among the pioneers in trying to map the development of the knowledge economy as part of its attempt to understand the drivers of economic growth of its member countries. In 1996, the OECD published the Knowledge-based Economy (OECD, 1996), an early attempt to incorporate statistical indicators on the measurement of the knowledge economy. Further work on the under-pinnings of the knowledge economy emphasized the role of the following key factors in economic growth (OECD 2001b in Al-Rahbi 2008): (a) A stable and open macroeconomic environment with effectively functioning markets that stimulate the private sector and the creation of new firms; (b) Diffusion of information and communication technologies (ICT) as an effective means to store, disseminate and link knowledge creators and user; (c) Innovation development in terms of funding and investing in R&D, coordinating R&D and entrepreneurial activities, and protecting the intellectual property rights of new inventors; and (d) Investing in human capital, the backbone of the knowledge economy, for enhancing education and training at all levels.

On the other hand APEC advocated for a framework where countries strive for innovation and technological change as focal points of productivity and competitiveness, supported by an effective national innovation system; pervasive human resource development, including a high standard of education and training throughout a person's working life; an efficient ICT infrastructure that allows citizens and businesses to readily and affordably access pertinent information from around the world; and a business environment that is enticing and supportive of enterprise and an innovation development imperative (APEC, 2003).

Finally, the World Bank Framework incorporates the key features of the previous two. It bases the knowledge economy on four key pillars, (1) effective government institutions and economic incentives that facilitate and encourage efficient creation, acquisition, dissemination and use of knowledge, (2) an education and training system that produces a productive and innovative labour force, (3) an ICT infrastructure to disseminate effectively the creation, adoption and use of knowledge, and (4) research and development (R\D) that creates dynamic interaction between local science and technology, and the local private sector to tap them into the growing stock of global knowledge (World Bank, 2007).

Implicit in the WB's framework is the recognition that the development of a knowledge economy is a long-term process, involving the formation and diffusion of new socio-economic values that make the dynamic change possible through promoting productivity, innovation and lifelong learning. The WB knowledge economy framework is the most widely used, and therefore forms the basis for the development of the proposed new indices. A detailed description of the framework follows.

WORLD BANK KNOWLEDGE ECONOMY FRAMEWORK

The WB knowledge economy framework has been developed on the basis of 109 input and output indicators (World Bank, 2007). The broad set of indicators provides a cross-sectoral approach, giving the user a holistic view of a wide range of relevant factors. Detailed descriptions on each of the indicators can be found on the WB website.[1]

The WB framework is based on two key indices, the Knowledge Index (KI), and the Knowledge Economy Index (KEI). The KI measures a countries ability to generate, adopt and diffuse knowledge. The knowledge is based on three of the four pillars above,

1 Source: World Bank, http://www.worldbank.org/kam, Accessed November 14, 2011

namely: Education and training; Information Communication Technology; and Research & Development and Innovation. On the other hand, the KEI also takes into account whether a country's environment is conducive for knowledge to be used effectively for economic development. It is based on all the four pillars previously presented.

Calculation of the composite KEI or KI for a specific country follows the Knowledge Assessment Methodology (KAM) developed by the WB. The process is based on the determination of the desired indicators to be used (serve as proxies for a countries preparedness to compete in the knowledge economy), and the set of comparison countries. According to Robertson(2007),

``The KAM enables countries to benchmark themselves with neighbours, competitors or other countries they wish to learn from on the four pillars of the knowledge economy. It is therefore a tool aimed at promoting `learning' amongst developing and developed countries about the elements involved in a very particular kind of economy; a globally-oriented, market-based economy and society. Learning through comparisons with others (normalisation), and making appropriate policy changes is seen as producing a nation's knowledge-based economy."

