Peer Reviewed Referred
and UGC Listed Journal
(Journal No. 40776)

ISSN 2277 - 5730

AN INTERNATIONAL MULTIDISCIPLINARY
QUARTERLY RESEARCH JOURNAL

AJANTA

Volume-VIII, Issue-I
January - March - 2019
Part - I

IMPACT FACTOR / INDEXING
2018 - 5.5
www.sjifactor.com

Ajanta Prakashan

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Ajanta Prakashan
Aurangabad. (M.S.)

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14. An Introspection of Industrial Revolution 4.0 with Historical Aspect and Understanding the Development Achieved for Welcoming the IR4.0

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Abstract:

At verge of industrial revolution 4.0, this paper attempts to understand the impact of technological changes on humans by comparing the timeline of the Indian historical movements along the timeline of the global inventions. Comparative analysis has conducted to understand the preparations made by the Indian economy to welcome the industrial revolution 4.0.Every revolution always has impact on the humanity; life style. Success of the industrial revolution is dependent on the new inventions and their complementary researches. It takes a considerable time to adopt the new inventions and accept new gadgets in the daily life. It is observed that it is essential that we welcome the industrial revolution 4.0 with the expectation that required changes in education, attitude and aptitude of the masswill take place in the journey toward the third world

Keywords- Industrial revolution, social engineering, inventions, time-line, non-human factor

Revolution means accepting the new ways for completing the routine activity or heading towards the new activity by eliminating the old inefficient ways. This paper talks about the overview of industrial revolutions and impact of the industrial revolution on the "Indian economy".

Every revolution always has impact on the humanity; life style.Success of the industrial revolution is dependent on the new inventions and their complementary researches. It takes a considerable time to adopt the new inventions and accept new gadgets in the daily life. Maturity period given reduces the resistance to change. As we are welcoming the industrial revolution 4.0, it is very necessary to understand the time line and history of industrial revolutions also

comparing the same with the timeline of Indian timeline. Comparison of timeline includes economic as well as historic timeline.

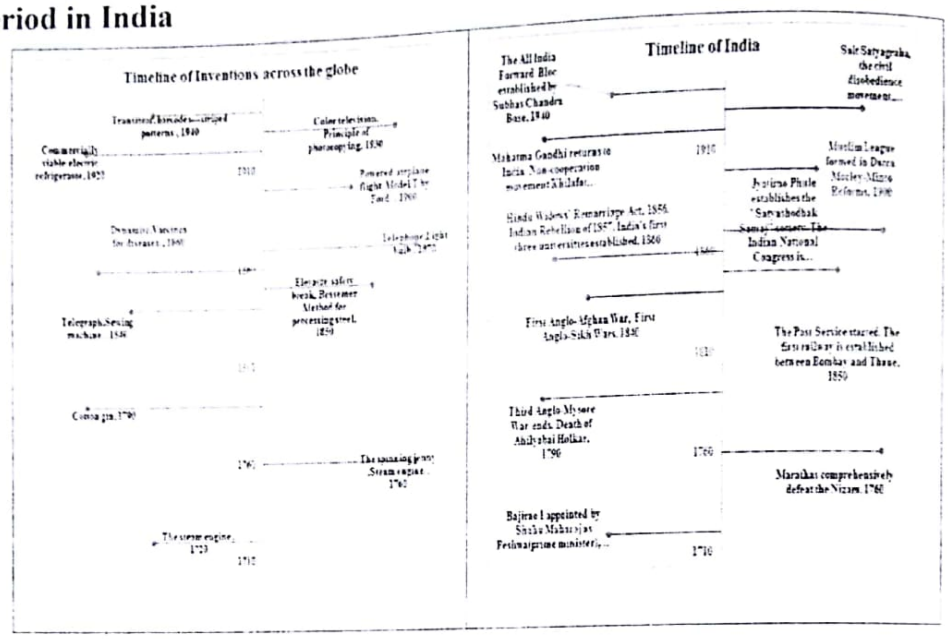
In first industrial revolutionin Britain first came in to bring machines into creation of products before the finish of the eighteenth century (1760-1840). This included going from manual creation to the utilization of steam-controlled motors and water as a wellspring of intensity.This helped farming enormously and the expression "industrial facility" turned into somewhat well known. One of the businesses that profited a great deal from such changes is the textile business, and was the first to embrace such strategies. It likewise comprised a tremendous piece of the British economy at the time.

