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A Conceptual Review on Economic, Business, Intellectual Property Rights and Science & Technology Related Activities in Asian Economies

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Abstract

Numerous of studies have observed that science & technology (S&T) and intellectual property rights (IPRs) regime are useful and effective to maintain the economic and social development in different economies. However, earlier studies found positive and negative impact of S&T and IPRs on economic growth and development in variouscountries. China, Indonesia, South Korea, Thailand, Malaysia are the greater competitors for Indian economy in IPRs and S&T. These economies have a greater share of manufacturing and industrial sector in their GDP due to their effective contribution in S&T and IPRs related activities. Hence, this study assesses the role of IPRs and S&T in socio-economic development in aforementioned economies based on existing studies. Furthermore, it provides the recent trend in economic, IPRs, S&T and business related indicators for India and selected Asian economies. Thereupon, it makes India's comparison in IPRs and S&Tassociated indicators among the selected Asian economies. It examines the India's position in economic, IPRs, S&T and entrepreneurship related indicators as compared to other economies. Finally, it come up with several policy proposal to increase the involvement of IPRs and S&T in socio-economic development in Asian economies. It recommended that research & development (R&D) expenditure is a crucial driver to attract the attention of researchers and scientists towards IPRs, subsequently it give incentive to existing researchers to increase their participation in R&D and S&T related activities. It suggested that S&T and IPRs activities create a path for innovation and discovery of new technologies for production of goods and services

Keyword:
IPRs; S&T; Economic development; Business Activities; Asian economies; India; Developing economies.

1. Background and Objectives

Intellectual property (IP) is an intangible asset of an individualresearcher and scientist (Sharma, 2014),[1]and it plays a crucial role in gaining competitive advantage in terms of technological advancement. Technological advancement is essential to achieve high economic growth in a market driven and emerging economies (Gould and Gruben,,

[1]https://www.aaup.org/sites/default/files/files/IntangibleAssets.pdf.

1996; Singh et al., 2017a). Indigenous technological capability is aneffective driver to increase economic growth and development (Hossain and Lasker, 2010). Intellectual property rights (IPRs) are conferred with respect to the creative and inventive activity of the human mind (Sharma, 2014). IPRs provide the legal security to an individual researcher and scientist who create innovative idea and technology which may be useful for manufacturing industries to create or produce goods and services (Sharma, 2014). Hence, the protection of IP is helpful to maintain competitive technological gain to achieve higher industrial growth in a country. At present IPRs regime is used not only as a powerful tool to protect creativity and generate revenue but also to build strategic alliance to increase socio-economic development (Sharma, 2014; Singh et al., 2017a) and technological changes in an economy. Effective IPRs regime is helpful to increase economic growth and development in several ways like poverty eradication, improving human health, improving education and others (Gould and Gruben, 1996; Schneider, 2005;Laik, 2005; Yueh, 2007; Sharma, 2014; Mrad, 2017). Hence, it may be imperative to achieve sustainable development (Sharma, 2014). Also, IPRs also play a significant role to encouraging new business development, rationalization of inefficient industry, and inducing technology acquisition and creation in an economy. Furthermore, IPRs is helpful for entrepreneurs to recover costs of their innovative expenses (Laik, 2015). In industrial economies, IPRs is a part of the institutional infrastructure that encourages private investments in formal R&D, and other inventive and creative activities (Yueh, 2007). Many economies like USA, Brazil, China, South Korea, United Kingdom, Malaysia and Singapore are doing well in science and technology (S&T) and industrial field due to strong IPRs regime (Singh et al., 2017b). These economies have been achieved higher per capita income and better human development than other economies like India, Pakistan, South Africa, Moldova and others (Singh et al., 2017a).

Technological invention, industrial design, artistic and literary work are the crucial forms of IPRs (Singh et al., 2017a; Singh et al., 2017b). Innovative idea and technological invention may be useful to create a new knowledge or process for product development in manufacturing industries (Singh et al., 2017b). *Technological development provides the systematic way to use of scientific, technical, economic and commercial knowledge to meet specific business objectives or requirements in manufacturing sector*.Also, there are several factors like socio-economic variables, science & technology (S&T) related indicators, and human skilledwhich may affect the technological development of a nation.Research and development (R&D) is an importantdriver to maintain the technological development of a county (Singh et al., 2017a; Singh et al., 2017b). It also provides platform to maintain social and economic development of a nation (Fayaz-Bakhsh and Mousavi, 2015). Singh et al. (2017a) observed that technological development has a positive and statistically significant association with socio-economic development in selected economies. So, technological development must be considered as a crucial driver to create several alternatives to sustain human livelihood and to increase global competitiveness of an economy.

Also, use of technological development brings new techniques to reduce human efforts to achieve their desirable goals in various areas (e.g., education, health, employment creation, transport, shelter, food security, new market creation, business development) (Sharma, 2014). It is useful to increase asset and resource productivity (i.e., human, environment, financial, social, physical, institutional, etc.) (Šlaus and Jacobs, 2011). So, technological development may be useful to achieve inclusive development and sustainable development. Technological development may create several ways to increase human well-being through creation of new business, job opportunities, product development in industries, new market, and infrastructure development.

Technological development has created several alternatives to increase socio-economic development in USA, Sweden and Switzerland, and some emerging economies like China, South Korea and Singapore (Singh et al., 2017a). Hence, in India, technological development can also bring better jobs opportunities and resources for livelihood

security for population through creating more enterprises and market for new products. However, in India, limited studies investigate the association of technological development and IPRs regime with socio-economic development. Also, no study provide the description on association of IPRs related indicators and science & technology related activities with socio-economic-development across economies using robust and viable empirical model. Furthermore, few studies apply robust and concrete empirical model to investigate the impact of technological development and IPRs regime on economic development especially in developing economies. Also, there are several research questions on association of IPRs regime and science & technology with socio-economic developmentare discussing by research academia and existing researchers. Thus, the study is proposed to answers some specific research questions which are given as:

- What is the role of technological development and IPRs in socio-economic development in developing economies?
- How technological development and IPRs have significant association with socio-economic development in selected developed and developing economies?
- What are the various components of technological development and how these components are associated with each other in developing economies?
- Whether socio-economic development have a significant impact on IPRs and technological development in developing economies or not?
- How developing economies can increase thecontribution of IPRs and technological development in socio-economic development in developing economies?

Relevance to aforementioned research questions, the present study is achieved following objectives:

- To assess the influence of IPRs and technological development on socio-economic development in India and selected Asian economies based on existing studies.
- To make India's comparison in economic, IPRs, science & technology and business related activities in selected Asian economies using available data.
- To provide the practical policy suggestions to increase the contribution of IPRs and technological development in socio-economic development in in India and selected Asian economies.

2. Relations of IPRs and Technological Development with Economic Development

It is observed that protection of IPRs contributes technological innovation and it is crucial to increase transfer and commercialization of technology (Mrad, 2017). IPRs also provide the incentive to stimulate innovation (Ilie, 2014). Subsequently, it technology transfer and commercialization boost the technological development. IPRs also encourage innovation which provide incentive to increase the involvement of a country in science & technology related activities (Hossain and Lasker, 2010). Gould and Gruben (1996) have examined the importance of IPRs in economic growth using cross-country data. It considered patent protection, trade regime, and country specific information to assess the influence of these aforesaid characteristics on economic growth. It found that IPRs regime is an essential components to maintain economic growth of a country.

Ilie (2014) have reviewed earlier studies and concluded that IPRs have a positive and negative impact on economic growth and development. This study claimed that impact of IPRs on economic growth and development depend upon factors which promote the benefits of intellectual property protection. Ezzeddine and Hammami (2018) have estimated the influence of IPRs regime on innovation in 10 emerging economies. Results of this study shows that IPRs have a positive and significant impact on innovation. Empirical findings of this study were based on country-wise panel data during 1985-2015. Further, it perceived that IPRs has a U-Shape relationship with innovation in selected 10 emerging economies. This study also empirically proved that human capital and economic development also have a significant impact on innovation. Mallik and Chowdhury (2001) have observed a positive and

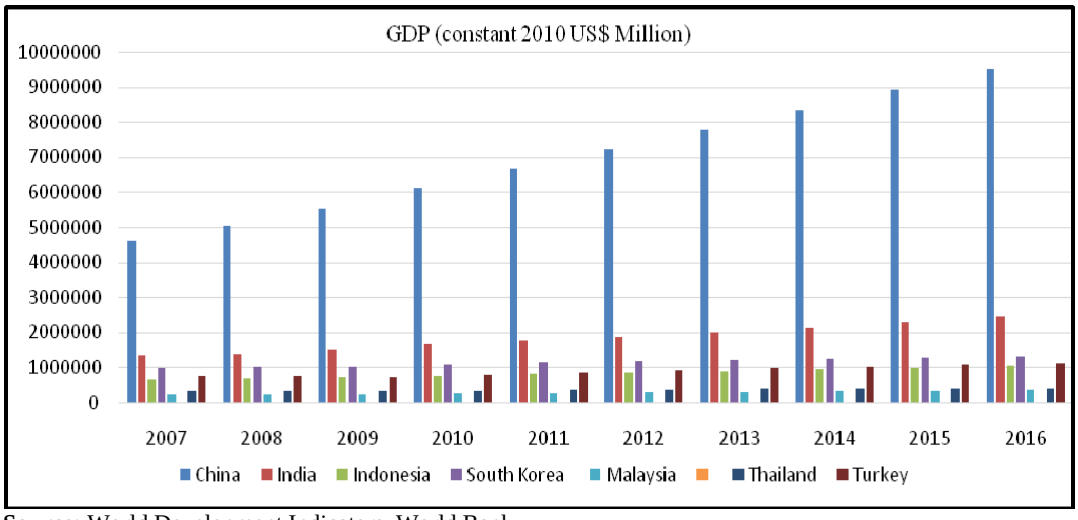
significant influence on economic growth in Bangladesh, India, Pakistan and Sri Lanka. Further, the study revealed that moderate inflation is useful to increase economic growth, but high economic growth is caused to increase inflation.

