The State, Systems of Innovation and Economic Growth: Comparative Perspectives from India and South Korea

Lakhwinder Singh* and Kesar Singh Bhangoo

Why long run growth rate differs across countries and over time remained unresolved question in development economics. In this paper an attempt has been made to examine the economic growth performance of India and South Korea to throw light on the above stated issue. National and sectoral growth rates of India and South Korea covering the period 1961-2011 have shown a dramatic differential in economic growth performance and concomitant structural change. The engine of growth in the South Korean economy during the fast phase of economic development has remained the manufacturing sector and followed standard patterns of economic growth as observed by the industrially advanced countries. In the case of India, despite massive efforts to industrialize and capacity building for establishing manufacturing base, the engine of growth has remained the service sector. The factors that contributed to the observed pattern of economic development in both the countries were national innovation system and nature and character of the state intervention. The analysis of sustainability and disruption of economic growth momentum in both the countries, India and South Korea, gives

* Professor, Department of Economics and Coordinator, Centre for Development Economics and Innovation Studies (CDEIS), Punjabi University, Patiala 147002, India. (Tel) +91-98-8875-5642, (Fax) +91-17-5228-3073, (Email) lakhwindergill@pbi.ac.in; Professor, Centre for Research in Economic Change, Punjabi University, Patiala-147002, India. (Tel) +91-98-1542-7127, (Fax) +91-17-5228-3073, (Email) kesarbhangoo@pbi.ac.in, respectively. This is the revised version of the paper which was presented in the 21st SJE-KERI International Symposium on "Understanding Economic Growth in India: Implications for India-Korea Cooperation," September 3, 2013, Seoul National University, Seoul. The authors are grateful to two anonymous referees of the journal for their insightful suggestions and Professors Donghyu Yang, Keun Lee, Dae Woo Lee and several participants in the Symposium for their helpful comments and suggestions. However, the usual disclaimer applies

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credence to the view that a wider approach to national systems of innovation that encompasses judicious combination of the state and the market is more suitable in understanding the long run growth differentials.

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I. Introduction

Historical analysis of economic growth experience of developed and developing countries testifies that achieving sustained economic growth rate is quite difficult. The current recession has not only impinged on the growth prospects of the advanced countries but also reduced the growth rates of the two fastest growing economies of the world, that is, China and India (Dreaze and Sen 2013). It is well recognized fact that economic level and growth rate differs widely across countries and over time. The question of why growth rate differs across countries and over time attracted the attention of large number of economists (Ruttan 2001). The factors that determine economic growth are quite complex and also varies over time. An important dynamic factor that has been underlined by Smith, Marx and Schumpeter, which determine long run growth of the capitalist economy, is the innovation. After examining more than two centuries growth experience of advanced industrialized countries, Kuznets (1966) has stressed the role of epochal innovation that generated dynamism and distinctive character of economic growth. The epochal innovation is the accumulation of 'useful stock of technological and social knowledge' that remained a 'source of high growth rates and high rates of structural shifts' in the industrialized countries of the world (Kuznets 1966, p. 286). He further emphasized that institutional and ideological adjustments in the social domain are a must to obtain the required growth dynamism and to realize full potentialities of innovations and further stimulation to innovations (Kuznets 1971). Furthermore, 'it is a society's ideas and beliefs that are ultimately responsible for its development' (Basu 2013, p. 27). However, like several other scholars, Kuznets also believed in sources of innovation that remained exogenous (Kuznets 1966; Solow 1957).

An intense debate on sources of economic growth of advanced coun-

tries in the last quarter of twentieth century has occurred that emphasized on the role of induced innovation as an engine of economic growth (Ruttan 2001). Innovation concept has been widened to understand as a systemic and non linear process rather than exogenous and isolated one (Cassiolato and Soares 2013). It deals with the social capacity building to generate and stimulate human knowledge that is useful for determining rate, structure and spread of economic growth within the economic system essentially called national system of innovation (SI). The national system of innovation (SI) approach pioneered by Freeman (1982) and expanded and popularized by Lundvall (1992) and Nelson (1993) has assigned the crucial role to the state as a coordinating agent to stimulate innovations and economic growth. The past century (20^{th} century) experience of investment by the governments of the advanced countries' in innovation generation, protection of markets and intellectual property rights and state subsidies to support entrepreneurial business and innovation strategies amply explains the efforts of the state to put in place innovation system for the innovation based productive economic activities to flourish (Lazonick 2008). It is pertinent to note that the World Development Report 1998/99, while recognizing that market for knowledge often fails, has emphasized the role of the state in developing national strategies to narrow knowledge gaps between developed and developing countries. Strategic policies adopted by the government for acquisition of knowledge and absorption of knowledge supplemented by expansion of education and skill base can act as a catalytic agent of economic change and development (World Bank 1999). The recent successful economic transformation and catch-up experience of the newly industrialized countries of the East Asia testifies that the state led innovation policy, which generated technological capabilities in short cycle technologies that acted as a window of opportunity as well as an instrument of barrier to entry, succeeded in accomplishing the task of economic transformation (Lee 2013a). The strong interventionist state of South Korea and other East Asian countries has succeeded in creating innovation system so that the economic agents of production can reap the benefits of dynamic comparative advantage and deliver long run growth. This in fact shows that the state has played an important role in generating dynamic environment for innovation and economic growth. Thus, among the factors that can explain a large amount of growth rate differentials across economic activities and countries and over time lies in the nature and characteristics of the state intervention in economic activities (Szirmai, Naude, and Goedhyus 2012; World Bank

1999). Therefore, in this paper an attempt has been made to examine the process of wide differences in economic growth of India and South Korea that has occurred over the last five decades. While unraveling the factors that have contributed to differential economic performance of these two countries, the national system of innovation approach has been followed. The rest of the paper is organized as follows. The analysis of growth and structural change of India and South Korea is presented in section II. Comparative analysis of input and output innovation indicators of India and South Korea is presented in section III. Section IV describes the differences in the role of the state in building national system of Innovation in India and South Korea. Conclusions and policy implications for economic cooperation are presented in the final section.