The KEI or KI provides a normalized ranking of a particular country, within the set of comparison countries. It therefore varies according to (1) the indicators chosen, and (2) the make up of the comparison set. The following procedure is followed to calculate a country's indices using the KAM (World Bank, 2007): (a) The raw data (u) is collected from the World Bank database, international organizations, or the country's database for every indicator under investigation. (b) Ranks are allocated to countries based on the absolute values (raw data) that describe each and every indicator (rank u). For instance, the rank equals 1 for a country that performs the best among the chosen countries for a particular indicator (that is, it has the highest score), the rank equals to 2 for a country that performs second best, and so on. (c) For each specific country, the number of countries that ranks lower or below it (N_w) is calculated. (d) The following formula is used in order to normalize the scores for every country on every indicator according to its ranking and in relation to the total number of countries in the sample (N_c),

$$\text{Normalized (u)} = 10\ N_w/N_c \quad (1)$$

(e) The above formula allocates a normalized score from 0-10 for each country with available data on required indicators. Ten represents the top score for the top performers and 0 the worst. The top 10% of performers gets a normalized score between 9 and 10; the second best 10% gets allocated normalized scores between 8 and 9 and so on. The 0-10 scale provides a normalized rank-order and describes the performance of each country on each indicator, relative to the performance of the rest of the country sample.

Use of all the indicators may not always be necessary or possible, depending on the state of a country's knowledge economy and the availability of data. In response, the WB developed a *Basic Scorecard*, a representative subset of 14 diverse indicators (see Table 1), that attempts to capture a country's preparedness for the knowledge-based economy.

PROPOSED BASIC SCORECARD FOR KENYA

A basic scorecard is a subset of the 109 WB knowledge economy indicators. In developing a basic scorecard relevant to Kenya appropriate indicators must be selected that are sensitive to the country's social, economic and cultural peculiarities. For example, Al-Rahbi (2008) in developing a 12 indicator basic scorecard for Oman, argued that Oman is a developing country where output indicators such as number of patents, productivity level, and number of scientists may still be too low to be useful in comparisons. He goes on to suggest that input indicators such as education levels, ICT development level, and research and development expenditure may be more useful at an early stage of knowledge economy development (Chen and Dahlman 2005). Similarly, the World Bank (2007) in its developing countries assessment, seems to favor such an approach.

This approach, therefore, was followed in the development of the basic scorecard for Kenya where all the main pillars of the knowledge economy may not yet be fully established. For example, government institutions and economic incentives, research and development (R&D) and innovation, and ICT may not yet be fully entrenched as potential drivers for sustainable economic development. As a result, 3-4 broad representative indicators of a developing knowledge economy were selected from each of the four WB pillars. The 13 indicators for the proposed basic scorecard for Kenya are presented in Table 2. For comparison, the 8 indicators that form part of the WB basic scorecard are shown in bold.

MOTIVATION FOR THIS STUDY

Calculation of KI and KEI, are primarily meant to allow countries to benchmark themselves against comparison groups in terms of their readiness for the knowledge economy. The KAM yields a normalized rank-order of countries within a comparison group. On a year-on-year basis, therefore, countries can see how their development efforts are paying off vis-a-vis the selected indicators, relative to their comparison group of countries.

The current formulation of the KAM, however, presents some challenges, especially for developing countries who aim to use the indices as tools to measure development progress in the era of the knowledge economy. First, the use of dynamic rank-ordering -- all countries are measured on their current performance -- may make it difficult to determine if a country is making progress or not. For example, a drop in the KI or KEI may be due to either a drop in the values of the assessed indicators (i.e., the country is retrogressing) or a faster increase in the indicator values of comparison countries (i.e., the country may be progressing, but others are progressing faster) or a combination of both. Within the current system, unless one does a close analysis of the underlying values, one cannot tell. In addition, although, the rank-order provides information on whether a country is doing better or worse than another in its comparison group, it does not provide information on the extent of the difference. For example, if country A and B have scores of 5 and 6, respectively, the only information one can glean from this is that A is in the fiftieth percentile and B in the sixtieth percentile of the comparison group. But one *cannot* tell if B is for example three times or four times better as measured by the index.

In addition, use of the interactive KAM on the WB website as a means to track a group of benchmarked countries is beholden on how current the data in the WB KAM database is. As of this writing, most of the indicator values are current to 2005-2007. Even if more recent data is available for a benchmarking group countries, their absence from the KAM database prevents calculation of up to date indices. It is these limitations that the proposed new indices seek to address through this study.