Datta and Mukhopadhyay (2011) have reported that there is short-run causality between inflation and economic growth in Malaysia. The study also suggested that in long-run economic growth Granger causes inflation. Jayathileke and Rathnayake (2013) observed a long-run negative and significant association of inflation with economic growth in Sri Lanka. The study did not find a statistically significant relationship between these variables in India and China. Kasidi and Nwakanemela (2013) empirically proved that inflation has a negative and statistically significant influence on economic growth in Tanzania. The study showed that there is no integration between inflation and economic growth during the period of study. Barro (2013) also implies that an increase in mean inflation by 10% per year is a caused to decrease growth rate of real per capita GDP by 0.2-0.3% year and it also decrease ratio of investment to GDP by 0.4-06%. The empirical findings of the study was based on 100 cross economies with different income groups.

3. Recent Position of Economic Development in India andComparator Economies

GDP size, GDP growth, GDP per capita, GDP per person employed, gross capital formation (% of GDP),manufacturing value added (% of GDP), industry value added (% of GDP),industry value added per worker, foreign direct investment net inflows (% of GDP),foreign direct investment net outflows(% of GDP), andinflation consumer prices (annual %) are the significant factors which affects the progress of social and economic development of a country (Adejumo and Adejumo, 2014; Yang et al., 2014; Singh et al., 2017a,b). These factors also useful to sustain the economic development of an economy. Therefore, the brief description of these factors for India and other selected economies are presented here:

GDP Size: Recent trend in GDP size for India, China, Indonesia, South Korea, Malaysia, Thailand and Turkey is given in Figure – 1. It infers that India has the second largest GDP size in these economies, while China has a largest GDP size.

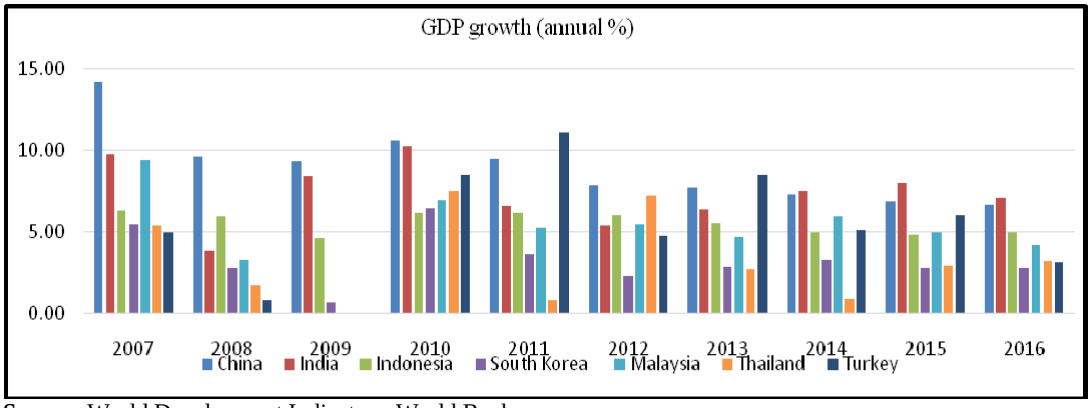


Source: World Development Indicators, World Bank.

Figure 1: GDP size in India and comparator countries

GDP Growth: India has achieved excellent economic growth of 8 to 9% on a sustainable basis during 2009-2016. It has achieved 7.2% annual growth in gross domestic product (GDP) in 2014. It is significantly higher than comparator

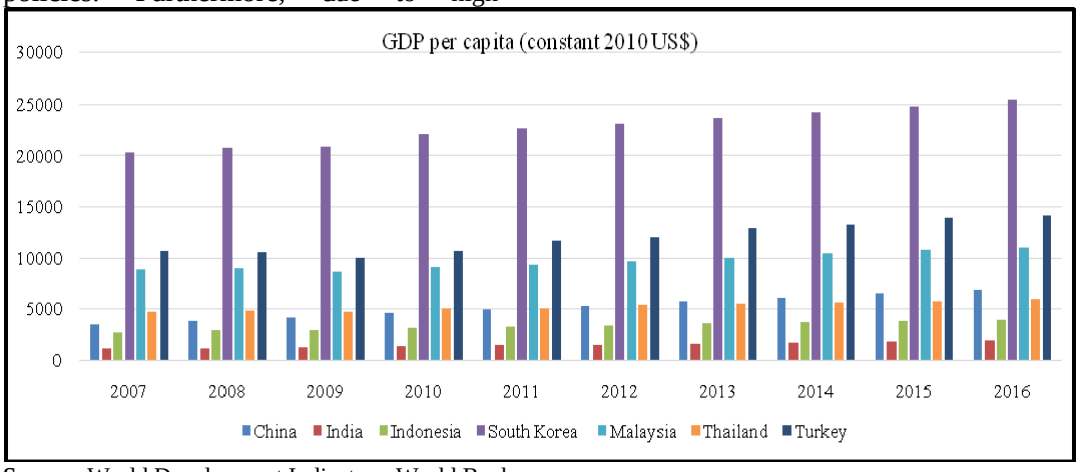
countries like China, Indonesia, South Korea, Malaysia, Thailand and Turkey. Figure – 2demonstrates the information on annual growth in GDP for India and other economies. It infers that annual GDP growth was 7.27% in China, 5.02% in Indonesia, 3.31% in South Korea, 5.99% in Malaysia and 0.87% in Thailand in 2014. It also implies that annual GDP growth is varied during 2008-2014 in these economies. However, it was relatively more stable in China, Indonesia and India than South Korea, Malaysia and Thailand.



Source: World Development Indicators, World Bank.

Figure 2: GDP growth in India and comparator countries

GDP per Capita: Trend in per capita GDP for Indian and comparator economies is given in Figure -3. It infers that India has a lowest per capita GDP as compared to South Korea, China, Indonesia, Malaysia, Thailand and Turkey. It indicates that India needs to improve per capita GDP through implementing appropriate policies. Furthermore, due to high manufacturing growth, China has raised its per capita GDP in last decade. In China, per capita GDP has increase from 3441.22 in 2008 to 7590.22 US$ in 2014. It implies that China is attained better annual growth in per capita GDP during 2008-2014. Hence, India has lower per capita GDP than other small economies like Indonesia, Malaysia and Thailand.

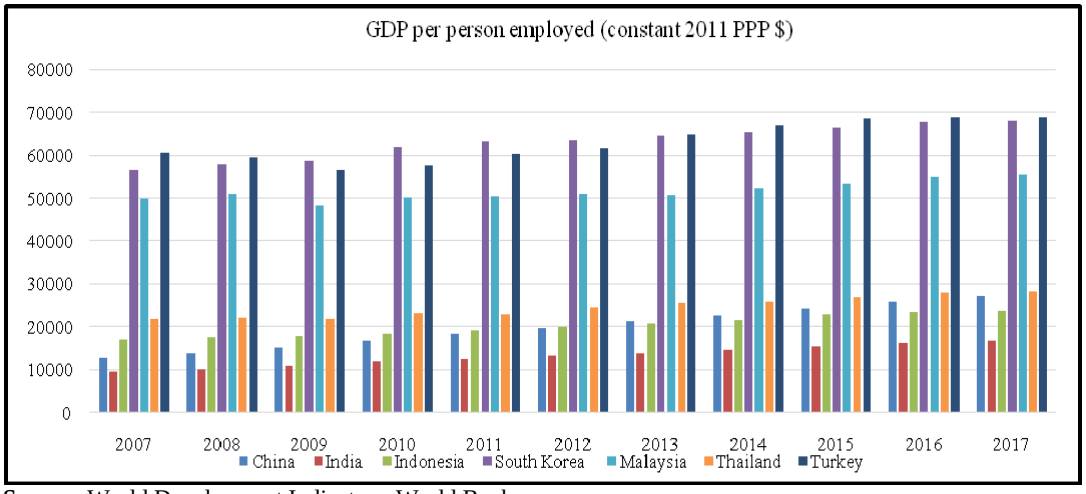


Source: World Development Indicators, World Bank.