The second industrial revolution dates somewhere in the range of 1870 and 1914 and presented prior frameworks, for example, telegraph and railways into enterprises. This era characterized large scale manufacturing as an essential way to creation.The electrification of processing plants contributed massively to production rates. The large scale manufacturing of steel helped making railroadscontributing to mass production. Developments in science, for example, the innovation of the color, though science was in a somewhat crude state at that point.

The Third Industrial Revolutionis substantially more recognizable to us than the rest as the vast majority living today knows about enterprises inclining toward computerized advances underway. Nonetheless, the third mechanical insurgency is dated somewhere in the range of 1950 and 1970. Others consider it the Information Age as well. The third upheaval was, and still is, an immediate consequence of the tremendous improvement in PCs and data and correspondence innovation.

The fourth industrial revolution takes the mechanization of assembling procedures to another dimension by presenting altered and adaptable large scale manufacturing advances.This implies machines will work freely, or collaborate with humans in making a client oriented field that always chips away at looking after itself. The machine turns into independent entity that can gather information, break down it, and act upon it. This happens by introducing self-advancement, self-insight, and self-customization into the business. It will be easy to interact with computers instead of operating it.

Figure-1: Comparative timeline of inventions around the globe and social engineering period in India



If time line of various inventions is scrutinized, one may find that very few inventions are done by Indians scientists like CV Raman, Visvesvaraya, Jagdish Chandra Bose, SrinivasaRamanujan etc. Indian timeline is flooded with the political and social movements when rest of the world was on the ride of scientific invention and revolutions. The importance of disciplined education was introduced with the establishment of three prominent universities in the 1860s. After independence, Indians started taking leap with world and were forced to accept the radical technological changes at the faster rate without getting the maturity period for accepting the technological changes as compared to the world as it was busy in accepting the fundamental changes in religion, education,mindset, etc. Maturity period plays a crucial role in declining the period of resistance to change.

As India is ready to welcome the industrial revolution 4.0, it calls for an evaluationof the necessity and importance of the industrial revolution 4.0 on the basis of the indicators such as literacy, GDP, population employment rate etc. A comparative analysis of all such indicator between India and Europe,USA has been done and the conclusions were presented in the paper. Indicators to identify the necessity and importance of the IR 4.0 are

1. Growth rate in population of working class
2. Literacy level
3. Composition of employment providing sectors
4. High-technology exports (% of manufactured exports)

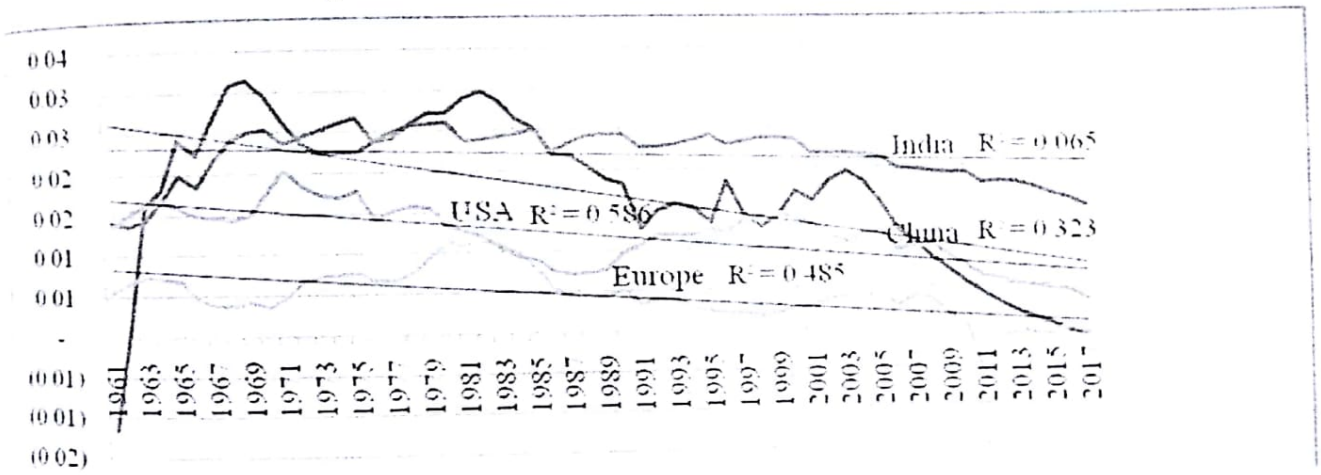
5. Number of Patents Applied & Scientific and technical journal articles
6. Research and development expenditure (% of GDP) & Researchers in R&D (per million people)

Each indicator were studied separately

1. Growth rate in population of working class

Population of the economy is composed of the children, senior citizens, adults. Adults can be further segregated as working (employed) and non-working class (unemployed). This indicator explains the growth rate observed in the number of employed people over the period of time.