The WB KAM database is updated periodically, with the publicly available 2009 database having data from as recent as 2007. The database is freely available on the WB website for interrogation and comparison of countries along a user-selected subset of indicators. Normalization of the variables may be based on pre-determined country groupings that include, all countries; East Asia and Pacific; low, medium and high income countries; etc. Normalized indices can then be compared across a set of desired benchmarking countries. For this study, South Africa, Singapore, Malaysia, Japan and South Korea were selected as the benchmark countries. Kenya (the subject country) and the benchmarking countries will collectively be referred to as the G6.

The `All 146 Countries' grouping in the WB interactive KAM database was used to normalize the indicators of the Kenya Basic Scorecard for the G6. The results are presented in Table 3. A simple average of the normalized scores from each of the selected Kenya Basic Scorecard indicators corresponding to the ICT; education and training; and Research & Development and Innovation pillars were used to calculate the KI. Similarly, a simple average of the indicator values from all the pillars yielded the KEI for each country. The raw data on which they are based is presented in Table A1 in Appendix. The KI and KEI for Kenya is 2.334 and 2.337, respectively. That is from the 146 countries in the database, for the 13 indicators selected, Kenya lies in the twentieth to twenty-fifth percentile, but bottom of the G6. Japan comes at the top with KI and KEI scores of 8.651 and 8.262, respectively, both firmly above the eightieth percentile.

Note that the percentiles provide a global (146 country) ranking. It does not inform on the extent to which Kenya is behind the other countries in the G6. Further, it provides a dynamic snapshot of Kenya's current ranking with no reference to a baseline status, thereby making it difficult to track progress being made. Overcoming these limitations using the anchored indices as illustrated in the next section, provides motivation for this study.

STUDY METHODOLOGY AND RESULTS

To calculate Kenya's preparedness for the knowledge economy, a two step process was followed. First, appropriate indices, based on the WB indices were developed to address the latter's limitations as had been previously presented. Second, from a desktop study of relevant documents, current data for Kenya and the selected G6 countries, for the Kenya basic scorecard indicators were sought and tabulated. Finally, more relevant indices for knowledge-based indices for Kenya were calculated.

The Proposed Anchored Knowledge and Knowledge Economy Indices

To address the challenges above, the concepts of anchoring and weighting are introduced. Anchoring the indices seeks to establish a baseline set of indicators for the subject country. It allows a country to track the progress it has made relative to a baseline set of data, in addition to establishing its readiness for the knowledge economy relative to a selected set of benchmark countries. In the proposed approach only the benchmarking countries most recent data, as well as the subject country's baseline year and most recent data are used for normalization. As a result, one needs only gather current data of the benchmarking countries and is therefore able to operate independently outside the WB KAM public database. If a truly representative set of benchmarking countries is selected, countries whose level of development and development progress can inform the aspirations of the subject country, the need to normalize against large regions or all countries is

removed. Use of the data in the WB KAM 2009 as the baseline anchor data for the subject country is proposed.

Anchoring and restricted normalization addresses two of the challenges previously enumerated. However the limitation of rank-order, where one cannot tell the extent to which the subject country has improved, *nor* the extent to which comparison benchmark countries have either moved away or are being approached by the subject country, remains. Weighting seeks to address this limitation. Weighting the benchmark group of countries most recent data combined with the subject country baseline data against the maximum and minimum indicator values provides a relative- or weighted-order for each country, along each dimension. Relative-order determines by how much each country, along a particular indicator, is better (or worse) than the others. In the rank-order based indices, so long as the relative positions of the countries remain the same, the indices will not change even though the gaps between countries could be decreasing (desired) or increasing (cause for alarm). Relative order captures any changes between countries, even where their rank-order remains the same. Year-on-year comparisons will now be able to track, (1) how a country is progressing (or regressing) relative to a base year, and (2) its normalized relative-order against its baseline and a set of benchmarking countries.