Figure 3: GDP per capita in India and comparator countries

GDP per person employed (constant 2011 PPP $): Recent trend in GDP per person employed for undertaken economies are given in Figure – 4. It shows that Turkey

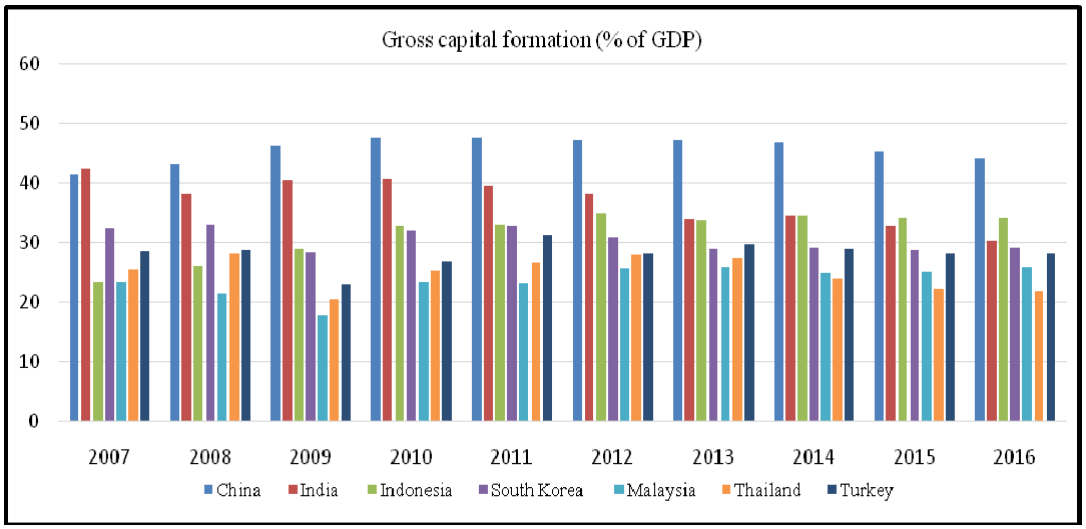
has a higher GDP per person employed as compared to South Korea, Malaysia, Thailand, China, Indonesia and India. While, India has a lowest contribution in GDP per person employed. Thus, India is essential to increase GDP per person employed.



Source: World Development Indicators, World Bank.

Figure 4: GDP per person employedin India and comparator countries

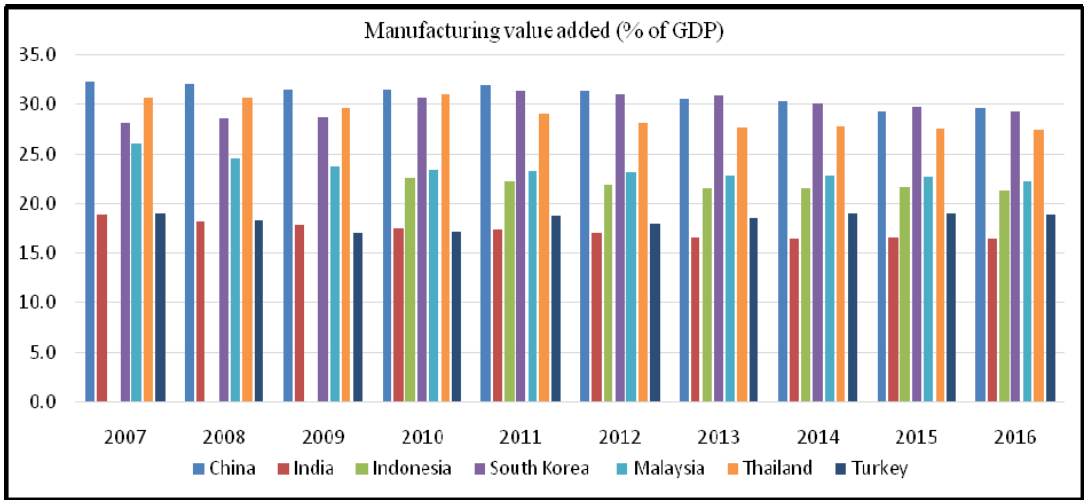
Gross capital formation (% of GDP): Capital formation is an important to increase the economic development in an economy. The trend in capital formation as a % of GDP is given in Figure – 5. It provides an evidence that China has higher position in capital formation, while India has a 3rdposition in capital formation among the six undertaken economies.



Source: World Development Indicators, World Bank.

Figure 5: Gross capital formation (% of GDP)in India and comparator countries

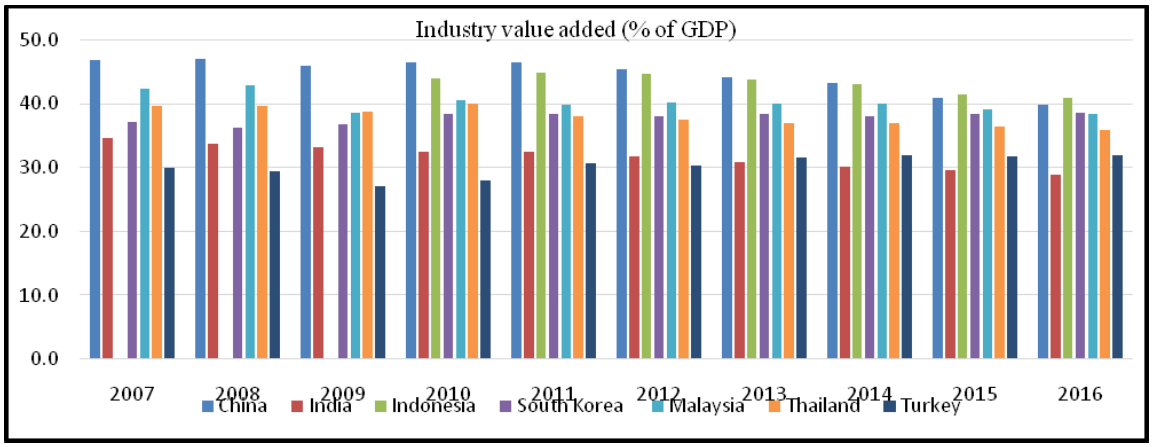
Manufacturing Value Added (% of GDP): In India's GDP, share of manufacturing sector has hovered around 15 to 17% during 2008-2014 **(**Bhat, 2014). As per World Development Indicators (WDI), it was extensively high in China, Indonesia, South Korea, Malaysia and Thailand in 2014. In 2014, manufacturing sector added 17.05% share in gross GDP of India. While, it counts 35.86% in China, 21.02% in Indonesia, 30.29% in South Korea, 22.09% in Malaysia and 27.72% in Thailand in the given year. Figure – 6, presents the share of manufacturing sector in GDP for India and other economies during 2007-2016. It implies that share of manufacturing sector in GDP has slightly declined after 2010 in comparator economies (except India).



Source: World Development Indicators, World Bank.

Figure 6: Manufacturing value addedin India and comparator countries

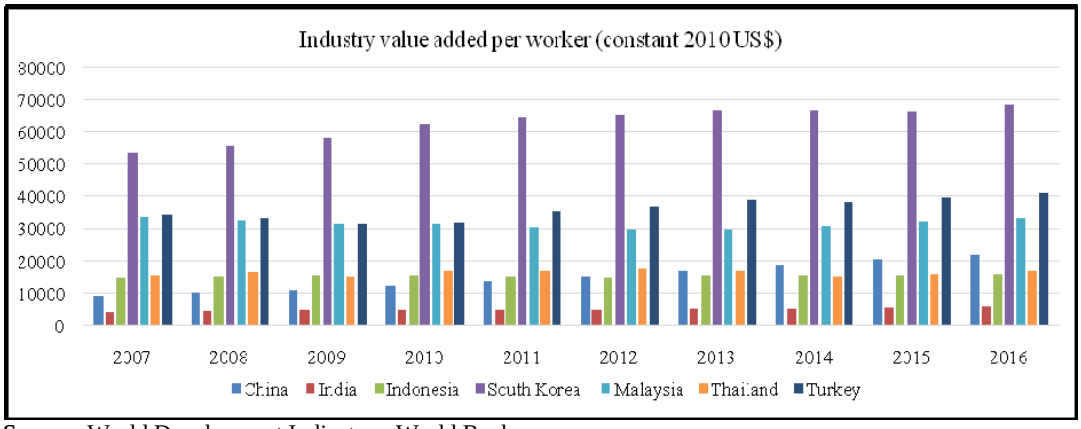
Industry Value Added (% of GDP): The contribution of industrial sector in GDP of undertaken economies in given in Figure – 7. Figure infers that India has a lower share of Industrial sector in its GDP, while Indonesia and China has a greater share of industry value added in their GDP.



Source: World Development Indicators, World Bank.

Figure 7: Industry value added (% of GDP)in India and comparator countries

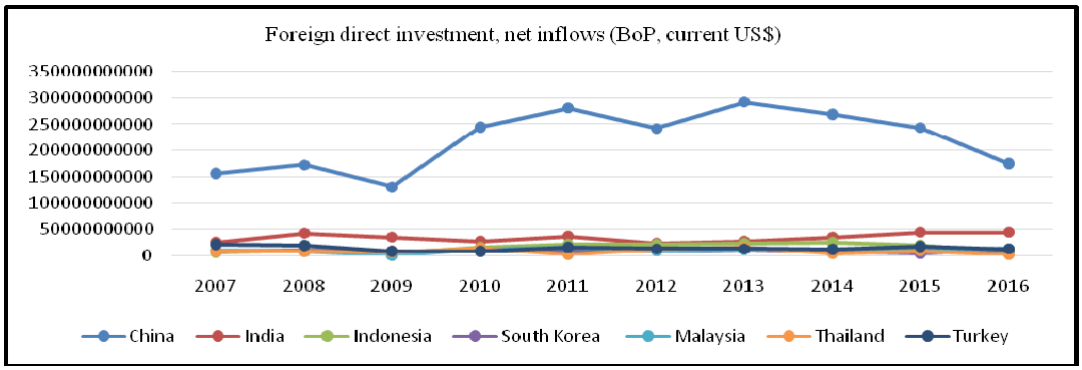
Industry Value Added per Worker: Recent trend in industry value added per worker for undertaken economies is given in Figure – 8. It is seen that India has lower contribution of per worker in industrial value added as compared to South Korea, Turkey, Malaysia, China, Thailand, Indonesia and India.



Source: World Development Indicators, World Bank.