II. Growth and Structural Change in the Economies of India and South Korea

India has been well recognized as an emerging global economic power. Compared to its historical past (British colonial rule), India's accomplishments in post independence period are quite remarkable. India has emerged as the first non advanced countries of the world to establish and succeed in uninterrupted democratic governance since 1947. Despite multitude of differences in terms of languages, cultures, religions and ethnicities, the secular democracy has deepened and flourished. As far as economic and social indicators are concerned, compared to centuries colonial rule India has advanced, though slowly, but has recently attained position of one of the fastest growing economy of the world (Dreeze and Sen 2013).

South Korea compared with India is a small country both in terms of geographical area and population. However, density of population of Korea is much higher than that of India. Korea is also a democratic country, but its stint with democracy is relatively very recent. South Korea has distinct achievements both in terms of social and economic indicators and has changed its global position from a low income country to a full-fledged developed country. South Korea is now a member of Organization for Economic Cooperation and Development (OECD) countries, which is an organization of advanced countries of the world. One of the most striking commonality shared by both the countries (India and South Korea) is the civilization heritage and accumulated stock of

ancient knowledge. Poverty was another common feature at the start of the era of modern economic growth. According to the available per capita income estimates in current purchasing power parity (PPP) US dollars for the year 1950, India and Korea showed a small difference. India's per capita income in 1950 was PPP$ 597. For the same year it was PPP$ 876 for Korea. It is pertinent to point out here that the difference between per capita income of Korea and India was 1.5 times. This difference in per capita income between Korea and India increased multiple times thereafter. In the year 1973, Korea's per capita income increased to PPP$ 2840, whereas India's per capita risen to PPP$ 853. Thus, Korea's per capita income increased by 3.33 times compared with India's per capita income. This per capita income gap has gone up to more than eight times towards the end of the 20^{th} century. This rising gap in per capita income between both the countries has marginally reduced in the first decade of the 21^{st} century. In the year 2012, the per capita income of India and Korea has increased to PPP $4,060 and PPP $30,290 respectively. The estimated gap turns out to be 7.5 times. This is precisely because of the fact that Indian economy seems to have started catching up. However, the gap in per capita income between South Korea and India has widened over the long period and marginally bridged in the recent one decades period owes an explanation.

When we compare the economic growth experience of India and South Korea during the 1960s, the GDP growth rates of India and South Korea were 3.4 and 8.6 per cent per annum respectively (Table 1). The large difference in growth rates between India and Korea was due to the bad economic development decade for India and it was beginning of era of planned economic development for Korea. India has faced two wars with the neighboring countries such as Pakistan and China in the first half of this decade. The external and internal constraints forced Indian state to declare planning holidays, that is, suspension of development plan for the period of 1966 to 1969. During this period, apart from devaluing currency, India accepted US aid under PL-480 with conditions that impinged on the program of import substitution industrialization. The direction of development was changed from big push industrialization to strengthening the defense forces for ensuring national security of the country. However, Korea was able to muster support in terms of foreign aid of US and more specifically from Japan. The aid from Japan has helped Korea to support technological needs for import substitution industrialization, which stimulated industrial growth. It is amazing to note that the industrial sector of Korea has grown at annual rate of 17.2 per

TABLE 1

GROWTH PERFORMANCE OF INDIA AND SOUTH KOREA ACROSS SECTORS

(Average annual growth rate)

Years	Sectors	India	Korea	World	East Asia	South Asia
1961-71	GDP	3.4	8.6			
	Agriculture	1.9	4.4			
	Industry	5.4	17.2			
	Manufacturing	4.7	17.6			
	Services	4.6	8.9			
1971-81	GDP	3.6	8.6			
	Agriculture	1.8	2.9			
	Industry	4.3	13.6			
	Manufacturing	4.5	14.5			
	Services	5.5	7.8			
1980-90	GDP	5.8	9.5	3.1	7.8	5.7
	Agriculture	3.1	2.8	2.8	4.7	3.2
	Industry	7.1	12.1	3.3	8.9	6.9
	Manufacturing					
	Services	6.7	9.0	3.3	8.9	6.6
1990-2000	GDP	6	5.8	2.8	8.5	5.6
	Agriculture	3.2	1.6	2.1	3.4	3.3
	Industry	6.1	6	2.3	10.7	6.0
	Manufacturing	6.9	7.3	3.5	10.9	6.6
	Services	7.7	5.6	3	8.5	7
2000-2011	GDP	7.8	4.1	2.7	9.3	7.3
	Agriculture	3.2	1.7	2.6	4.1	3.2
	Industry	8.4	5.3	2.6	10	8.1
	Manufacturing	8.6	6.4	3.2	9	8.2
	Services	9.4	3.5	2.9	10	8.7

Source: World Bank (1984, 1999 and 2013).

cent per annum (Table 1). The manufacturing sector of Korea recorded higher growth rate than the industrial sector as a whole. During the same period, the Indian manufacturing sector not only recorded lower growth rate (4.7 per cent) than the overall industrial sector (5.4 per cent), but it was contrary to Korean industrial sector's direction of growth. The comparative analysis of sectoral growth pattern of India and Korea for the period 1960-1970 shows that industrial sector in both the countries remained a leading sector in terms of growth rates. It is pertinent to add that all the sectors of Korea have grown faster than that of India.

