

## **Emergence of Knowledge Economy- A Comparative Study of BRICS Nations**

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### **Abstract**

*The 21<sup>st</sup> century is recognized as an era of Knowledge. It is realized that knowledge is a critical element of producing wealth and creating job in contemporary societies. One of the new developing associations that the world is currently seeing is the formation of the BRICS countries namely Brazil, Russia, India, China and South Africa. This present paper does the comparative study of BRICS nations on the basis of Knowledge Economy Index (KEI) as given by World Bank Institute. The paper highlights the four pillars of knowledge economy and its indicators. Over time comparison is also done among BRICS nations. It has been found that these developing economies have shown improvement over the period. The paper concludes that education and information and communication infrastructure play a major role in converting the industrial economies to knowledge economies and which will further pave the way for social and economic development. Russia Federation is strong in all the four pillars of knowledge economy and could be placed at 1<sup>st</sup> rank on basis of KEI and India being weak on the basis of indicators of knowledge economy is placed at 5<sup>th</sup> rank among BRICS nations.*

**Keywords:** Knowledge Economy, BRICS, Knowledge Economy Index (KEI), Knowledge for Development (K4D)

### **Introduction**

The 21<sup>st</sup> century is recognized as an era of knowledge economy. A knowledge-based economy relies on the use of innovative ideas and on the application of technology. It is an economy in which knowledge is created, acquired, transmitted and used more effectively by individuals, enterprises, organizations and committees to promote economic and social development. It is realized that knowledge is a critical element of producing wealth and creating job in contemporary societies. Some 2300 years back Kautilya, the celebrated author of Arthashastra proposed to create wealth from knowledge by emphasizing the importance of knowledge as prime mover of producing wealth. Education is the fundamental enabler of the knowledge economy. Well educated and skilled people are essential for creating, sharing, disseminating and using knowledge effectively. By building on their strengths and doing ample investments in human capital, effective institutions, relevant communications technologies and innovative and competitive enterprises, developing countries can capitalize on the knowledge revolution.

### **Concept of Knowledge Economy**

The World Bank Institute offers a formal definition of a knowledge economy as one that creates, disseminates and uses knowledge to enhance its growth and development. A knowledge economy uses data as its raw material and transforms it using technology, analysis tools and human intelligence into knowledge and expertise.

### **Concept of BRICS**

The acronym was coined by Jim O' Neil in a 2001 paper entitled, "Building Better Global Economic BRICs". BRICS originally BRIC before the inclusion of South Africa in 2010, is the title of an association of emerging national economies: Brazil, Russia, India, China, South Africa. With the exception of Russia, the BRICS members are all developing industrialized countries, but they are distinguished by their large, fast growing economies and significant influence on regional and economic affairs.

Goldman Sachs said that the greatest economic assets that Brazil and Russia possess are their capacity to be the world's biggest provider of raw materials whereas China and India are going to be the world's biggest manufacturers of all kinds of commodities.

As a result of the 1998-99 World Development Report on Knowledge for Development, the topic of the Knowledge economy gained prominence with policymakers worldwide. In 2001, the K4D (Knowledge for Development) program held a high level policy forum to share knowledge strategies among key stakeholders from Brazil, India and China- potential knowledge superpowers representing 45 percent of the world's population.

### **Main Objectives of the Study**

- To highlight the four pillars of knowledge economy as given by World bank Institute.
- To make comparative study of BRICS nations on basis of KEI, pillars of knowledge economy and their indicators. Over time comparisons is also done among the nations.

### **Methodology & Database**

The methodology adopted in the study is analytical and descriptive. The study is based on secondary sources of information drawn from various publications. Data are also drawn from publications, print and electronic of governmental and non-governmental agencies such as of World Bank to arrive at conclusions. The study makes comparison among BRICS nations for the period 1995, 2000, 2008 and 2012. The comparative study is done on the basis of Knowledge Economy Index (KEI).

The most commonly cited of the KAM's several indexes is the Knowledge Economy Index (KEI). KEI is a broad measure of the overall level of preparedness of a country or region for the knowledge economy. The KEI summarizes each country's performance on 12 variables corresponding to the four knowledge economy pillars. The KEI is constructed as the simple average of the normalized values of those indicators from 0 to 10. A KEI score that is close to 10 implies relatively good development of the four knowledge economy pillars as compared to other countries, while a score close to 0 indicates relatively poor development.