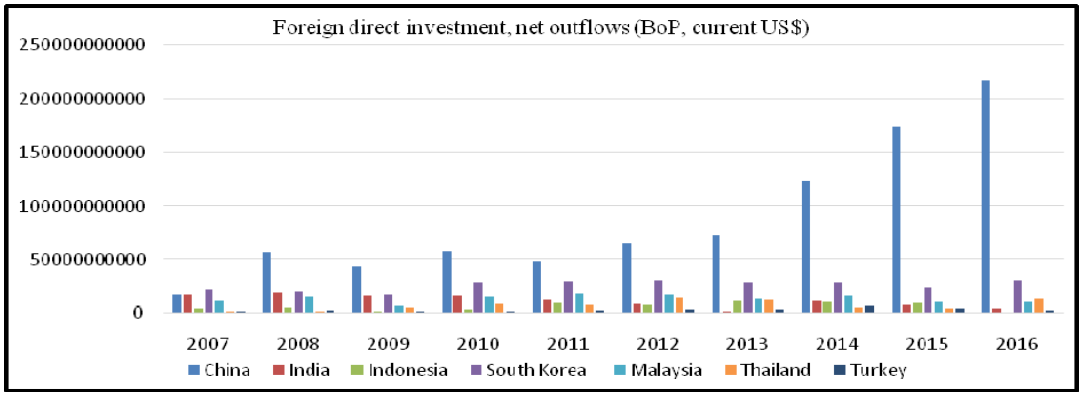
Figure 8: Industry value added per workerin India and comparator countries

Foreign Direct Investment (FDI): Foreign direct investment (FDI) plays a crucial role to maintain international production networks of a country (Hoda and Rai, 2014). FDI inflows tend to have a larger effect on bilateral imports than exports. India has lower participation in international production networks as compared to other Asian economies like China, Thailand, and South Korea (Hoda and Rai, 2014). Thus, there is a principally very limited stock of FDI in manufacturing sector in India (Hoda and Rai, 2014). While, China, Malaysia and Thailand are major players which have impressive growth in manufacturing through encouraging regional and global production networks in the last two decades (Hoda and Rai, 2014; Wei and Balasubramanyam, 2015). Appropriate FDI policies of these economies are useful to increase their international network at world-wide. Also, China have introduced more comprehensive policies to attractexport-orientated FDI policies. Thus, China is attracted a record highest level of FDI since 1990 (World Development Indicators, World Bank, 2015. The trend in FDI net inflows (BoP, current US$) and FDI net outflows for undertaken economies are given Figure – 9 and Figure – 10 respectively.



Source: World Development Indicators, World Bank.

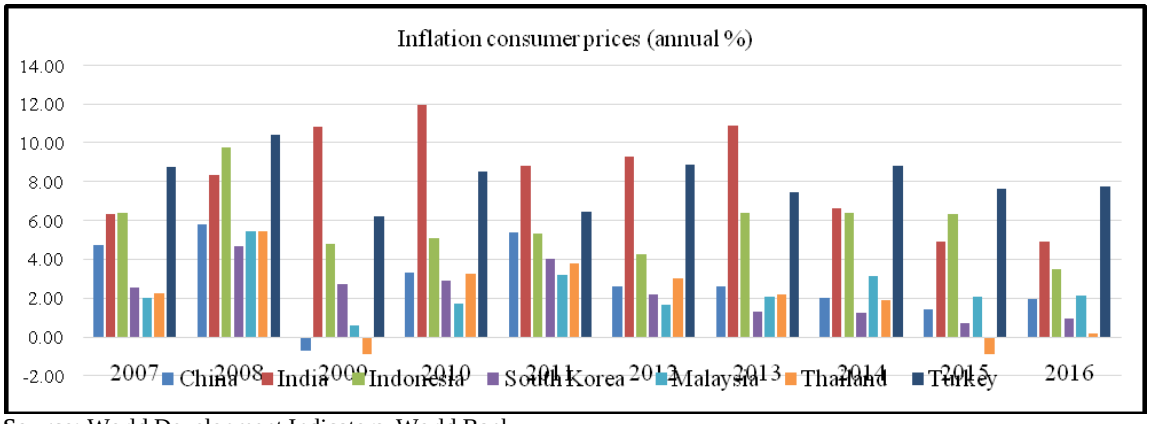
Figure 9: Foreign direct investment net inflows (BoP, current US$) in India and comparator



Source: World Development Indicators, World Bank.

Figure 10: Foreign direct investment net outflows in India and comparator economies

Inflation Consumer Prices (Annual %): The central objective of policy makers and monetary experts of an economy is to achieve high economic growth.It is also a main intention of macroeconomic policy maker is to sustain high economic growth with low inflation (Datta and Mukhopadhyay, 2011; Kasidi and Nwakanemela, 2013).However, the relationship between inflation and economic growth is one of the most important controversy among the researchers, economists, policymakers and monetary authorities in the last few decades (Datta and Mukhopadhyay, 2011; Kasidi and Nwakanemela, 2013; Jayathileke and Rathnayake, 2013). Hence, it can be argued that high inflation have created several problems in most economies, especially for India and Indonesia (Mallik and Chowdhury, 2001; Mukhopadhyay, 2011; Jayathileke and Rathnayake, 2013; Wei and Balasubramanyam, 2015). China, South Korea, Malaysia and Thailand consistently regulate the pace of inflation in last decade. Figure – 11, presents the latest information on consumer price inflation for these countries. As India, Indonesia and Turkey have high inflation during 2008-2016, thus it implies that both the economies could not consider a conductive action and effective policy to control high inflation.



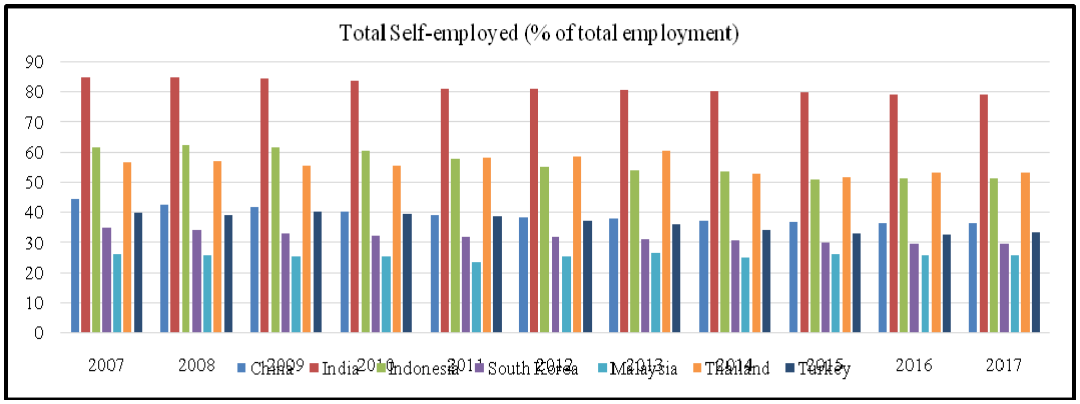
Source: World Development Indicators, World Bank.

Figure 11: Inflation consumer price (annual %)in India and comparator countries

4. Business Activities in India and Comparator Economies

To measure the appropriate business environment is a very controversial issue in an economy. However, researcher can identify the business ecosystem of an economy through other proxy variables such as total self-employed person (Fritsch and Wyrwich, 2017), economic freedom score, start-up procedures to register a business, market capitalization of listed domestic companies (% of GDP), individuals using the internet (% of population), bank nonperforming loans to total gross loans, and automated teller machines (ATMs) (per 100,000 adults) which are essential to increase the business ecosystem in an economy.

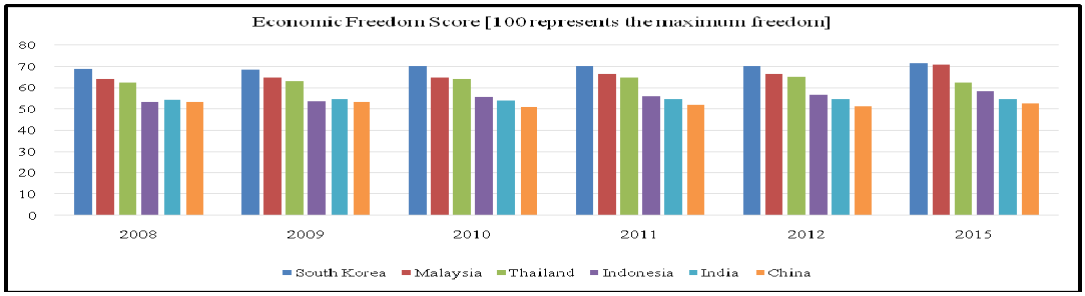
Total self-employed (% of total employment): The trend in self employed as a % of total employment s presented in Figure – 12. It infers that India has a largest self-employed person among the undertaken economies. India has a second largest population size in the world, thus it is obvious that India has a largest self-employed person in Asian economies. Thailand and Indonesia, more than 50% population are self-employed.



Source: World Development Indicators, World Bank.