Two shocks (1971 war with Pakistan and the 1973 oil shock) to Indian economy in the first half of the decade of the 1970s resulted into slow-down in economic growth of its economy. Indian economy was able to achieve only 3.6 per cent per annum growth rate during the decade of 1970s. However, Korean economy grown steadily during this period and achieved 8.6 per cent per annum growth rate. Sectoral growth rates decelerated in both the countries across the board except services sector of India. Whereas the service sector growth rate was accelerated and was the highest among the other sectors. Contrary to it, Korean industrial sector has remained a leading sector of its economy.

An acceleration of economic growth has occurred in both the countries during the decade of the 1980s. Korea's growth rate of GDP was 9.5 per cent per annum whereas it was 5.8 per cent for India. Both the countries recorded higher GDP growth rates compared with the world as a whole during the same period (Table 1). As far as sectoral growth rates were concerned, both the countries recorded highest growth rates in the industrial sectors of their respective economies. During this decade, engine of growth in both the countries remained industrial sector. India recorded higher growth rate only in agriculture sector, however, industrial and service sectors growth rates were much higher in the Korean economy. It is important to note here that South Korean economy has been growing at a higher rate compared with East Asian as well as of South Asian countries.

The growth rates of India and Korea were converged during the decade of the 1990s. India's GDP growth rate was marginally higher (6 per cent per annum), whereas Korea's GDP growth rate was 5.8 per cent per annum. It needs to noted that the East Asian financial crisis, which severely affected South Korean economy, has occurred towards the end of this decade (1997-98). Except manufacturing sector, all other sectors of the Indian economy recorded higher growth rates than that of Korea. Service sector turns out to be the fastest growing sector in India but manufacturing sector remained the leading sector in Korean economy. Indian economy surpassed the Korean economy in terms of GDP growth rates as well as in all the sectoral growth rates in the first decade of the 21st century. One of the similarities of sectoral growth rates of South Korea and India during the decade of 2000s was that the manufacturing sector showed higher growth than the overall industrial sector growth rate. However, unlike the South Korean economy, the service sector has emerged as the fastest growing sector of the Indian economy. The acceleration of the rate of growth of the service sector during

TABLE 2

DISTRIBUTION OF GROSS DOMESTIC PRODUCT ACROSS SECTORS IN INDIA AND SOUTH KOREA (1960-2011)

Sectors	India				South Korea			
	1960	1980	2000	2011	1960	1980	2000	2011
Agriculture	50	38	23	18	37	15	5	3
Industry	20	26	26	25	20	40	38	39
Services	30	36	51	56	43	45	57	58

Source: World Bank (1985, 2013), World Development Indicators, Washington, D.C.: The World Bank.

2000-11 compared with that of 1990-2000 clearly brings out the message that service sector has emerged in the Indian economy as the 'engine of growth'.

The high rates of economic growth of South Korean economy over a longer period of time are expected to dramatically alter the production structure of its economy. There was a substantial fall in the share of agriculture sector between the 1960 and 2000. It declined from 37 per cent to 5 per cent during the four decade of fast economic development. The industrial sector improved its share in GDP from 20 per cent to 40 per cent between 1960 and 1980 (Table 2). Thereafter, the service sector has shown dramatic increase in its share in the GDP. The production structure in the year 2011 is just like the production structure of a developed economy where agriculture sector is marginalized and contributes only 3 per cent of GDP. The industrial sector contributes 39 per cent of the GDP whereas services sector turns out to be the leading sector accounting for 58 per cent of the GDP. The perusal of table 2 clearly brings out the fact that the production structure of Indian economy altered at a slow pace. Agriculture sector occupied dominant position but its share in GDP declined slowly from 50 per cent to18 per cent during the period of five decades. There were marginal improvement in the share of industrial and services sectors between 1960 and 1980. The industrial sector's share in GDP remained stagnant between 1980 and 2000 and declined marginally thereafter. The services sector dramatically improved its relative share in GDP during the period of analysis. The decline of share of agriculture has resulted into the rise in the share of services sector of the Indian economy. An important fact that comes out from the analysis of the change in the production struc-

ture is that both economies turned out to be predominantly services sector oriented. However, the Korean economy followed the standard patterns of economic development as has been observed by the advanced countries (Kuznets 1966; Chenery 1960). Indian economy skipped the phase of industrialization and prematurely turned towards service oriented economy even at a very low level of per capita income.