### **Four Pillars of Knowledge Economy and their Indicators according to KAM basic scorecard**

The World Bank Institute's Knowledge for Development Program (K4D) helps to build the capacity of client countries to access and use knowledge to become more competitive and improve growth and welfare. It has developed a four pillar framework that countries can use as the basis for their transition to knowledge economy.

#### **Pillar I Economic and Institutional Regime**

The country's economic and institutional regime must provide incentives for the efficient use of existing and new knowledge and the flourishing of entrepreneurship. The indicators under this pillar are:

- Tariff and non-tariff barriers
- Regulatory quality
- Rule of law

#### **Pillar II Education and Skills**

The country's people need education and skills that enable them to create and share and to use it well. This includes following indicators:

- Average years of schooling
- Gross secondary enrolment rate
- Gross tertiary enrolment rate

#### **Pillar III Information and Communication Infrastructure**

A dynamic information infrastructure is needed to facilitate the effective communication, dissemination and processing of information. The indicators included are as follows:

- Telephones per 1000 people
- Computers per 1000 people
- Internet users per 1000 people

#### **Pillar IV Innovation system**

The country's innovation system- firms, research centres, universities, think tanks, consultants and other organizations must be capable of tapping the growing stock of global knowledge, assimilating and adapting it to local needs and creating new technology. This includes following indicators:

- Royalty payments and receipts US\$ per person
- Technical journal articles per million people
- Patents granted to nationals by the US patent and Trademark office per million people

### Analysis & Interpretation

As of 2013, the five BRICS nations represent almost 3 billion people with a combined nominal GDP of US\$ 14.9 trillion and an estimated US\$ 4 trillion in combined foreign reserves. Presently, India holds the chair of the BRICS group.

**Economic Performance of BRICS Nations:** Table 1 highlights the economic performance of BRICS nations

**Table 1: Economic Performance of BRICS nations**

Indicators/ Nation	Brazil		China		India		Russia Federation		South Africa	
	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized
Annual GDP Growth (%) 2005-2009	3.40	3.89	11.90	9.72	8.40	9.51	4.00	5.14	3.60	4.44
GDP per capita US\$ PPP, 2009	10,367	5.32	6,828	4.33	2296	2.77	18932	6.95	10278	7.85
GDP (Current bill) US\$, 2009	1594.49	9.52	4985.46	9.86	1377.26	9.38	1231.89	9.24	285.37	7.85
Human Development Index, 2010	0.70	5.14	0.88	9.38	0.87	9.24	0.70	5.28	0.60	3.06
Multidimensional Poverty Index, 2008	0.04	6.05	0.06	5.47	0.30	2.56	0.01	8.60	0.01	7.09
Seats in Parliament held by women (as % of total), 2009	9.00	1.87	21.00	6.62	9.00	1.97	11.00	2.59	34.00	9.14
Composite Risk Rating 07/2010-06/2011	74.48	6.94	75.49	7.34	68.28	4.11	73.23	6.95	69.64	5.00
Gender Inequality Index, 2008	0.63	3.97	0.41	6.94	0.75	0.83	0.44	6.69	0.64	3.80

Source: [www.worldbank.org](http://www.worldbank.org)

Table 1 show that China's growth rate is the highest in the world with a rate of 11.9% of GDP. India follows suit with an annual GDP of 8.4%. Russia stands third in the group with its GDP at 4%. South Africa stands fourth at 3.6% GDP while the last but not the least is Brazil with a GDP of 3.4% annually. Per capita income is highest in case of Russia followed by Brazil, South Africa, China and India. Russia has highest per capita income (18932 US\$) and India has lowest (2296 US\$). Human development index is highest in case of China (0.88) and lowest in South Africa (0.60).

**Economic & Institutional Regime of BRICS nations:** As per basic scorecard of KAM 2012, Economic & Institutional Regime of BRICS is shown in table 2.

**Table 2: Economic & Institutional Regime of BRICS Nations**

Variable/Nation	Brazil		China		India		Russia Federation		South Africa	
	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized
Tariff & Non-tariff Barriers, 2011	69.80	2.17	71.60	2.66	64.20	1.12	68.20	1.68	77.20	4.34
Regulatory Quality, 2009	0.18	5.14	-0.20	3.97	-0.28	3.77	-0.46	2.67	0.42	6.23
Rule of Law 2009,	-0.18	5.21	-0.35	4.73	0.05	5.82	-0.77	2.33	0.06	5.89

Source: [www.worldbank.org/kam](http://www.worldbank.org/kam)

Table 2 shows that normalized score of tariff & non-tariff barriers are highest in South Africa (4.34) followed by China (2.66), Brazil (2.17) and Russia (1.68).