Figure 12: Total self-employed (% of total employment)in India and comparator countries

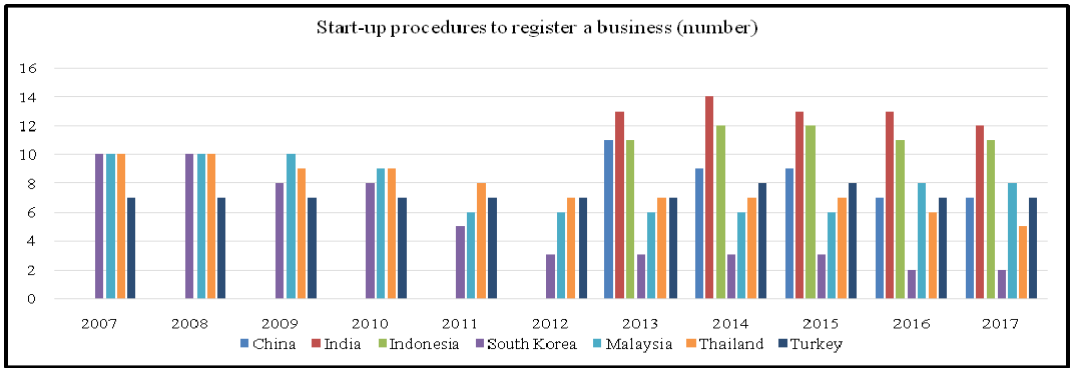
Economic Freedom Score:Economic freedom is a crucial determinant to assess the business environment of an economy. The economic freedom score for undertaken economies is given Figure – 13. It is observed that India is in relatively poor position to maintain the economic freedom as compared to South Korea, Malaysia, Thailand and Indonesia.



Source: World Development Indicators, World Bank.

Figure 13: Economic freedom scorein India and comparator countries

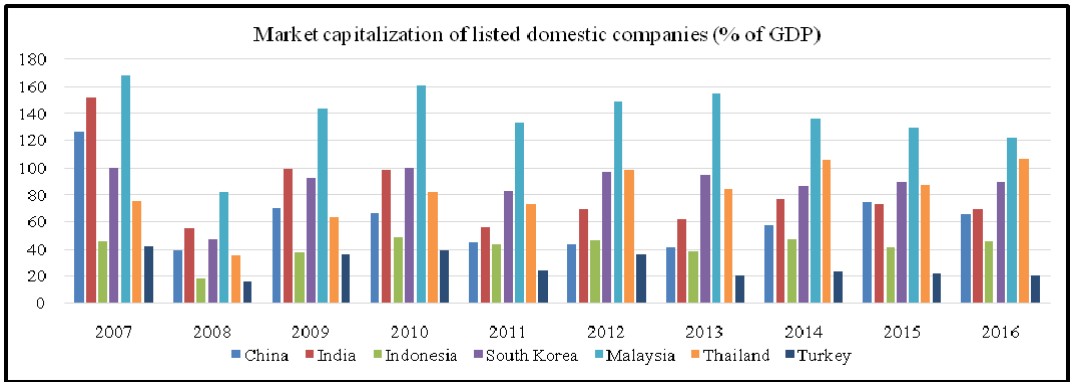
Start-up Procedures to Register a Business: India has better position in start-up procedures to register a business as compared to other economies. The start-up procedures for India and comparators economies is given in Figure – 14.



Source: World Development Indicators, World Bank.

Figure 14: Start-up procedures to register a businessin India and comparator countries

Market Capitalization of Listed Domestic Companies (% of GDP): Market capitalization of domestic companies can be considered as an important indicator for business in an economy. The trend in this indicators for undertaken economies is given in Figure - 15. It shows that Malaysia and Thailand are found better economies in which more domestic companies are in market capitalization. India has a 4th position in market capitalization.



Source: World Development Indicators, World Bank.

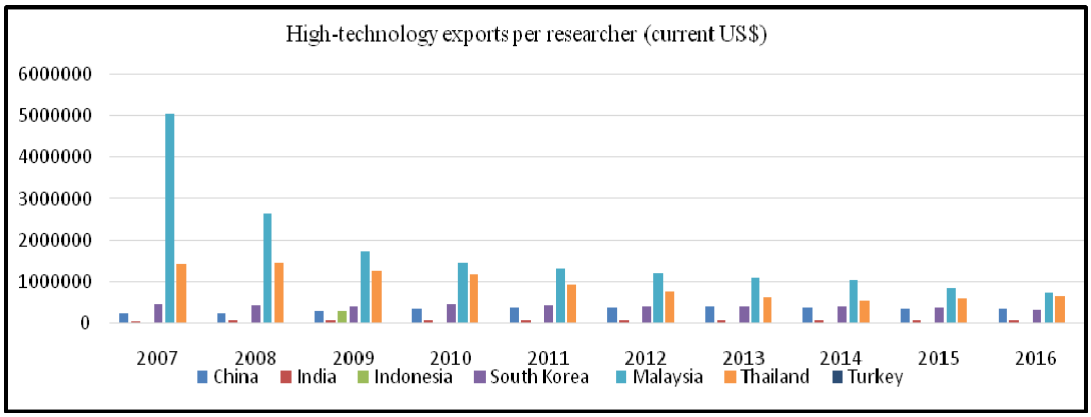
Figure 15: Market capitalization of domestic companies in India and comparator countries

Individuals using the Internet (% of population): Internet facility is work as prime driver for social media. Social media play a significant role to maintain the association between costumer and producers. Hence, the trend in individual using internet as a % of population for undertaken economies is presented in Figure – 16. It demonstrates that South Korea has a better positon in individuals using the internet as compared to Malaysia, Turkey, China, Thailand, India and Indonesia. In India, only 30% population are using internet services, thus India needs to give more attention to increase the use of internet by its dwellers.

exports per researcher for India and comparator economies is given in Figure – 24 and Figure – 25 respectively.

Source: World Development Indicators, World Bank.

Figure 24: High-technology exports (% of manufactured exports) in India and comparator countries



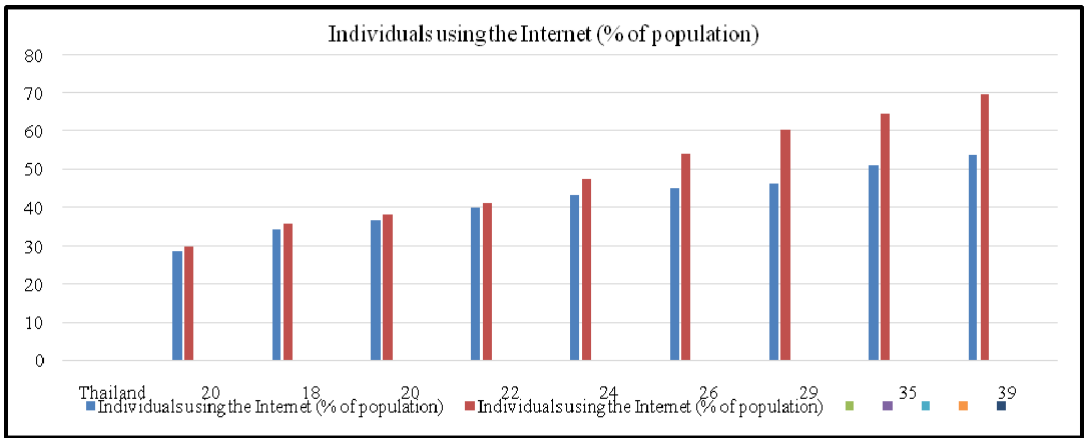
Source: World Development Indicators, World Bank.

Figure 25: High-technology exports per researcher (current US$)

6. Progress of IPRs in India and Comparator Economies

The strength of an economy in intellectual property rights can be estimated through several indicators such as patent applications files, industrial design registered, trademark registered, scientific and technical journal articles published, charges for use of intellectual property receipts, and charges for use of intellectual property payments (Singh et al., 2017a,b). This section provide the progress of IPRs in India and comparator economies.

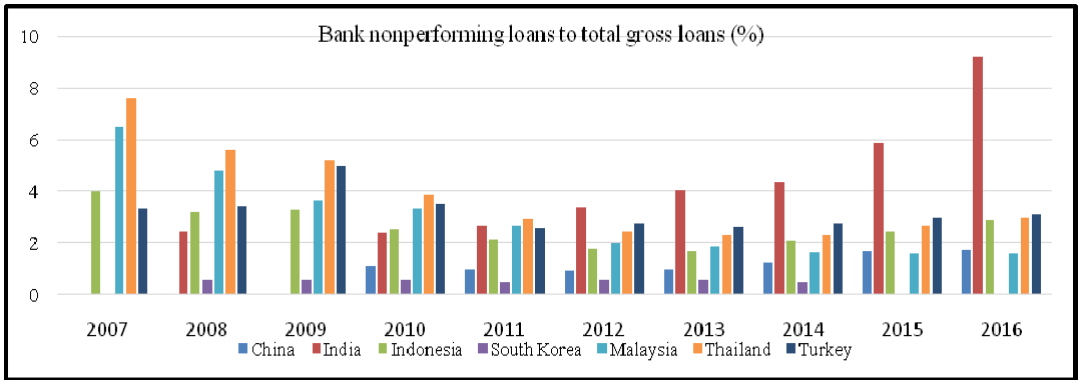
Patent Application Files per 1000 Researcher: Patent is crucial indicator to assess the innovative capability of a county and it is major component of IPRs (Singh et al., 2017a,b). China has a largest contribution in patents application files as compared to other economies, while, India has a 3rdposition in patent applications filings in 2016. The contribution of researcher in IPRs is measured in term of patent applications files per 1,000 in undertaken economies. The trend in number of patent applications files per 1,000 researcher for India and other economies is given in Figure – 26.



Source: World Development Indicators, World Bank.