The dynamics of the sectoral linkages based on input-output transaction table of India and South Korea have been examined by Singh I., and Singh L. (2013) to understand and ascertain the extent of differences in input use. As per the estimates of this study, the share of intermediate input in GDP is 50.17 per cent for India and it is 59.43 per cent for South Korea. Industrial sector intermediate input use is highest in South Korea (72.52 per cent). However, the highest intermediate input use for India is in the agriculture sector. The analysis of backward and forward linkages brings out that the South Korean secondary sector has higher backward linkages with secondary and services sectors compared to India. It is noteworthy fact that South Korean service sector is more integrated with other sectors on the backward side but India's services sector is somewhat stand alone system means that it does not have much backward linkages with other sectors of the economy.[1]

[1] India has been widely acknowledged world wide as the 'office of the global economy' due to ICT services exported to the rest of the world. This sector of the Indian economy is expected to generate backward linkages in terms of demand created for manufactured electronic hardware. Instead of fulfilling the demand for electronics products from the home grown industry, these manufactured products are being imported from other countries of the world. Contrary to it, the manufacturing led economic catch-up usually generates complementary production within and across sectors and introduces productivity improvements in agriculture and service sectors. However, the service sector in India remained stand alone sector and failed to generate desired complementarities for productive activities to take place in India rather remained highly dependent on the external world, that is, the hard ware imports such as mobile phones and computers and accessories. It is estimated that the imports of such complementary products have already surpassed the oil import bill of India. By 2020, the imports of electronics products which are required for ICT service sector to grow will surpass US $ 400 billion. This missing link generated the phenomenon of 'Jobless Growth' on the one hand and deficit in the balance of payments on the other. However, historical experience of economic catch up through manufacturing in fact expanded new and complementary sectors that generated new opportunities of employment as well as huge exports to finance imports and reduced the pressure on current account. Take for example the case of South Korea where twin problems mentioned above solved by the all along growth initiated by the manufacturing sector.

This aggregative analysis of backward linkages also shows that South Korean services sector has higher backward linkages compared to India's services sector (Singh I. and Singh L. 2013).

Korea and India have been transforming their economies though at a different rate. The structural transformation and economic development process involved multiple factors. Korea's fast pace of catch up has been essentially attributed to its highly developed capacity to absorb and use of new technology developed elsewhere (Lundvall 2011). A fine distinction that has been made in innovation literature is the active and passive learning system. Korea has enacted and followed active system of learning which has been attributed to the successful transition of her economy (Viotti 2002). However, the slow economic transformation of the Indian economy can be linked to passive learning systems. The development process in both countries involves the absorption and use of innovations developed in the advanced countries. Both the countries have experienced capacity building during this process of adapting innovations which have enabled to develop their own systems of innovation.

III. Structure and Trends in Innovations-India and South Korea

It is increasingly realized that the growing economies are becoming more and more knowledge intensive. The accumulation of scientific and technological knowledge, transfer of technology and rising education and skills of human capital are the outcome of conscious investment decisions made by both the economic actors of production and of the state. Thus, the culture of science and technology and input involves of the national economy affects innovation capability building and economic outcomes (Freeman 2008). This can be reflected through the input and output measures of innovations. The expenditure on research and development (R & D), which is the most important source of innovations, has increased from 409.8 to 1276.9 billion US dollars on purchasing power parity in the global economy between the period 1990 and 2009, that is, more than three times (Table 3). It is significant to note that the R&D expenditure during the same period has increased both in the advanced countries as well as developing countries. The developing countries R & D expenditure has gone up 8.22 times whereas it increased only 2.5 times in the case of advanced countries. The investment on R & D in both the North American and European countries has increased al-

TABLE 3
GROWTH AND STRUCTURE OF RESEARCH AND DEVELOPMENT EXPENDITURE IN THE GLOBAL ECONOMY

(GERD in billion PPP$)

	1990	1999/2000	2002	2007	2009
World Total	409.8	755.1	787.7	1155.4	1276.9
Developed Countries	367.9 (89.77)	596.7 (79.02)	650.0 (82.52)	882.9 (76.41)	931.5 (72.95)
Developing Counties	42.0 (10.25)	158.4 (20.98)	137.7 (17.48)	272.5 (23.59)	345.4 (27.05)
North America	156.4 (38.16)	281.0 (37.21)	297.2 (37.73)	398.6 (34.50)	417.5 (32.70)
Latin America and Caribbean	11.3 (0276)	21.3 (02.82)	22.0 (2.79)	34.4 (3.0)	40.0 (3.13)
Africa	5.2 (1.27)	5.8 (0.77)	7.0 (0.89)	10.8 (0.93)	11.8 (0.92)
Europe	138.8 (33.87)	202.9 (26.87)	236.4 (30.01)	324.4 (28.08)	363.4 (28.46)
Asia	94.2 (22.99)	235.6 (31.20)	214.0 (27.17)	367.9 (31.84)	421.8 (33.03)
South Korea	-	-	22.5 (2.9)	40.7 (3.5)	43.9 (3.5)
India	-	-	13.3 (1.7)	24.3 (2.1)	-

Note: Figures in parentheses are percentages.
Source: UNESCO (2013).

most at a same pace. Among the developing countries, the Asian countries have increased R & D expenditure at a much faster pace compared with other developing countries. It was 4.5 times in Asia (Table 3). Korea and India have also emerged as significant R & D investor countries in the global economy. When we compare the R & D expenditure of Korea with the Latin American and Caribbean countries, the relative share of Korea is higher than all the Latin American countries. It was 3.5 per cent for Korea whereas it was 3.13 in the year 2009 for Latin American countries. Similarly, the relative share of R & D expenditure of India was higher than the combined share of the African countries. Korean and Indian intensity of innovation investment (R & D-GDP ratio) during the

decade of 1960s, 1970s and the early 1980s was almost similar. However, Korea crossed the threshold level of 1 per cent in 1983 (Lee 2013b) but India could only reach to this threshold level in the second half of the first decade of the twenty first century (Krishna 2013, p.158).