Modifying the previously presented KAM procedure, the procedure for calculating the new indices, the Anchored Knowledge Index (AKI) and Anchored Knowledge Economy Index (AKEI), follows: (a) Select a set of representative indicators from the 109 WB indicators. (b) Select a set of benchmarking countries. (c) Collect the most recent raw data u_i for selected indicators. The baseline data for the subject country is obtained from the WB KAM 2009 database. (d) Determine the maximum (max_i) and minimum (min_i) value for each indicator. Note that the subject country will have two sets of data, baseline and current. (e) Calculate the normalized **relative-order (weight)** -- between 0 and 10 -- for each indicator from Equation 2

$$\text{Normalized } (u_A) = 10\,(u_i - \min_i)/(\max_i - \min_i) \quad (2)$$

Calculation of the Anchored Knowledge Economy and Knowledge Indices for Kenya

The Anchored Knowledge (Economy) Indices used the most recent available data for the G6, as well as the data in the WB KAM for Kenya's baseline. Recall that Kenya, the subject country, appears twice. Using publicly available data from the Internet and other Government sources, data for each country along each of the indicators was compiled and tabulated as presented in Tables A2 to A7 in the Appendix. From the data, anchoring, weighting and normalization along each of the indicators for the G6 was carried out, and calculations of the AKI and AKEI done based on Equation 2. The results are presented in Table 4. It is worth noting that some of the data was not readily available, and proxy data was used as indicated in the tables, where applicable. In addition, the year of the data varies depending on the latest data available.

DISCUSSION

On close inspection of the results, three things immediately become apparent, illustrating the strength of the proposed approach. First, a comparison between Kenya current and baseline (shown as Ken 09) shows that Kenya has improved on aggregate over the past five years, with the AKEI increasing from 0.659 to 0.751, a marginal increase of 12.5%, while the AKI has increased from 0.476 to 1.084, or 127%. The difference between the two indices can be explained by closer examination of the individual indicators. The economic indicators (GPD/Cap, HDI, CRB and DSB) have all either stagnated or declined during the period. A lot of this may be attributed to the post election violence experienced in Kenya in early 2008, that has a severe negative effect on the economy. This has depressed any significant improvement in the AKEI. On the other hand, most of the other non-economic indicators have shown marginal to significant improvements over the same period. Use of anchoring and weighting now enables the determination of the extent to which Kenya has improved (or regressed) relative to the baseline on each of its indicators.

Further, weighting allows the determination of the extent the subject country is behind (and hopefully one day ahead) of the other G6 countries, both as an aggregate index or along each of the indicators. For example, South Africa has an AKEI and AKI of 3.266 and 2.884, respectively. Compared to Kenya, South Africa has indices 586% and 166% higher. From a development perspective, one can know determine not just that South Africa is ahead of Kenya along these two indices, but to what extent. But for the Internet Access per 1,000 population (INT/1000) indicator, Kenya's value of 0.329 is 140% higher than South Africa's indicator value of 0.137. Indicator on indicator comparisons, therefore, provide a basis for countries to focus their limited resources on the most poorly performing areas as they strive to ready themselves for the knowledge economy.

CONCLUSIONS

This study has presented the rationale for the introduction, and the procedures to calculate two new indices to measure a countries readiness for the

knowledge economy. The Anchored Knowledge Index and the Anchored Knowledge Economy Index, provides for relative-ordered (weighted) normalization based only on a benchmarking group of countries. The subject country appears twice, both as the most recent data, as well as from data from the WB KAM 2009. The latter data set provides an anchor or baseline for data analysis in future years. Relative-order determines by how much each country, along a particular indicator, is better (or worse) than the others. In the current WB Knowledge Economy Index and Knowledge Index based solely on rank-order based, so long as the relative positions of the benchmarking countries remain the same, the indices do not change even though the gaps between countries could be decreasing (desired) or increasing (cause for alarm).

A 13 indicator basic scorecard for Kenya was developed aiming to capture the key characteristics of the Country's development efforts in striving to be a middle income country by 2030, in the context of the knowledge economy. Further, based on the scorecard, indices were calculated demonstrating the efficacy of the proposed approach.