Figure-2: Growth rate in Population ages 15-64



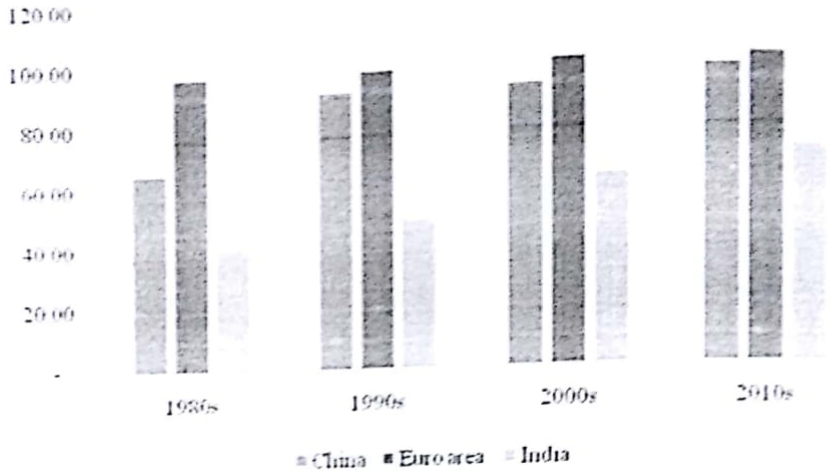
***Data Source: World Bank Dataset**

It is observed that growth rate of population of working class has reached the negative level for most of region except India. IR 4.0 i.e. Artificial Intelligence (AI) will be fruitful for the countries where labors are not available. AI should be implemented in India after considering the growth in working class population.

2. Literacy level

Literacy level is barometer to measure the economy's growth in terms of social and cultural growth. This indicator is calculated as the percentage of people who are educated against (from) the total population.

Figure-3: Literacy rate, adult total (% of people ages 15 and above)