An important change in the structure of innovation investment that has occurred in the global economy is the rising share of R & D investment in the developing countries compared with the developed countries. This rise in the relative share of innovative investment in developing countries is due to fast pace of rise in R & D expenditure in the Asian countries. However, the Latin American and Caribbean countries and African countries have also gained relative position in the global innovation investment. South Korea has emerged as outstanding so far as the gains in innovative investment are concerned. Despite the increased innovation investment efforts of the developing countries, the relative share of innovative investment of the developed countries continue to be absolutely very high, that is, 72.95 per cent in the year 2009. This clearly brings out the fact that global knowledge economy is highly concentrated in the advanced countries. Therefore, the dependence of the developing countries in terms of scientific and technological innovations on the advanced countries is very high and will continue to be so in foreseeable future.

Another important input measure of innovation is the scientific manpower engaged in innovation activities. The world average between the period 2005 and 2010 was 1271 researchers per million people. For Korea, it was 5481, which is more than four times higher than the global average. However, India's researchers per million people during the same period were only 136. Somewhat similar situation exists when we compare South Korea and India in terms of technicians per million people during the period 2005-2010. In case of India, it was 93 and Korea employed 987 technicians per million people (Table 4). In terms of both input variables related to innovation investment and scientific manpower, Korea has an absolute edge over India. Thus, the degree of intensity of investment and scientific manpower in South Korea is very high and even higher than the most of the developed countries.

Among the output measures of innovations, the science and technology journal articles come out to be an important indicator. The S&T journal articles contain new ideas and thus contribute to the existing stock of knowledge. In this context, India's contribution to the global science and technology remained quite enduring. In absolute terms India's has contributed higher number of S & T journal articles than

TABLE 4
INDICATORS OF INNOVATIONS - INDIA AND SOUTH KOREA

	India	South Korea	World
Researchers per million people 2005-10	136	5481	1271
Technicians per million people 2005-10	93	987	-
S&T Journal Articles (2009)	19917	22271	788333
Exports % of GDP 2005-10	0.76	3.76	2.21
R&D of million 2011	12871	122021	1791989
High Tech. Exports as % of Manufacture 2011	6.9	25.7	17.7
Receipts $ million 2011	302	4336	24080
Payments $ million	2820	7295	241561
Patents Application field by residents 2011	8841	138034	1264981
Patents Applications filed by non residents 2011	33450	40890	681082
Trade Mark Applied file (Total (2011)	198547	133645	3843695

Source: World Bank (2013).

South Korea in the year 2001 (Singh 2007). However, Korea surpassed India in terms of its contribution of S&T journal articles in 2009 (Table 4). In all the output indicators of innovations, Korea is much ahead compared with India. Two most important output indicators of innovations such as high-tech exports as a proportion of manufacture and patent applications filed by both residents and non residents in the year 2011, the proportions and levels achieved by Korea are much higher than India. Only in trade mark applications filed in year 2011, India remained ahead of Korea. When we look at the balance of technological payments, both the countries remained deficit. This implies that technology and technology related services hired by both the countries and payments made in lieu of that are much higher than that of the payments received on that account. However, the payments on technology account made by India are more than nine times higher than receipts but this ratio is only 1.7 times for Korea in 2011. This indicates that the gap of technology balance of payments is quite narrow in the case of Korea but is very large in the case of India (Table 4). Therefore, the technology

TABLE 5

INNOVATION PERFORMANCE OF INDIA AND SOUTH KOREA

Innovation Indices \ Country	India			South Korea		
	2001-02	2005-06	2009-10	2001-02	2005-06	2009-10
1. Technology sophistication index	4.5 (28)	4.7 (28)	4.3 (43)	4.9 (22)	5.3 (16)	5.2 (23)
2. Firm level innovation index	5.4 (34)	5.5 (19)	-	5.1 (52)	5.8 (8)	-
3. Firm level technology absorption index	5.2 (31)	-	5.3 (39)	5.4 (27)	-	6.1 (9)
4. Quality of scientific research institution index	5.2 (21)	5.1 (17)	4.7 (30)	4.9 (27)	5.1 (19)	4.8 (25)
5. Company spending on research and development index	3.5 (42)	3.8 (27)	3.6 (37)	4.5 (18)	5.2 (8)	4.7 (12)
6. University/industry research collaboration index	3.7 (38)	3.3 (36)	3.7 (58)	4.6 (20)	4.8 (10)	4.7 (23)
7. Government procurement of advanced technology products index	3.8 (45)	3.9 (41)	3.5 (76)	4.6 (15)	4.8 (10)	4.1 (39)
8. FDI and technology transfer index	5.3 (30)	5.1 (34)	5.1 (28)	4.9 (46)	4.8 (56)	4.5 (86)

Note: Figures in parentheses are relative global ranks.

Source: World Economic Forum (2010), The Global Competitiveness Report 2010-11, Geneva: WEF.

dependence on the other countries as revealed from the above analysis is very high in India compared with Korea.