REFERENCES

[1] APEC (2003), `The Drivers of New Economy in APEC,' APEC Secretariat, Singapore

[2] Bell, D. (1973), The Coming of the Post-Industrial Society: A Venture in Social Forecasting, Middlesex: Penguin

[3] Bontis, N. (2002), `The Rising Star of the Chief Knowledge Officer,' Ivey Business Journal, vol. 66, no. 4, pp. 5-20.

[4] Chen, D.H.C. and Dahlman, C.J. (2005), `The Knowledge Economy, the KAM Methodology and World Bank Operations,' World Bank, Washington DC.

[5] Davis, S. and Botkin, J. (1994), `The Coming of Knowledge-Based Business,' Harvard Press Review, Sept/Oct.

[6] Drucker, P. (1994), Post-capitalistic Society, Harper Business, New York. Drucker, P. (1998), `From Capitalism to Knowledge Society,' in D. Neef (ed.), The Knowledge Economy, Butterworth-Heinemann, Boston.

[7] Drucker, P. (1999), `Knowledge-worker Productivity: The Biggest Challenge,' California Management Review, vol. 42, no. 2, pp.79-94.

[8] Foray, D. and Lundvall, B.-A. (1996), `The Knowledge-based Economy: From the Economics of Knowledge to the Learning Economy', in OECD, Employment and Growth in the Knowledge-based Economy, Paris.

[9] Grewal, B., Xue, L., Sheehan, P. and Sun, F. (2002), `China's Future in the knowledge economy,' Center for Strategic Economic Studies, Victoria University, and Tsinghua University Press, Melbourne, Australia.

[10] Houghton, J. and Sheehan, P. (2000), `A Primer on the Knowledge Economy,' Working Paper no.18, Center for Strategic Economic Studies (CSES), Victoria University.

[11] Lee, L., Markotsis, D. and Weir, T. (2002), `Social Impacts of the New Economy,' New Economy Branch, Department of Industry Tourism and Resources, Canberra, Australia.

[12] OECD (1996), The Knowledge-based Economy, OECD, Paris.

[13] OECD (1997), National Innovation Systems, OECD, Paris.

[14] OECD (1999), Managing National Systems of Innovation, OECD, Paris.

[15] OECD (2001b), Bridging the `Digital Divide': Issues and Policies in OECD Countries, OECD, Paris.

[16] OECD (2002), Employment Outlook, OECD, Paris.

[17] Porter, M.E. (1998a), `On Competition,' in M.E. Porter (ed.), Clusters and Competition: New Agendas for Companies, Governments, and Institutions, Harvard Business School Press, Boston.

[18] Powell, W.W. and Snellman, K. (2004), `The Knowledge Economy,' Annual Review Sociology, vol. 30, pp. 199-220.

[19] Robertson, S. L., (2007) `Producing Knowledge Economies: The World Bank, the KAM, Education and Development,' published by the Centre for Globalisation, Education and Societies, University of Bristol, Bristol BS8 1JA, UK at: http://www.bris.ac.uk/ education/people /academicStaff/ edslr/publications/19slr/

[20] Sheehan, P. (1999), `The Global Knowledge Economy: Challenges for China's Development', CSES Working Paper no.15, Victoria University, Melbourne.

[21] Sheehan, P. and Grewal, B. (2000), `The Global Knowledge Economy and Regional Concentration of Manufacturing in Australia,' Working Paper no.19, CSES Victoria University of Technology, Melbourne.

[22] Thurow, L.C. (1999), Building Wealth: The New Rules for Individuals, Companies, and Nations in a Knowledge-Based Economy, Harper Collins, New York.

[23] UNESCO (2005a), Towards Knowledge Societies, UNESCO Publishing, Paris

[24] World Bank (2004), Knowledge Economies in the Middle East and North Africa: Toward New Development Strategies.

[25] World Bank Institute (2002), `Knowledge Assessment Methodology and Scorecards,' Knowledge for Development Program, World Bank, Washington, DC.