Figure 16: Individuals using the Internet (% of population) in India and comparator countries

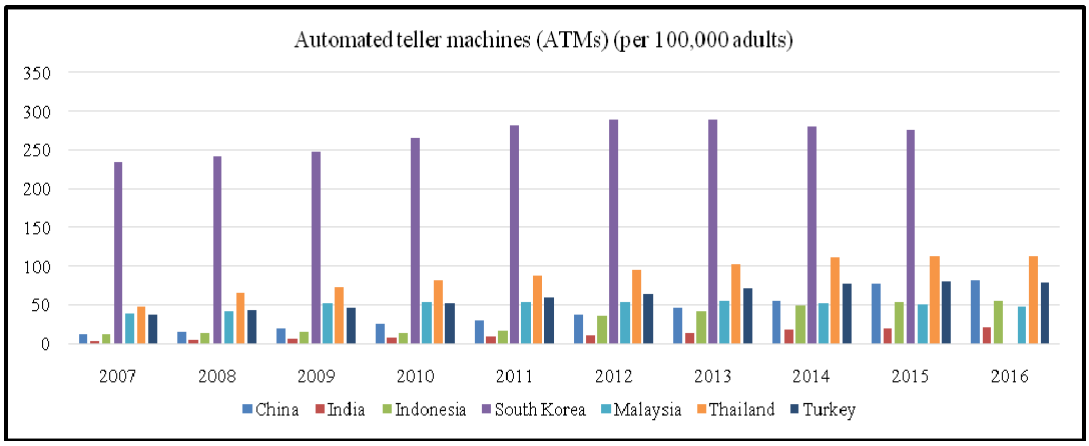
Bank Non-performing Loans to Total Gross Loans (%):Financial organization provides the loan to the business community, hence financial organization have a greater contribution in business creation. However, non-performing asset (NPA)is caused to increase the financial burden to banks, thereby they will not be in a position to provide more loan to business community. Subsequently, business activities may be negatively affected due to rise in NPA. The trend in bank non-performing loans to total gross loan for undertaken economies in given in Figure – 17. It shows that India has larger NPA as compared to other Asian countries, while Malaysia has a lower NPA.



Source: World Development Indicators, World Bank.

Figure 17: Bank nonperforming loans to gross loans(%) in India and comparator countries

Automated Teller Machines (ATMs) (per 100,000 adults): The trend in ATM per 100,000 adults is presented in Figure – 18. It infers that India has lowest ATMs per 100,000 adults as compared to other undertaken Asian economies.



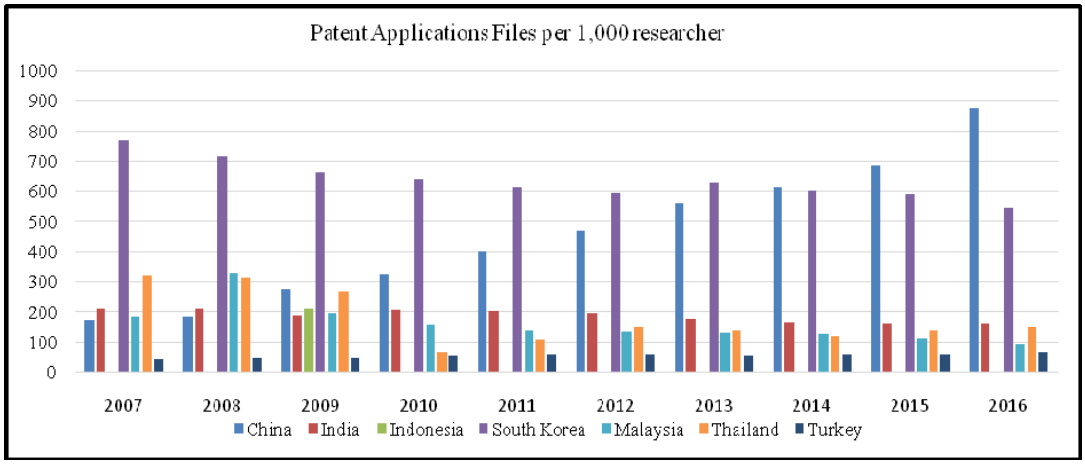
Source: World Development Indicators, World Bank.

Figure 18: ATMs (per 100,000 adults)in India and comparator countries

5. Science & Technological Progress in India and Comparator Economies

Science & technological progress of an economy can be observed through several indicators such as researchers in R&D, R&D expenditure (% of GDP) (Sattar and Mahmood, 2011; Yang et al., 2014), R&D expenditure per researcher, ICT goods exports (% of total goods exports), ICT goods imports (% total goods imports), merchandise trade (% of GDP), and high-technology exports (% of manufactured exports) (Singh et al., 2017a,b). Therefore, the current section provide India's strength in science & technology with comparison to other Asian Economies.

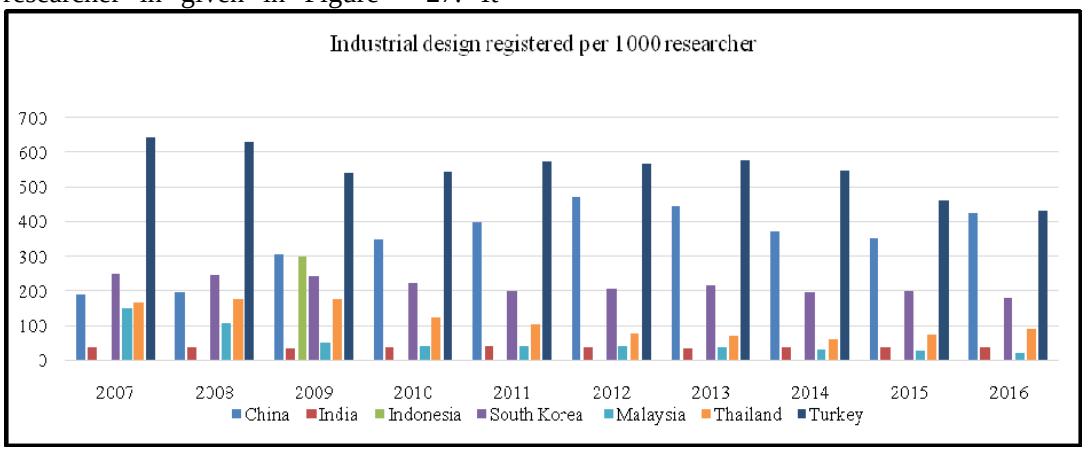
Number of Researchers in R&D (per million people), R&D Spending, and R&D Expenditure per Researcher (Current US$): China's public spending on R&D is increased by two fold in last decades (World Development Indicator, World Bank, 2015). China has increased their spending in R&D from 1.46% in 2008 to 2.01 in 2013 (Figure – 20). Thus, the number of researchers per million has also increased in China, thus R&D spending significantly reflects the number of researchers in China. Similar to China, South Korea also has increased their R&D investment in science & technology during last decade. So, number of researchers per million people has increased 4867 in 2008 to 6457 researcher in 2013. In contrary, India, Indonesia, Malaysia and Thailandcould not increase their R&D spending on science & technology (Figure – 19). Although number of researchers per million population has increased in Malaysia during 2008-2013. R&D expenditure per researcher (Current US$) for India and comparator economies is also given in Figure – 21. It shows that South Korea is doing more expenditure per researcher as compared to China, Turkey, India, Malaysia, and Thailand. Therefore, India needs to increase more R&D expenditure per researcher, thus it would be useful for India to maintain its position in science & technology.



Source: World Development Indicators, World Bank.

Figure26: Patent applications files per 1,000 researcherin India and comparator countries

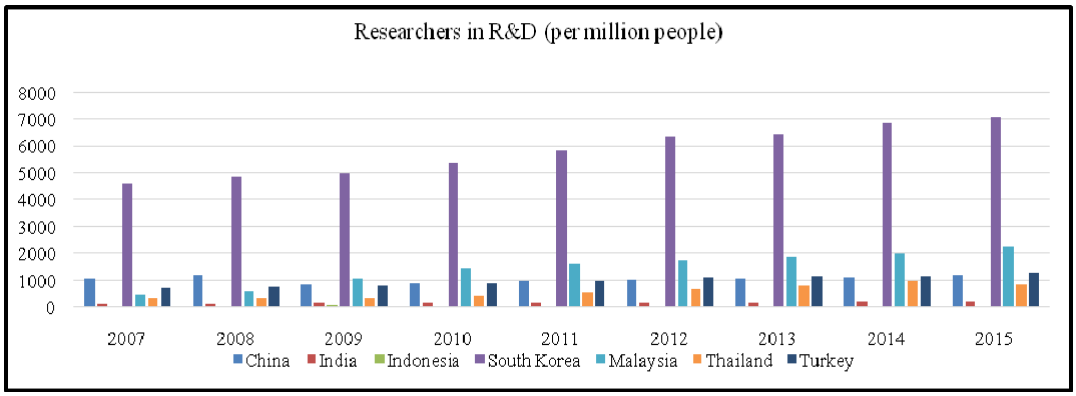
Industrial Design Registered per 1,000 Researcher: Industrial design is another component of IPRs, which may be useful to identify the progress of an economy in IPRs. In order to assess the strength of undertaken economies in IPRs, industrial design applications files per 1,000 researcher in given in Figure - 27. It demonstrates that Turkey has better position in creation of industrial design, while China have a 2nd position in creation of industrial design in 2016. India is a relatively poor position in creation of industrial design in 2016.



Source: World Development Indicators, World Bank.