India has lowest normalized score of tariff and non-tariff trade barriers (1.12). Regulatory Quality has highest normalized score in South Africa (6.23) and lowest in Russia (2.67). Rule of law has highest normalized score in case of South Africa (5.89) followed by India (5.82), Brazil (5.21), China (4.73) and Russia Federation (2.33) respectively. This indicates that Economic and Institutional regime (EIR) as reflected by three EIR variables is strong in case of South Africa. EIR performance on basis of tariff and non-tariff barriers is weak in case of India and Russia. EIR performance on basis of three EIR variables is weak in case of Russia indicating country's unconducive institutional environment for all success in the knowledge economy. China is showing moderate performance on basis of three EIR variables.

**Innovation System:** Table 3 highlights innovation system as per basic scorecard (KAM 2012).

**Table 3: Innovation system of BRICS Nations**

Variable/Nation	Brazil		China		India		Russia Federation		South Africa	
	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized
Royalty payments and receipts (US\$ per person), 2009	15.21	6.08	8.63	5.52	1.78	3.12	32.43	6.64	34.59	6.72
Technical Journal Articles per million people, 2007	62.54	6.76	43.11	5.93	16.18	4.55	98.20	7.24	58.19	6.48
Patents granted by USPTO per million people, 2005-2009	0.68	6.10	1.05	6.51	0.51	5.82	1.28	6.92	2.51	7.47

Source: [www.worldbank.org/kam](http://www.worldbank.org/kam)

Table 3 shows performance of BRICS nations on basis of three variables of Innovation system. Royalty payments and receipts have highest normalized score in case of South Africa (6.72), followed by Russia (6.64), Brazil (6.08), China (5.52) and India (3.12) respectively. Technical Journal Articles per million people have highest normalized score in case of Russia (7.24) followed by Brazil (6.76), South Africa (6.48), China (5.93) and India (4.55) respectively. Patents granted by USPTO per million people has highest value in case of South Africa (7.47) followed by Russia Federation (6.92), China (6.51), Brazil (6.10) and India (5.82). This indicates that South Africa has strong innovation systems on basis of three variables as given by basic scorecard. India's performance on basis of three variables of Innovation system is weak. China being ahead of India shows slightly better performance as compared to India.

**Education & Skill of Population:** Table 4 indicates education and skill of population of BRICS nations as per basic scorecard (KAM 2012).

**Table 4: Education & Skill of Population of BRICS Nations**

Variable/Nation	Brazil		China		India		Russia Federation		South Africa	
	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized
Average years of schooling, 2010	7.54	3.23	8.17	4.17	5.12	1.26	9.69	6.54	8.56	4.72
Gross Secondary Enrolment Rate, 2010	100.79	8.55	78.19	3.66	60.02	2.55	84.81	4.69	93.87	6.69
Gross Tertiary Enrolment Rate, 2009	34.44	5.04	24.53	3.97	13.48	2.98	77.19	9.15	15.41	3.19

Source: [www.worldbank.org/kam](http://www.worldbank.org/kam)

Table 4 shows performance of BRICS nations on basis of three variables that is average years of schooling, gross secondary enrolment rate and gross tertiary enrolment rate. Russia Federation (6.54) has highest normalized score in average years of schooling followed by South Africa (4.72), China (4.17), Brazil (3.23) and India (1.26). In case of gross secondary enrolment rate highest normalized score is of Brazil (8.55) followed by South Africa (6.69), Russia Federation (4.69), China (3.66) and India (2.55). Russia Federation (9.15) has highest normalized score in case of gross tertiary enrolment rate followed by Brazil (5.04), China (3.97), South Africa (3.19) and India (2.98). This indicates that Russia is strong in education pillar on basis of average years of schooling and gross tertiary enrolment ratio. India is weak in education pillar having lowest normalized scores in all the three variables of education pillar. China is ahead of India in case of all three variables. Brazil is strong in case of gross secondary enrolment rate.