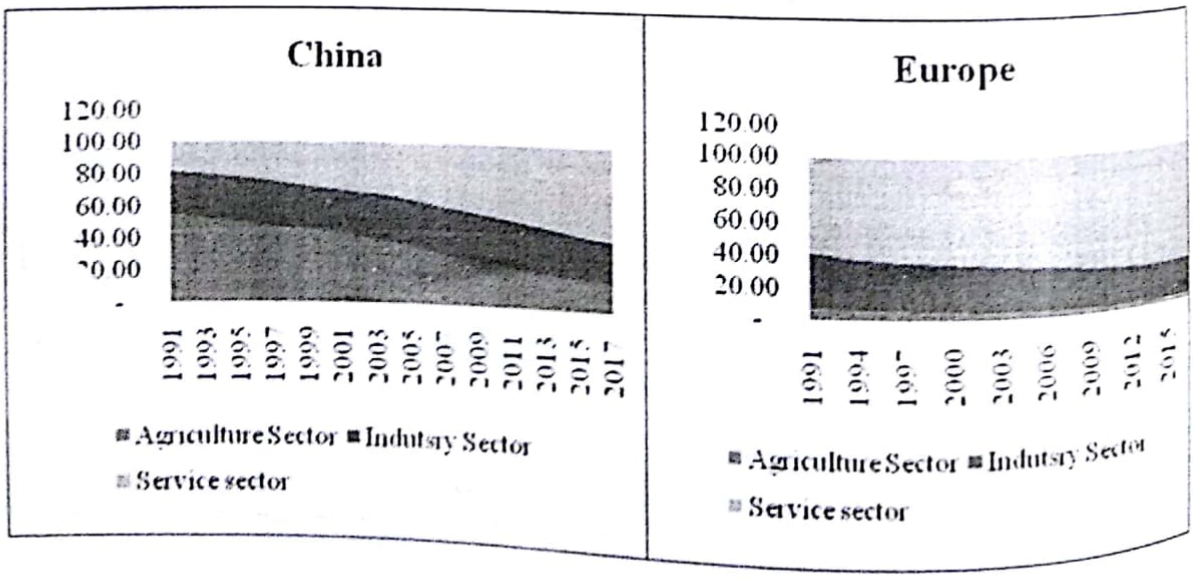
***Data Source: World Bank Dataset**

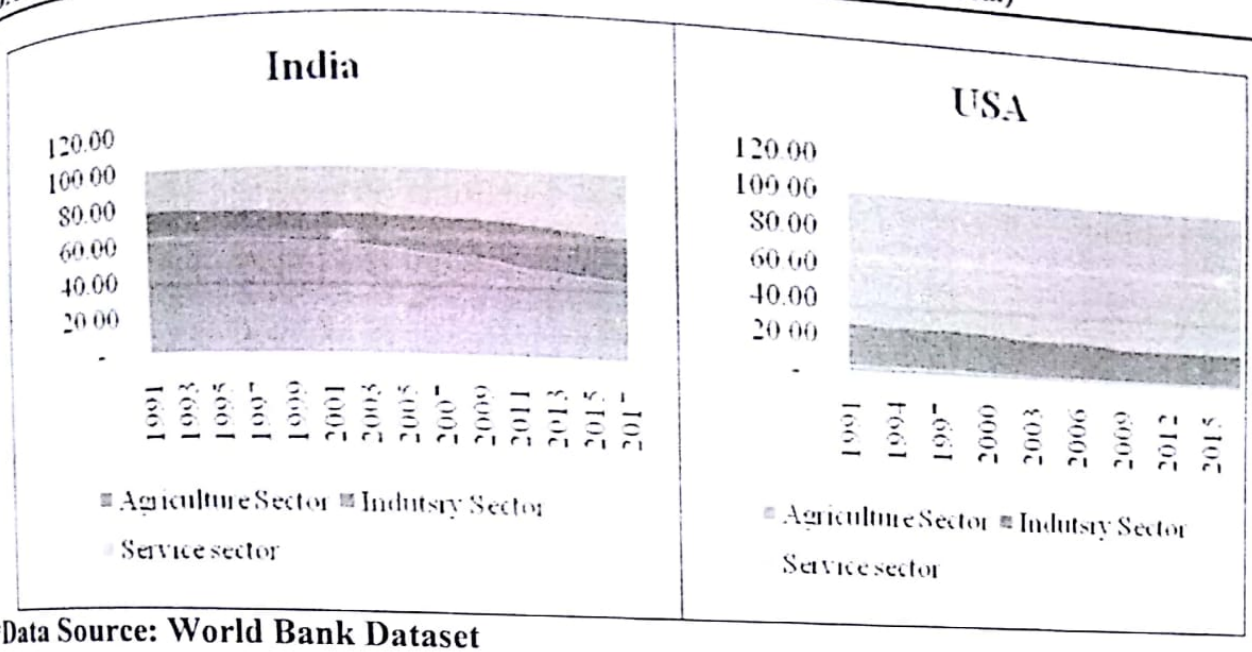
It is observed that literacy level among the working class is very highin case of China as compared to Europe zone and India. In the decade 2010, literacy level of India is still below 70%. Implementation and application of IR4.0 will be successful only when the well-educated and highly skilled workforce is available to operate the mechanism of AI. India has to increase its literacy level to fit the upcoming change in technology.

3. Composition of employment providing sectors

Agriculture, industry and tertiary (service) are the three sectors of the economy which generates the employment for the economy. Percentage of employment generated in each sector percentage to total employmentfor every year has been calculated.