Table 1: Indicators in WB Basic Scorecard

- Average Annual Gross Domestic Product (GDP) Growth
- Human Development Index (HDI)
- Tariff and Non-tariff Barriers
- Regulatory Quality
- Rule of Law
- Royalty and License Fees Payments and Receipts (US$ millions) Per Million Population
- Scientific and Technical Journal Articles Per Million Population
- Patent Applications Granted by the USPTO Per Million People
- Adult Literacy Rate (percent age 15 and above)
- Secondary Enrollment (percent gross)
- Tertiary Enrollment (percent gross)
- Telephones Per 1,000 People
- Computers Per 1,000 Persons
- Internet Users Per 1,000 People

Table 2: Indicators for Kenya Basic Scorecard. Those in bold form part of the WB basic scorecard

Pillar	Indicator
Economic Performance and Economic Regime	• GDP per capita (GDP/Cap) • **Human Development Index** (HDI) • Cost to register a business (CRB) • Days required to register a business (DSB)
Education and Training	• **Adult literacy Rate (percent age 15 and above)** (ALR) • **Secondary enrollment (percent of gross)** (SE) • **Tertiary enrollment (percent of gross)** (TE)
ICT	• **Telephones per 1,000 (all lines)** (TEL/1000) • **Computers per 1,000 people** (COMP/1000) • **Internet users per 1,000** (INT/1000)
Research and Development, and Innovation	• Researchers in R&D per million population (RRD/Mil) • Total expenditure for R&D as a percent of GDP (ERP/GDP) • **Science and Technology Journal Articles per million population** (SEJA/MIL)

Table 3: Indices Aggregated to Calculate the KI and KEI Basic Scorecard for Kenya

Indicator	Value	Year	Source
GDP/Cap	50,633	2009	World Bank
HDI	.85	2010	United Nations Development Programme
CRB	.7	2010	IFC Doing Business Reports
DSB	3	2010	IFC Doing Business Reports
RRD/Mil	6,894	2008	Singapore Department of Statistics - 2010 Statistical release
ERD/GDP	2.52	2007	Singapore Department of Statistics - 2010 Statistical release
SEJA/MIL	1352	2008	UNESCO reports for publications and US Census Bureau for population estimates (2009)
TEL/1000	1,701	2010	Yearbook of Statistics, Singapore 2010
COMP/1000	743	2010	Yearbook of Statistics, Singapore 2010
INT/1000	733	2010	Yearbook of Statistics, Singapore 2010
ALR	95.9	2009	World Bank Development Indicators Database - 2011
SE	100	2008	Japan data used as a proxy as data not available
TE	58	2008	Japan data used as a proxy as data not available

Table 4: Indices Aggregated to Calculate the Anchored KI and Anchored KEI using the Kenya Basic Scorecard

Indicator	Ken. (09)	Ken.	Sing.	S. Kor.	Malay.	Japan	S. Afr.
GDP/Cap	.000	.006	10.000	5.222	2.54	6.297	1.780
HDI	1.229	0.000	9.238	10.000	6.732	9.189	3.120
CRB	.000	0.000	10.000	6.410	5.692	8.256	8.641
DSB	.000	0.000	10.000	5.926	4.815	2.593	2.963
RRD/Mil	.000	0.000	10.000	6.668	0.413	9.516	0.444
ERD/GDP	.000	.000	6.821	9.277	1.387	10.000	2.225
SEJA/MIL	0.000	.100	10.000	5.398	.677	3.029	.748
TEL/1000	0.000	1.510	10.000	4.817	5.751	4.242	4.529
COMP/1000	.000	.000	10.000	7.121	2.838	9.086	.955
INT/1000	.000	.329	8.957	10.000	6.804	9.561	.137
ALR	.000	6.009	10.000	8.924	8.251	8.924	6.906
SE	.000	1.755	10.000	9.397	3.766	10.000	8.793
TE	.000	.056	5.769	10.000	3.441	5.769	1.220
AKEI	**.659**	**.751**	**9.291**	**7.628**	**4.805**	**7.420**	**3.266**
AKI	**.476**	**1.084**	**9.061**	**7.956**	**3.703**	**7.792**	**2.884**