**Information & Communication Infrastructure:** Table 5 shows information and communication infrastructure of BRICS nations as per basic scorecard (KAM 2012)

**Table 5: Information & Communication Infrastructure of BRICS Nations**

Variable/Nation	Brazil		China		India		Russia Federation		South Africa	
	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized	Actual	Normalized
Total Telephone per 1000 people, 2009	1110.00	4.97	800.00	3.24	480.00	1.86	1940.00	9.59	1030.00	4.34
Computers per 1000 people, 2008	350.00	7.47	60.00	3.22	30.00	1.99	130.00	5.34	80.00	3.84
Internet users per 1000 people, 2009	390.00	6.28	290.00	4.90	50.00	1.86	420.00	6.55	90.00	2.55

Source: [www.worldbank.org/kam](http://www.worldbank.org/kam)

Table 5 shows information and communication infrastructure of BRICS nations on basis of three variables that is total telephones per 1000 people, computers per 1000 people and Internet users per 1000 people as given by basic scorecard. Russia Federation (9.59) has highest normalized value in case of total telephone per 1000 people followed by Brazil (4.97), South Africa (4.34), China (3.24) and India (1.86) respectively. Computers per 1000 people normalized score is highest in case of Brazil (7.47) followed by Russia Federation (5.34), South Africa (3.84), China (3.22), India (1.99).

Russia Federation (6.55) has highest normalized score in case of internet users per 1000 people followed by Brazil (6.28), China (4.90), South Africa (2.55) and India (1.86) respectively. This indicates that Russia Federation is strong on information and communication infrastructure as shown by total telephone users per 1000 people and internet users per 1000 people. Brazil follows Russia except in case of computers per 1000 people in which it lies ahead of Russia. India is weak on ICT front having lowest normalized score in all the three variables even lowest as compared to South Africa. China immediate competitor of India is ahead of India on basis of all three variables.

**Ranking of BRICS Nations in the world:** Table 6 shows rankings of BRICS Nations on basis of knowledge economy index and four pillars of knowledge economy as per KAM 2012.

**Table 6: Ranking of BRICS nations in the world (KAM 2012)**

Nation/Variable	Knowledge Economy Index		Economic Incentive Regime		Innovation System		Education		Information & Communication Infrastructure	
	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index
Brazil	60	5.58	82	4.17	51	6.31	61	5.61	58	6.24
Russia Federation	55	5.78	117	2.23	40	6.93	44	6.79	44	7.16
India	110	3.06	99	3.57	76	4.5	111	2.26	122	1.9
China	84	4.37	97	3.79	54	5.99	95	3.93	94	3.79
South Africa	67	5.21	64	5.49	44	6.89	81	4.87	98	3.58

Source: [www.worldbank.org/kam](http://www.worldbank.org/kam)

Table 6 shows that Russia Federation is ranked 55<sup>th</sup> position for KEI in world. Russia's overall performance was hampered mainly by weaknesses in its EIR pillar which with a value of only 2.23 puts it in 117<sup>th</sup> place. In the education pillar, lower scores in average years of schooling and secondary enrolment rates have led to 44<sup>th</sup> place. Its ICT pillar has registered a sizeable improvement mainly because of an increase in the number of telephone users.

Brazil with a current KEI of 5.58 has fallen to 60<sup>th</sup> rank. Its education pillar advanced due to strong growth in average years of schooling and in its gross tertiary enrolment rate. The EIR is Brazil's weakest pillar mainly because of relatively high trade barriers.

India's KEI fell to 110<sup>th</sup> in 2012 KEI rankings. India's innovation pillar has leaped up and ranked 76<sup>th</sup>. India's EIR and ICT pillars have registered slight declines.

With significant improvements in its EIR, innovation and education pillars, China has jumped to rank of 84<sup>th</sup>. Its innovation pillar has made the largest gain because of rapid increase in all three key indicators. However its ICT pillar dropped because of relatively slow progress on all the three indicators.

South Africa is at 67<sup>th</sup> rank as per KEI in the world. It is ahead of China and India. It is showing better performance as compared to China and India on basis of all pillars.

**Basic Scorecard of BRICS Nations (KAM 2012):** Table 7 does comparison of BRICS Nations on basis of knowledge economy index, knowledge index and four pillars of knowledge economy.