Figure-4: Composition of employment





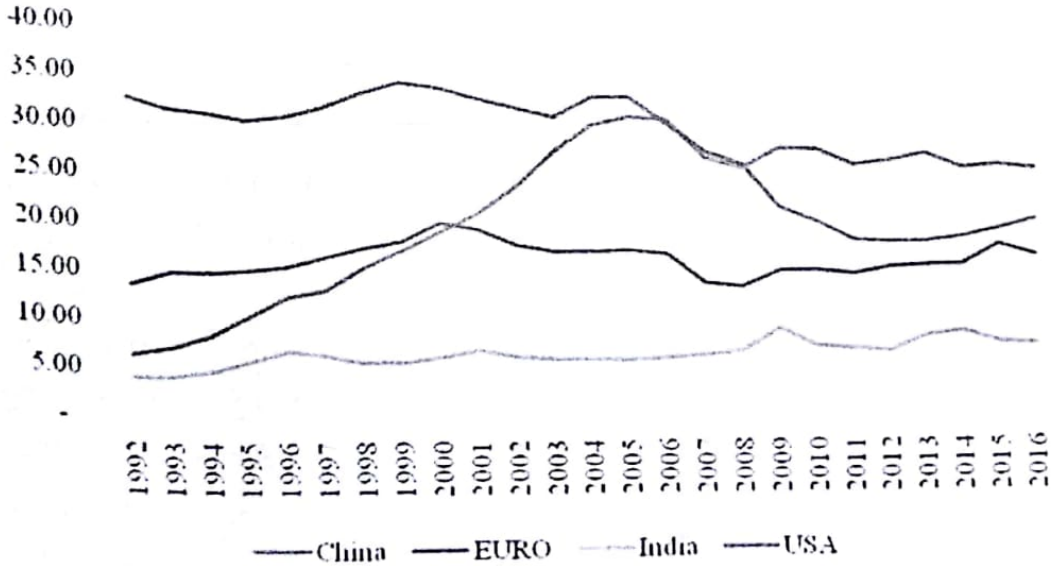
*Data Source: World Bank Dataset

It is observed from the graph that major population of China and India is dependent on the agriculture for employment. China is showing the declining trend in case of dependency on the primary sector, while for India is still high. It is essential to understandthe affect of IR 4.0 on 42 percent Indian population dependent on the primary sector.

4. High-technology exports (% of manufactured exports)

In the era of IR4, country having high exports comprising high technology and allied services will be next economical leader of the globe. Current indicator helps to understand the percentage of technology export to the total manufacturing exports.

Figure-5: High-technology exports (% of manufactured exports)



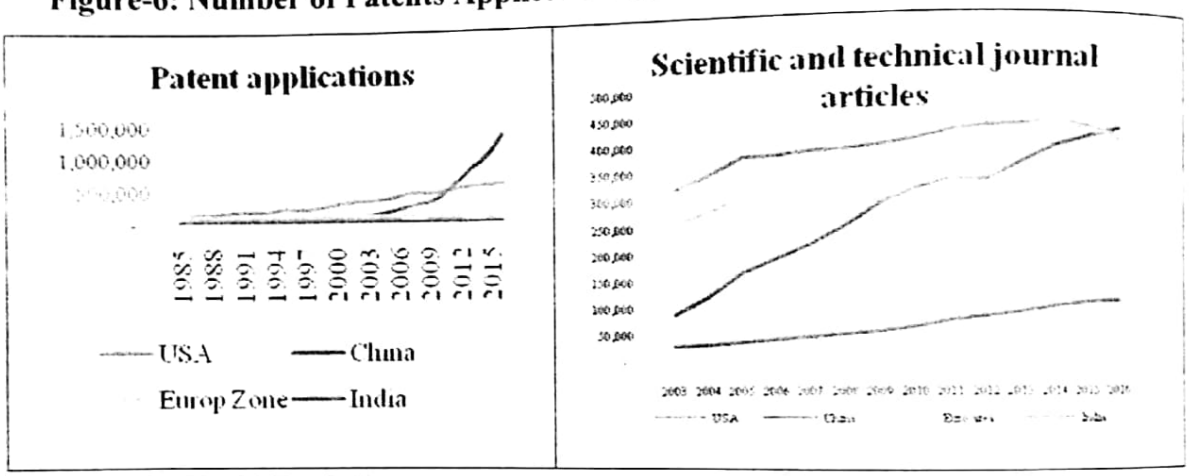
*Data Source: World Bank Dataset

It is obvious that introduction of AI will give new opportunity to export the technical knowhow which will boost the earnings of the country. The previous trend for technological export is seen in the graph above. It is observed that China, Europe and USA are dominant exporters of the same. It will be fruitful, if we look at the number of patents applied by the above mentioned regions to forecast about the dominance.

4. Number of Patents Applied& Scientific and technical journal articles

This factor gives the impression about status of research and thought process of the current generation regarding the developments required in the field of science and technology.