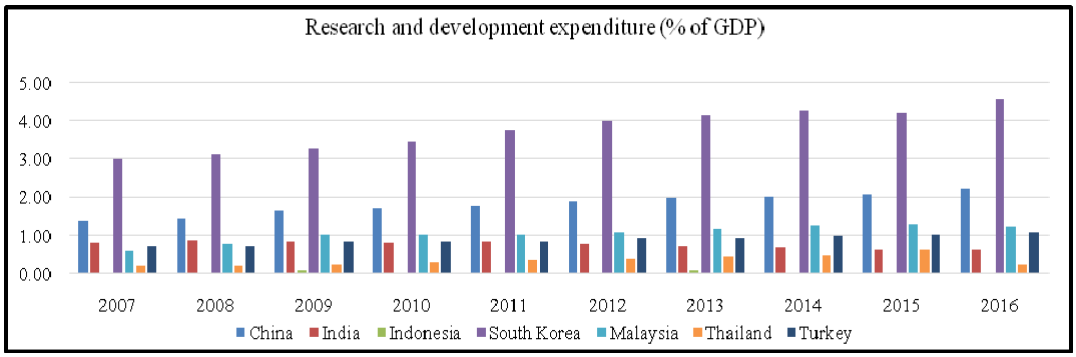
Figure 27: Industrial design registered per 1,000 researcherin India and comparator countries

Trademark Registered per 1,000 Researcher: Trademark is also a component of IPRs (Singh et al., 2017a,b), hence the recent trend in trademark applications files per 1,000 researcher in India and comparator economies in given in Figure - 28. It shows that China and India have 1st and 2nd position respectively in trademark applications filings in 2016. While, other economies like South Korea, Malaysia, Thailand and Turkey have a lower position in trademark applications filings as compared to India and China.



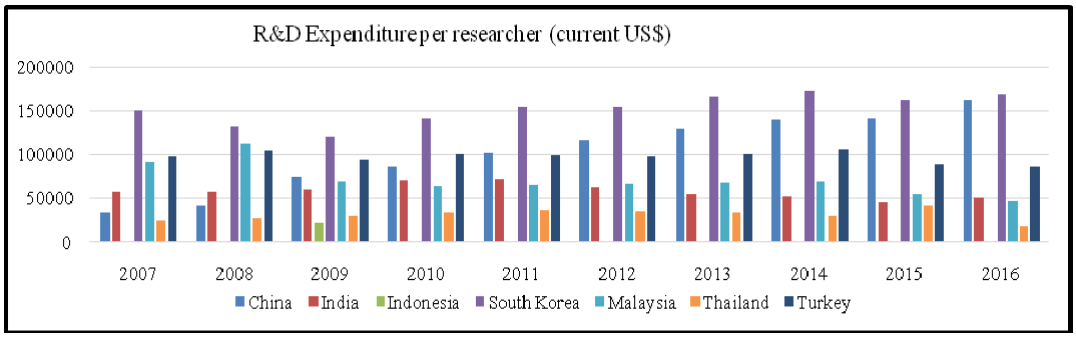
Source: World Development Indicators, World Bank.

Figure 19: Researchers in R&D (per million people) in India and comparator countries



Source: World Development Indicators, World Bank.

Figure 20: R&D expenditure (% of GDP)in India and comparator countries

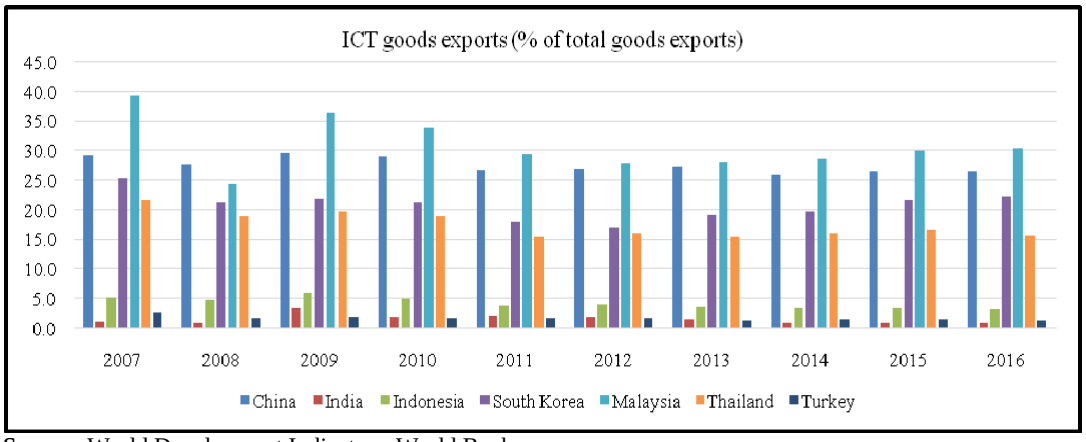


Source: World Development Indicators, World Bank.

Figure 21: R&D expenditure/researcher (current US$)in India and comparator countries

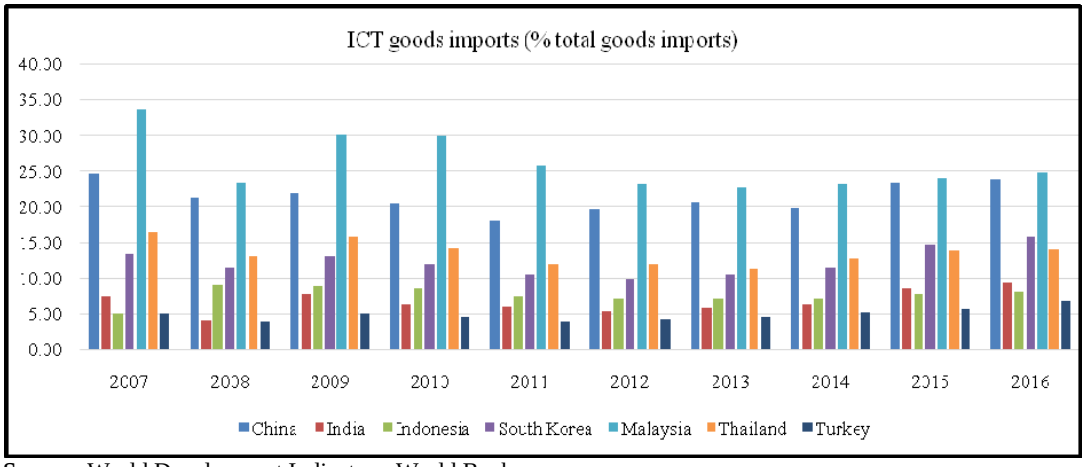
ICT Goods Exports and Imports (% of Total Goods Exports and Imports): Information and communications technology(ICT) of goods includes computer, communication equipment, electronics equipment, instruments for communication technology. Thus, ICT goods exports and imports is a good indicators to observe the strength of an economy in science & technology. The ICT goods exports as % of total exports and ICT imports as a % of total goods imports for undertaken economies is given in Figure – 22 and Figure – 23. Figure – 22, indicate that Malaysia is found in better position in exports of ICT goods, while India has only 1% contribution of ICT goods exports in total exports of

goods in 2016. Turkey have lower dependency on imports of ICT goods as compared to other undertaken economies. India have a 3rd position in imports of ICT goods among the undertaken 7 economies in 2016.



Source: World Development Indicators, World Bank.

Figure 22:ICT goods exports (% of total goods exports)in India and comparator countries

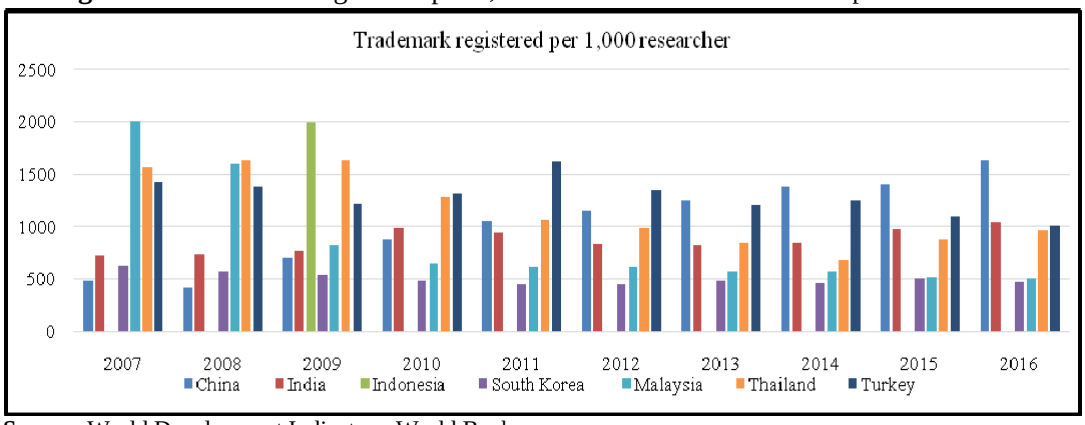


Source: World Development Indicators, World Bank.