APPENDIX: DATA USED IN CALCULATION OF INDICES

Table A1: Indicator Values from WB Interactive KAM database for the G6

Indicator	Ken.	S. Kor.	Sing.	Malay.	Japan	S. Afr.
GDP/Cap (2007)	1,542	24,801	49,704	13,518	33,632	9,757
HDI (2005)	.52	.92	.92	.81	.95	.67
CRB (2009)	39.7	16.9	.7	14.7	7.5	6.0
DSB (2009)	30	17	4	13	23	22
RRD/Mi (2006)	—	4,162	5,712	502	5,546	360
ERD/GDP (2006)	—	3.23	2.39	.6	3.4	.92
SEJA/MIL (2005)	6.34	340.6	846.34	23.96	434.36	51.08
TEL/1000 (2007)	310	1,360	1,700	1,040	1,240	980
COMP/1000 (2007)	10	580	740	230	410	80
INT/1000 (2007)	80	760	660	560	690	80
ALR (2007)	73.6	97.9	94.4	91.9	100	88
SE (2007)	50.27	97.5	63.18	69.7	101.41	95.83
TE (2007)	3.47	94.67	55.9	30.24	58.6	15.41

Source: World Bank

Table A2: Most Recent Publicly Available Data for Kenya used in the Calculation of the Anchored Knowledge (Economy) Indices

Indicator	Value	Year	Source
GDP/Cap	1,573	2009	World Bank
HDI	.47	2010	United Nations Development Programme
CRB	39.7	2010	IFC Doing Business Reports Kenya Report 2011
DSB	30	2010	IFC Doing Business Reports Kenya Report 2011
RRD/Mil	91	2009	Ministry of Higher Education, Science and Technology - Science Technology and Innovation Indicators Survey - 2009
ERD/GDP	.16	2008	Ministry of Higher Education, Science and Technology - Science Technology and Innovation Indicators Survey - 2009
SEJA/MIL	262	2008	UNESCO reports for publications and Kenya 2009 National Census for population estimates
TEL/1000	520	2009	Communication Commission of Kenya (CCK) Report – Quarterly Sector Statistics Report (2nd Quarter, Oct-Dec 2009/2010)
COMP/1000	10	2007	World Bank KAM Database
INT/1000	104	2010	Communication Commission of Kenya (CCK) Report – Quarterly Sector Statistics Report (2nd Quarter, Oct-Dec 2009/2010)
ALR	87	2009	Kenya Census 2009 Data
SE	59	2009	Kenya Census 2009 Data
TE	4	2009	Kenya Census 2009 Data

Table A3: Most Recent Publicly Available Data for Singapore used in the Calculation of the Anchored Knowledge (Economy) Indices

Indicator	Value	Year	Source
GDP/Cap	50,633	2009	World Bank
HDI	.85	2010	United Nations Development Programme
CRB	.7	2010	IFC Doing Business Reports
DSB	3	2010	IFC Doing Business Reports
RRD/Mil	6,894	2008	Singapore Department of Statistics - 2010 Statistical release
ERD/GDP	2.52	2007	Singapore Department of Statistics - 2010 Statistical release
SEJA/MIL	1352	2008	UNESCO reports for publications and US Census Bureau for population estimates (2009)
TEL/1000	1,701	2010	Yearbook of Statistics, Singapore 2010
COMP/1000	743	2010	Yearbook of Statistics, Singapore 2010
INT/1000	733	2010	Yearbook of Statistics, Singapore 2010
ALR	95.9	2009	World Bank Development Indicators Database - 2011
SE	100	2008	Japan data used as a proxy as data not available
TE	58	2008	Japan data used as a proxy as data not available

Table A4: Most Recent Publicly Available Data for South Korea used in the Calculation of the Anchored Knowledge (Economy)