**Table 7: Comparison of BRICS Nations on basis of basic scorecard (KAM 2012)**

Variable/Nation	Brazil	China	India	Russia	South Africa
1. Knowledge Economy Index (Average 3,4,5,6)	5.58	4.37	3.06	5.78	5.21
2. Knowledge Index (Average 4,5,6)	6.05	4.57	2.89	6.96	5.11
3. Economic Incentive & Institutional Regime	4.17	3.79	3.57	2.23	5.49
4. Education	5.61	3.93	2.26	6.79	4.87
5. Innovation	6.31	5.99	4.50	6.93	6.89
6. Information & Communication Infrastructure	6.24	3.79	1.90	7.16	3.58

Source: [www.worldbank.org/kam](http://www.worldbank.org/kam)

Table 7 shows that Knowledge economy index (KEI) which is taken as average of normalized values of four pillars of knowledge economy. Russia has highest KEI (5.78) followed by Brazil (5.58), South Africa (5.21), China (4.37) and India (3.06). It indicates that among BRICS nations Russia Federation can be placed at 1<sup>st</sup> rank and India at 5<sup>th</sup> rank. Knowledge index (KI) is taken as average of normalized values of three pillars excluding economic incentive and institutional regime. On basis of KI also Russia Federation is placed at 1<sup>st</sup> rank and India at 5<sup>th</sup> rank. Economic Incentive & Institutional regime shows highest normalized score in case of South Africa (5.49) followed by Brazil (4.17), China (3.79), India (3.57) and Russia (2.23). South Africa is strong on EIR pillar and placed at 1<sup>st</sup> rank whereas Russia is weak on EIR pillar and is placed at 5<sup>th</sup> rank. Education pillar shows highest normalized score in case of Russia (6.79) followed by Brazil (5.61), South Africa (4.87), China (3.93) and India (2.26). This indicates that Russia and Brazil are strong on education pillar and placed at 1<sup>st</sup> and 2<sup>nd</sup> rank respectively among BRICS nations whereas India is weak on education pillar and placed at 5<sup>th</sup> rank. Innovation pillar shows highest normalized score in case of Russia (6.93) followed by South Africa (6.89), Brazil (6.31), China (5.99), India (2.26). Russia is strong on innovation pillar and is placed at 1<sup>st</sup> rank whereas India is weak and therefore placed at 5<sup>th</sup> rank. Information and communication infrastructure (ICT) pillar shows highest normalized value in case of Russia (7.16) followed by Brazil (6.24), China (3.79), South Africa (3.58) and India (1.90). Russia being strong on ICT pillar is placed at 1<sup>st</sup> rank and India being weak on ICT pillar is placed at 5<sup>th</sup> rank.

**Over time Comparison of BRICS Nations on basis of KEI:** Table 8 does overtime comparison of BRICS nations on basis of knowledge economy index as given by KAM 2012.

**Table 8: Over Time Comparison of BRICS Nations on basis of KEI**

Nation/Year	2012	2008	2000	1995	Change over 2008	Change over 2000	Change over 1995
Brazil	5.58	5.50	5.48	5.08	0.08	0.10	0.50
Russia	5.78	5.58	5.28	5.67	0.20	0.50	0.11
India	3.06	3.04	3.14	3.57	0.02	-0.08	-0.51
China	4.37	4.36	3.83	3.99	0.01	0.54	0.38
South Africa	5.21	5.55	5.77	6.05	0.34	-0.56	-0.84

Source: [www.worldbank.org/kam](http://www.worldbank.org/kam)



Table 8 shows KEI of BRICS nations for period of 2012, 2008, 2000, 1995. Comparison of change over the year 2008 to most recent shows the positive change for all nations. The change as compared to 2000 to most recent is negative in case of India and South Africa and same is the case in the year 1995.

### **Conclusions**

The present study broadly concludes that Russia Federation is strong on basis of four pillars of knowledge economy and could be placed at 1<sup>st</sup> rank on basis of KEI (KAM 2012) among BRICS nations whereas India is weak on basis of pillars of knowledge economy and is placed at 5<sup>th</sup> rank. China immediate competitor of India is ahead of India on basis of KEI and pillars. Brazil also occupies strong position on basis of indicators. South Africa, a new entrant in acronym BRICS is also working strongly to pave the way for knowledge economy. No doubt BRICS nations are dynamic economies and can be foreseen as a viable superpower group of the future. It will take time for BRICS nations to become strong on various indicators of knowledge economy pillars and convert their industrialized economies into knowledge economies. Developing economies has shown improvement over the period of time. Education and Information and communication infrastructure plays a major role in emergence of knowledge economy.

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