Recently several comparable innovation measures have arrived on the scene to measure innovation performance across countries. One such measure of innovation based on seven point scale has been developed by the World Economic Forum. The score one is assigned to the lowest characteristics of innovation and seven is the highest level of innovation. The scores and global ranks of India and Korea are presented in Table 5. To gage the overall performance of innovation, the technology sophistication index has been invented. According to this index, India in the

year 2001-02 was ranked number 28 among the 78 sampled countries with 4.5 score value. However, Korea's position was much higher than that of India, while it has attained the global rank 22 with score points 4.9. Korea improved further score points and global rank in the year 2005-06. But India's rank remained constant even though score value has marginally improved. It is surprising that the technology sophistication index based ranks and the scores have dramatically declined for India in the year 2009-10. The technology sophistication index based rank of Korea has also declined from 16 to 23 from 2005-06 to 2009-10 but the score changed marginally to 5.2 from 5.3 in the same period.

Firm level innovation index, which measures the efforts of the firms to develop new technologies, shows that the score differentials are quite small in both the countries. India's firm level innovation index based score was 5.4 in the year 2001-02. The value of the scores of firm level innovation index for Korean firms was 5.1. However, the global ranks on the basis of above mentioned scores for India and Korea were 34 and 52 respectively. This has improved to 19^{th} for India but dramatically improved to 8^{th} for Korea. Similar improvements have been witnessed for both the countries so far as the firm level technology absorption index is concerned. It is important to note here that the quality of scientific research institution index provides scores and global ranks much higher for India compared with that of Korea in the year 2001-02. India and Korea further improved the quality of scientific research institutions as indicated by the index in the year 2005-06. However, Korea reduced gap both in terms of scores and global ranks thereafter. During the period 2001-02 to 2009-10, the quality of scientific research institutions has improved at a fast rate in Korea compared to that of India (Table 5). The studies conducted by the various scholars examining the of quality and capacity of scientific research institutions testifies that the Indian universities and public research institutions possess relatively strong research capabilities (Lee and Kang 2010; Joseph and Abraham 2009). The relationship between university and industry in terms of producing and using innovation is shown with the help of university/industry collaboration index. When we compare the quality of scientific research institution index and university/industry research collaboration index, the scores and global ranks of Korea and India are higher as shown by the quality of scientific research indices. This implies that the university/industry linkages are not widely spread but their intensity is on the rise. In this context, the recent research findings show that the firms who posses certain level of R&D capabilities can

able to use and benefit from university/public research institution innovations (Lee and Kang 2010). This evidence gives support to the view that the firm and university R & D is complementary rather than substitute. Since the company level research effort is much higher in Korea compared with India, but the quality of research institution is higher in India than that of Korea. This is precisely the reason that intensity of university/industry linkages is higher in Korea than that of India (Table 5).

Foreign direct investment has been considered in economic literature beneficial for the host country due to several reasons. Among them technology transfer has been considered to be the most important for the host country. Precisely because of this reason a large number of countries are making suitable and more favorable regulatory changes to attract foreign direct investment.

There has been an increasing trend of more favorable regulatory changes to attract foreign investment and the number of changes in regulations were peaked in the global economy to 162 in the year 2005 (Singh L. and Singh B. 2010). India and Korea have also made several changes in their respective foreign investment regulatory regimes in the recent past to attract higher inflows of investment (Gill 2013). Therefore, it is a matter of great significance to understand that how has FDI remained helpful in technology transfer to local agents of production in both the countries. The scores and scores based global ranking of FDI and technology transfer index are presented in Table 5. India and Korea in 2001-02 recorded 5.3 and 4.9 scores respectively and accordingly global ranking was 30^{th} for India and 46^{th} for Korea. These scores marginally declined in the year 2009-10 for both countries. However, there has emerged a wide gap between India and Korea in terms of global ranks assigned according to the FDI and technology transfer index. India was ranked 28^{th} whereas this rank for Korea was 86^{th}. This may be due to the reason that Korean firms have transitioned to frontiers of innovations and at that stage firms learn more from their own in-house R & D as well as more from interaction with the university/public research institutions. Therefore, the benefit of technology transfer through spillover effects from other firms dramatically decreases when firms reach to the frontiers of innovations (Singh 2004). Since Korea has been emerging as an important investor in India, therefore India can receive higher benefits of technology transfer from Korea while enhancing the strategic cooperation. As noted above, the quality of public research institutions is very high in India, therefore, the Korean firms operating

in India can generate university/industry linkage to derive benefits from Indian research institutions. This cooperation between Korea and India can be mutually beneficial and rewarding. It is well recognized that the public innovation support does matter for generating culture of technological innovations. In this context, both the countries, India and Korea have extended a substantial amount of help to their respective local firms so that domestic firms can sustain and inculcate the culture of innovations. Korea's extent of public support in the form of government procurement of advanced technology products index remained very high. Korea was ranked number 15^{th} in the year 2001-02 with score 4.6 according to the government procurement of advanced technology products index. It is very high compared to India. Whereas India's score was 3.8 in 2001-02 and the global rank was 45^{th}. India's global rank over a period of time nose-dived to 76 in 2009-10 with score value 3.5. Korea's global position has also gone down to 39^{th} with 4.1 score value in the same year. Despite the reduction of public support indicated by the government procurement of advanced technology products index, Korean government has remained more active supporter to new innovations compared with the support extended to Indian firms by the Indian government.