Figure 23: ICT goods imports (% total goods imports)in India and comparator countries

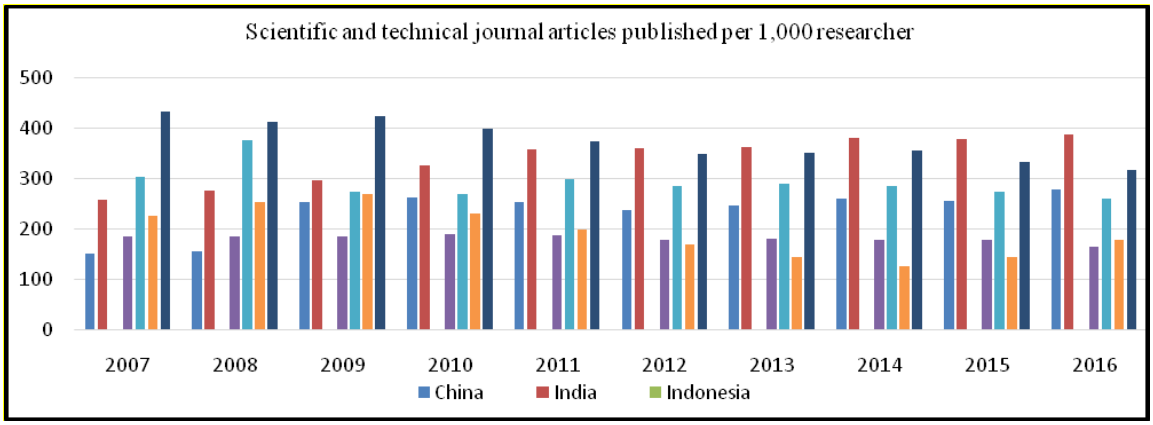
High-technology Exports (% of Manufactured Exports): High-technology exports are products which created through high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. Share of high-technology export in manufactured export has increased in China, South Korea and Malaysia after 2011. Thus, these economies are witnessed increasing technological upgrading during 2011-2013. India's progress in exporting high-technology products is less pronounced (Wignaraja, 2013). While, Indonesia and Thailand show a decreasing trends in high-technology export in manufactured exports during similar time period. In 2013, Malaysia was the bigger exporter of high-technology among these economies, which counts 43.6% share of high-technology export in total manufactures exports. The trend in high-technology exports as a % of manufactured exports and high-technology

Figure28: Trademark registered per 1,000 researcherin India and comparator countries



Source: World Development Indicators, World Bank.

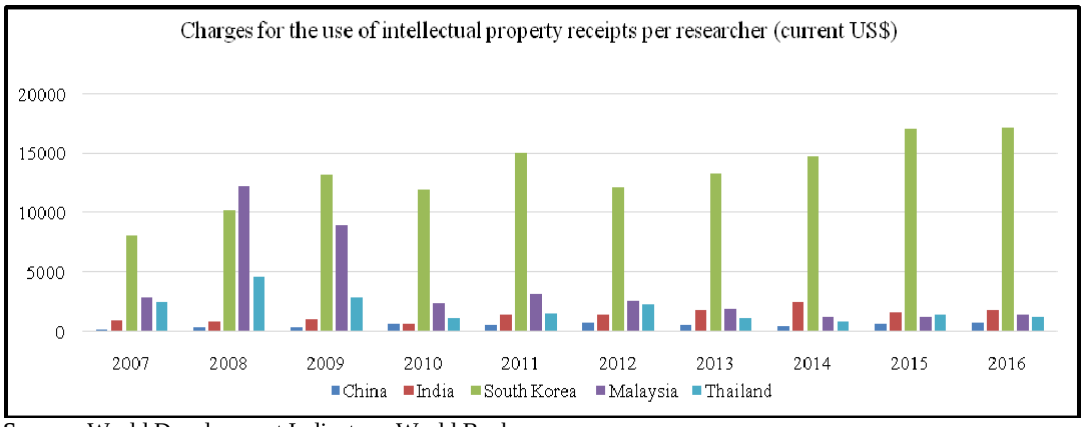
Scientific and technical journal articles published per 1,000 researchers: Scientific and technical journal is a crucial driver to disseminate the knowledge across scientific research community. It is also a component of IPRs and it provides a platform for researcher to do more research for creation of knowledge which convertas an innovation in an economy. Therefore, the scientific and technical journal articles published per 1,000 researchers is given in Figure - 29. It shows that Indian researchers have a greater contribution in scientific and technical journal articles as compared to Turkey, China, Malaysia, Thailand and South Korea in 2016.



Source: World Development Indicators, World Bank.

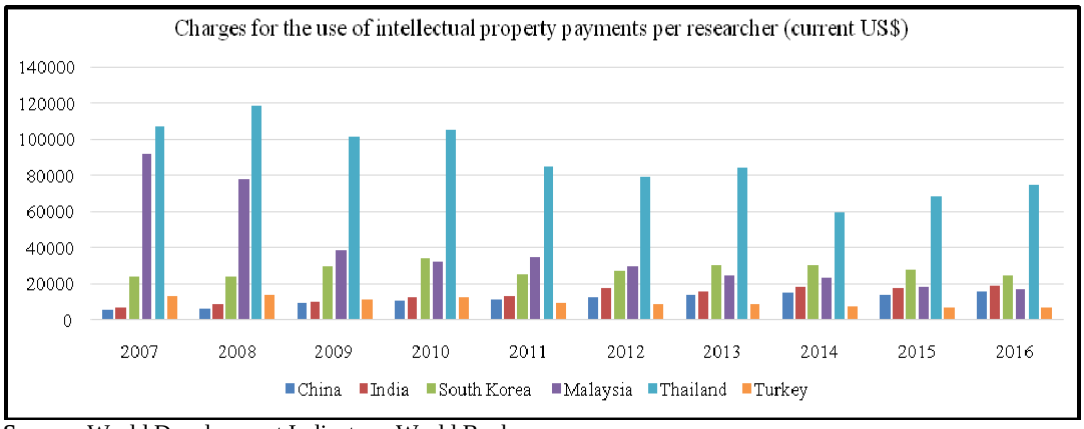
Figure 29: Scientific and technical journal articles published per 1,000 researcherin India and comparator countries

Charges for use of IP Receipts and Payments per Researcher (current US$): Charges for use of IP receipts and payments per researcher for undertaken economies are given in Figure – 30and Figure 31 respectively. It infer that India has a 2nd position in charges for use of IP receipts among the undertaken 7 economies, while India has 3rd position in charges for use of IP payments per researcher. It also suggested that India needs to increase more spending on charges for use of IP payments to protect the IP of individual researcher.



Source: World Development Indicators, World Bank.

Figure30: Charges for use of IP receipts per researcherin India and comparator countries



Source: World Development Indicators, World Bank.

Figure31: Charges for use of IP payments per researcherin India and comparator countries

7. Conclusion and Policy Implications

The main aim of this study is to assess the influence of intellectual property rights (IPRs) and science & technology (S&T) on economic development in India and selected Asian economies based on existing studies. Thereupon, it make India's comparison in economic, IPRs and science and technology related activities in selected Asian economies using available data. Finally, it provides the practical policy suggestions to increase the contribution of IPRs and S&T in economic development in India and Asian economies. It reported that IPRs is significant driver to boost the technological development and advancement in developing economies. In the present study, numbers of patent is considered as an innovation and technological development. Existing studies have also provided an evidence that innovation is useful to increase the attention of policy makers to implement a strong IPRs regime (Ezzeddine and Hammami, 2018). Hence, it can be concluded that IPRs and technological development have causal relationship with each other. IPRs and technological development also have a positive impact on economic development, subsequently economic development is useful to enhance the social development in developing economies.

India has a second largest GDP size with positive GDP growth in Asian economies, despite that it has lower per capita GDP, GDP per person, low contribution of manufacturing sector in its GDP, and low industry value added as compared to China and South Korea. Hence, India needs to improve their position in above mentioned factors to increase economic development. India has higher inflation which also adversely affect the domestic economy.

It is found that India has a largest number of self-employed population in Asian economies. In India,only 30% population is using internet, thus India could not create an appropriate ecosystem for IT sector. Thus, there is a requirement to create a better and conducive ecosystem for IT sector to boost business environment in India. Rising bank-performing loans to gross loans is analso major problem in India, which is hampering business environment in India. Hence, India needs to control non-performing asset to sustain business ecosystem in long-term. Furthermore, India have lower number of Automated Teller Machines (ATMs) per 100,000 adults as compared to South Korea, Thailand, China, Turkey, Indonesia and Malaysia. Thus, it is suggested for India to improve the strength of financial organization through effective policy.

India has lower number of researchers in R&D on per million people than South Korea, Malaysia, Turkey, China and Thailand. India also have lower spending on R&D as % of its GDP as compared to South Korea, China, Malaysia and Turkey. Further, India also have relatively lower position in R&D spending on per researcher as compared to South Korea, China, and Turkey. Due to above reasons, India have low contribution in ICT good exports, merchandise trade, high-technology exports as percentage of manufactured exports, and high-technology exports per researcher in global market as compared to other Asian economies. Subsequently, India have a poor position, while China and South Korea have a better position in science & technology. Thus, it recommended that India desires to improve its position in above-mentioned activities to get significant benefits from science & technology in near future.

Furthermore, India have lower position in patent applications filings per 1,000 researchers and industrial design application files per 1,000 researchersthan China and South Korea. It implies that India needs to increase the participation of existing researchersand scientists towards IPRs. South Korea and China are biggest competitive economy for India among the Asian Economies. If India wish to be a globally economy, then it needs to consider following suggestions:

1. To control high Inflation and real interest rates.
2. Appropriate bank credit facilities to business organizations with low interest rate and also control NPA in banking sector.
3. To increase extensive public spending in R&D in emerging sector of science & technology.
4. Need to increase researchers and scientists in emerging sector of science & technology, which would create more innovation.
5. To control migration of researchers and scientist in developed economies.
6. To adopt strong intellectual property rights regime to protect the IP of individual researcher and scientists.
7. India needs to increase its participation in international trade network.
8. Needs to increase domestic demand of goods and services in market and reduce dependency on imports of goods and services.
9. To increase the attention of peoples towards business activities, which would increase the jobs opportunities

for skilled and unskilled labour, subsequently it will improve the economic capacity of peoples.

10. Introduction of new industrial training and research organizations in India.

11. Creation of high-technology goods and services are require through high spending in R&D in high-tech firms.

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