Indicator	Value	Year	Source
GDP/Cap	27,168	2009	World Bank
HDI	.877	2009	United Nations Development Programme
CRB	14.7	2010	IFC Doing Business Reports
DSB	14	2010	IFC Doing Business Reports
RRD/Mil	4,627	2007	World Bank Development Indicators Database - 2011
ERD/GDP	3.37	2008	World Bank Development Indicators Database - 2011
SEJA/MIL	733	2008	UNESCO reports for publications and US Census Bureau for population estimates (2009)
TEL/1000	520	2009	World Bank Development Indicators Database - 2011
COMP/1000	532	2006	World Bank Development Indicators Database - 2011
INT/1000	809	2009	World Bank Development Indicators Database - 2011
ALR	93.5	2009	World Bank Development Indicators Database - 2011. East Asia Pacific Countries average used as Proxy
SE	97	2008	World Bank Development Indicators Database - 2011
TE	98	2008	World Bank Development Indicators Database - 2011

Table A5: Most Recent Publicly Available Data for Malaysia used in the Calculation of the Anchored Knowledge (Economy) Indices

Indicator	Value	Year	Source
GDP/Cap	14,012	2009	World Bank
HDI	.74	2010	United Nations Development Programme
CRB	17.5	2010	IFC Doing Business Reports
DSB	17	2010	IFC Doing Business Reports
RRD/Mil	372	2006	World Bank Development Indicators Database - 2011
ERD/GDP	.64	2006	World Bank Development Indicators Database - 2011
SEJA/MIL	97.5	2008	UNESCO reports for publications and US Census Bureau for population estimates (2009)
TEL/1000	1,110	2009	World Bank Development Indicators Database - 2011
COMP/1000	218	2006	World Bank Development Indicators Database - 2011
INT/1000	576	2009	World Bank Development Indicators Database - 2011
ALR	92	2009	World Bank Development Indicators Database - 2011
SE	69	2008	World Bank Development Indicators Database - 2011
TE	36	2008	World Bank Development Indicators Database - 2011

Table A6: Most Recent Publicly Available Data for Japan used in the Calculation of the Anchored Knowledge (Economy) Indices

Indicator	Value	Year	Source
GDP/Cap	32,453	2009	World Bank
HDI	.844	2009	United Nations Development Programme
CRB	7.5	2010	IFC Doing Business Reports
DSB	23	2010	IFC Doing Business Reports
RRD/Mil	6,565	2010	World Bank Development Indicators Database - 2011
ERD/GDP	3.62	2010	World Bank Development Indicators Database - 2011
SEJA/MIL	414	2007	UNESCO reports for publications and US Census Bureau for population estimates (2009)
TEL/1000	900	2009	World Bank Development Indicators Database - 2011
COMP/1000	676	2006	World Bank Development Indicators Database - 2011
INT/1000	777	2009	World Bank Development Indicators Database - 2011
ALR	93.5	2009	World Bank Development Indicators Database - 2011. East Asia Pacific Countries average used as Proxy
SE	100	2008	World Bank Development Indicators Database - 2011
TE	58	2008	World Bank Development Indicators Database - 2011

Table A7: Most Recent Publicly Available Data for South Africa used in the Calculation of the Anchored Knowledge (Economy) Indices

Indicator	**Value**	**Year**	**Source**
GDP/Cap	10,278	2009	World Bank
HDI	.597	2009	United Nations Development Programme
CRB	6	2010	IFC Doing Business Reports
DSB	22	2010	IFC Doing Business Reports
RRD/Mil	393	2007	World Bank Development Indicators Database - 2011
ERD/GDP	.93	2007	World Bank Development Indicators Database - 2011
SEJA/MIL	262	2007	UNESCO reports for publications and US Census Bureau for population estimates (2009)
TEL/1000	940	2009	World Bank Development Indicators Database - 2011
COMP/1000	80	2006	World Bank Development Indicators Database - 2011
INT/1000	90	2009	World Bank Development Indicators Database - 2011
ALR	89	2008	World Bank Development Indicators Database - 2011
SE	94	2009	World Bank Development Indicators Database - 2011
TE	15	1994	World Bank Development Indicators Database - 2011