IV. State and Evolution of Social Capabilities in India and Korea

India and Korea like other less developed countries of the world started their development process in the post colonial era to achieve autonomous/self reliant development path. The state was assigned a prime role in economic development than the market with a view that market alone was not sufficient to transform the backward economies to industrialized ones. The development consensus at that time was to catch-up with the industrialized countries and improves the living and working conditions of the citizens. It was also considered that industrialization is the dynamic sector which has a capacity to generate productive employment for the surplus labor force that was engaged in the traditional sector. This grand strategy of modern economic development has faced the constraint of low rate of savings and its transformation to investment due to very weak private sector. It was also considered that under investment can occur in the sectors that were critical for development due to expected high propensity to consume of the rich. Therefore, the

TABLE 6
PHASES OF NATIONAL INNOVATION SYSTEM OF KOREA AND INDIA

Phases	South Korea	India
First Phase	Period of Inception 1960-1970	Policy for Science and Self Reliance-1947-1970
Second Phase	Period of Structural Adjustment 1980s	Period of Redefining Self Reliance-1970-1990
Third Phase	Period of Tade-off 1990s	Decentralised Science and Technology Policies 1990s onwards

Source: Suh (2000) and Krishna (2013).

public policy was shaped with a lead role was given to public investment, import substitution industrialization with external and internal controls and directed allocation of resources in the private sector (Nayyar 2008). For the grand strategy of economic development of fostering industrialization, the pre-requisite is the social capability building for sustained state led capitalism. For the success of this strategy, the development policy needs systemic changes in institutions and organizations. Innovations turn out to be a handy tool for inducing structural changes in the institutions and organizations to realize the sustained economic development (Yoguel and Robert 2010). In this context, 'the state which is considered in relation to innovation system covers almost the entirety of the state and its sphere of governability' (Scerri and Lasters 2013, p.10).

India's liberal democratic state and Korea's authoritative state enacted suitable development policies to govern the markets of their respective economies to achieve the goal of catch-up with advanced countries of the world. Both the countries enacted suitable planned development strategies to allocate resources for fostering import substitution industrialization. It was realized that the establishment of manufacturing industries and enhancement of productivity requires science and technology support. The evolution of the role of state in building national innovation system can roughly be divided in three phases in both the countries (Table 6). The first phase of Indian science and technology policy spanned from 1947 to 1970. During this period, the emphasis was on laying down basic infrastructure for science and technology of the country including the expansion of the university education for ensuring adequate supply of S & T human resources. Second phase (1970-1990) redefined

self-reliance while emphasizing on further expansion and establishment of second layer of science agencies. These were the department of space, electronics, environment, biotechnology and department of ocean development. Third phase begins with the liberalization and globalization of the Indian economy in 1991. However, the national science and technology policy of self-reliance to build capabilities not only continued but emphasis shifted to global competitiveness and export promotion. Indian state mediated systems of innovation has acquired reasonable dynamic capabilities in sectors such as space, agriculture and food security, pharmaceuticals, biotechnology, ICT software and telecommunications. India's science and technology policy over the five decades has been governed by the goal of self-reliance and its associated strategy of import substitution. The evolution of national innovation system to build social capabilities resulted from the national needs and priorities of economic development. The major weakness of the system of innovation of India is the under-utilization of scientific and technological capabilities. This implies that the potential remained unexploited. The state mediated system of innovation has emphasized only on the supply side but some problems remained on the demand side. Another important weakness that has emerged on the scene is the lower contribution of private firms to participate in evolving innovation capabilities and their research input remained rather miniscule (Krishna 2013). Therefore, the degree of the intensity of research and development remained less than one per cent for a longer period of time. Consequently, the output indicators showed relative regression in the global economy in the recent past.

Korea's development experience of science and technological capabilities rather remained highly successful. Korea has faced a similar situation of external imbalances and persistent trade deficit during the first phase of import substitution and self-reliance as was faced by India. Two decades period of 1960-1980, which is the first phase of science and technology policy, witnessed the state mediated technology development based on public research and development expenditure. This was the period of establishment of public research institutions and universities. However, the domestic conditions of research capabilities of both private enterprises and universities were remained quite weak. The government led research institutions fulfilled technological requirements/demands of the government and the industry. This was also known as the stage of imitation, first stage of innovation, of simple technology to meet the growing demand of technology for industry. The second phase of Korea's science and technology policy roughly covers the decade of 1980s. During

this period, the state has emphasized on raising capabilities of private enterprises and also of the universities/PRIs. Private sector research capabilities were promoted while providing tax incentives and establishment of public-private partnership of R & D in bigger and risky projects. This is the period when Korea crossed the threshold of 1 per cent R & D-GDP mark (Lee 2013b). Increased intensity of R & D expenditure and emphasis on higher education transformed the Korean industrial economy from capital accumulation driven to knowledge driven. This phase of science and technology policy is distinctly known for inducing improvements in mature technologies along with encouraging imitation in advanced technologies. The third phase (1990s) of South Korean science and technology development was described as a take-off stage. Industrial enterprises led innovation system was established in the knowledge intensive manufactured products such as electronics, automobile and mechanical engineering. During this phase increasing emphasis was given on future oriented complex advanced technology development through creative research. Revamping of public research institutions has been done with a view to preparing them for take-off stage (Suh 2000). The research and development intensity (R & D expenditure-GDP ratio) has increased more than 1 percentage point from 2.3 per cent in 1993 to 3.5 per cent in 2011 (Lee 2013b). Korean system of innovation, during the four decades, transformed from the stage of imitation to innovation. South Korea created dynamic innovation advantages while gearing up the system of innovation to specialize in short cycle technologies (Lee 2013a). The success of the state mediated capability building has happened in South Korea mainly due to the active learning ensured by the state through introducing accountability as an endogenous tool in the system of innovation. However, India has developed capabilities to some extent but the liberal democratic state failed in ensuring accountability as an endogenous tool in the system of innovation.[2] This difference of institu-

[2] One of the flaws of the Indian system of governance is that it fixes targets to be achieved and for that matter a huge amount of economic concessions has been granted to the private corporate sector. The government has been consistently failing to fix responsibility when concessions and support extended by the government could not bring the desirable results especially in the case of research and development expenditure and innovation outcomes. It is a case of policy failure. India failed to prod the private corporate sector to spend right amount of investment in innovative activities and consequently the threshold level of R&D-GDP ratio could not be achieved. There are several such policy matters which could not be either implemented or benefits of policy could not reach to whom it was meant for. Land reform and redistribution of land to the

tional approach can be a good candidate to explain wide differences in the economic growth performance that has occurred in India and Korea. However, at the given level of social and technological capabilities in both the countries, the occasional shocks had devastated and disrupted the economic growth momentum of both of India and South Korea several times in the historical past. This has raised the doubts about the capability based approach to explain long run sustained economic performance (Lee, Kim G., Kim H. K., and Song 2010).[3] The capability view can be treated at the best a necessary condition for realizing sustained economic development but not the sufficient condition. Therefore, it is pertinent to add that it is the social capabilities enabled by the wider concept of systems of innovation approach that encompasses governance of markets and ensuring a complementarily between the state and the market perhaps can be relied to explain and achieve sustained economic development path.

tiller is another example. It took thirty six years to pass anti corruption law. This is perhaps where India's liberal democracy under preformed precisely because of the reason that unlike other functional democracies, India is a very diverse country in terms of geography, ethnicity, languages, culture, caste and religions. The governance system is more preoccupied on the political stability and could not manage to introduce accountability as an endogenous tool of functioning of the economic system. There are strong lobbies and group interests operating that have been succeeded in warding of the accountability to be an endogenous tool of the economic, political and social systems. This weakness of the liberal democracy has led Indian economy to underperform in several areas also pointed out by a recent study by Dreze and Sen (2013).

[3] It is well known fact that external shocks in India and South Korea in particular and in other developing countries in general have disrupted the ongoing economic growth momentum. Despite the fact that social and technological capabilities were well developed and continuously improving, but the economic growth process was disrupted for instance 1991 in India and 1997-98 in South Korea. This crisis was mainly erupted because of the failure of macro-management of the system due to external pressures. For example, it was well examined through an intensive case study of Japanese economic crisis by Ruttan (2001) and South Korean crisis by Lee, Kim G., Kim H. K., and Song (2010). These studies have clearly pointed out that there is a dire need that the state should shoulder responsibility to conduct the management of the economic system in a manner so that the market led external shocks should not be allowed to disrupt the sustained economic growth momentum. The crisis even impinges on the well developed social and innovation capabilities. Therefore, it is argued that the system of innovation approach needs to be expanded beyond social and innovation capabilities and encompass the macro management capabilities as well.

V. Conclusions

India and Korea embarked on the modern economic development path at the same time and under almost similar global economic environment. Korea's sustained economic growth experience during the 1960s, 1970s and 1980s has transformed it from a low income country to a high income industrialized country. However, the India's growth experience during the last six decades only allowed it to change its position from a low income to a low medium income country in the global economy. Indian and Korean growth rates converged in the 1990s and India has surpassed the Korean growth rates in the first decade of the 21st century. The engine of growth of the Korean economy during the fast phase of economic development was manufacturing sector. However, despite massive efforts to industrialize build manufacturing base, the engine of growth in the Indian economy remained service sector. Therefore, the structural imbalance in terms of income shares and employment shares has occurred in the Indian economy. Income growth and high income shares accounted by the service sector, however, the high shares of workforce remained employed in the traditional-agriculture sector of the India economy. This structural imbalance has resulted into low levels of social indicators and high incidence of poverty in India.

India and South Korea had substantially raised innovation capacity building during the six decades of economic development. The analysis of indicators of innovation shows that India and Korea remained quite close to each other with regard to various indicators of innovations. The sustained research and development investment efforts contributed to economic and innovation outcomes. However, Korea surged ahead due to raising R & D intensity multiple times and also inducing company level intensity of in R & D. This success of Korean state in capability building and enacting the culture of innovations may explain partly the growth differentials. It is pertinent to note here that the analysis of sustained growth and disruption of economic growth momentum both in Korea and India gives credence to the view that a more inclusive view of national systems of innovation which encompasses judicious combination of the state and the market that deliver and sustain economic growth. The comparative analysis of growth, structure and systems of innovation of India and South Korea brings out several possibilities of mutual economic cooperation and many lessons of policy making that can be learnt from each other's experience of sustained economic development.

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