Figure-6: Number of Patents Applied& Scientific and technical journal articles



***Data Source: World Bank Dataset**

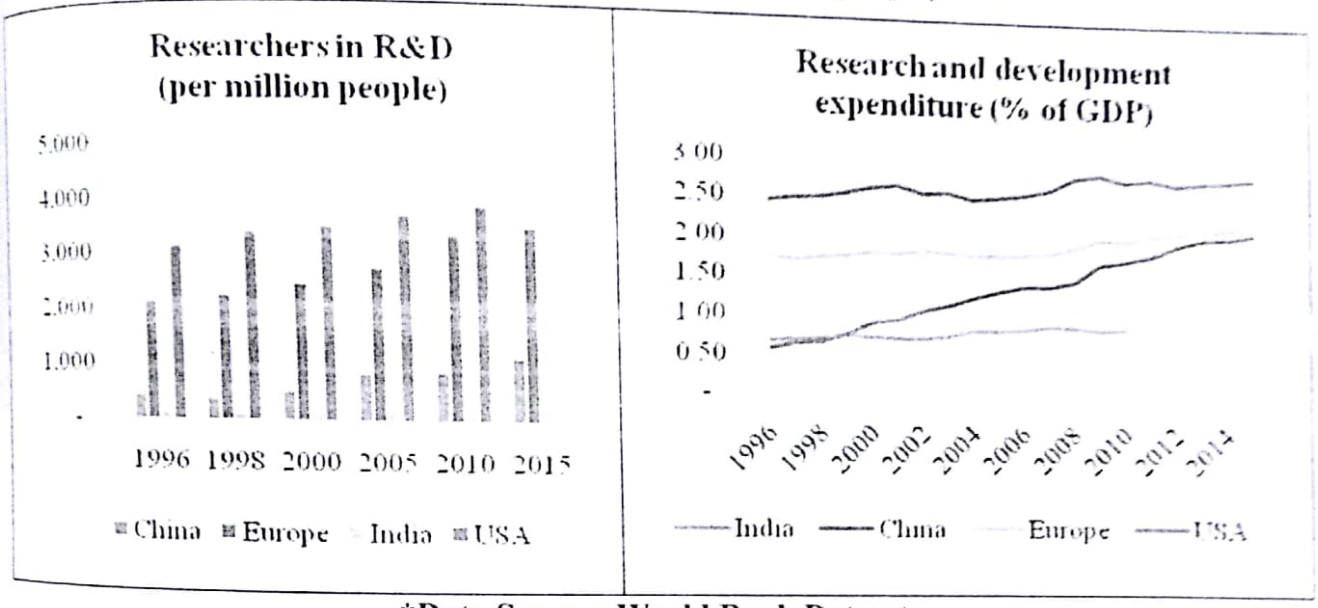
It is observed that growth in the number of patent application has been seen after 2001 especially in case of China and USA. In 2016, only 13,199 patents application received from India as compared to around 6 Lacs in USA and 13 Lacs in China. Patents can be proved as golden earning arm for the country, where again it is proved that USA and China will have tremendous opportunity to export in near future once patents are commercialized.

Scientific and technical journals show the actual contributionby respective country in the field of science and technology. It is observed that there is gradual rise in case of India because the youngsters have started contributing in the field of research, which may lead to the glorious picture for India in the upcoming decade.

5. Research and development expenditure (% of GDP) & Researchers in R&D (per million people)

Every country has to infuse funds to be in the race of survival. This indicator is the ratio of expenses incurred to gross domestic product of economy. The other graphs compare the number of researcher for every million population.

Figure-7: Research and development expenditure (% of GDP) & Researchers in R&D (per million people)



***Data Source: World Bank Dataset**

Research and development expenditure (% of GDP)

It is observed that mostly all the countries are spending around 1 to 3% of the GDP on the research activity. Here, we have to focus on the timeline of the Industrial revolution. First three revolutions were flourished due to continuous contributions from the scientists of the Europe and America. These regionshave well established infrastructure dedicated to the research and development. In case of China, acceptance of the industrial revolution has stated only after the social reforms and movements, both India and China require more funds and number of researcher for assuring growth.

Researchers in R&D (per million people)

It is seenthat, to match the speed of revolutionary world China has already tightened the shoes. We can see the huge growth in the number of researchers in case of China as compared to the Europe and India.

It is the need of hour for India to prepare ourselves for upcoming revolution. India has already gearing up by eliminating shortfalls and putting efforts at what it is best at. Indian citizens also should understand that the "Government of India" is not "Harry" with the magical tools for changing the scenario in fraction of seconds. From the above comparative analysis, it is understood that India has to work meticulously to be along with the world.

Now let's understand the actual ground work done by the India with the help of Indicator not considered above.Authors have selected the following indicators to understand the India's outreach in various sectors.

- Business extent of disclosure index (0=less disclosure to 10=more disclosure)
- New businesses registered (number)
- Time required to start a business (days)
- Age dependency ratio (% of working-age population)
- Secure Internet servers and Secure Internet servers (per 1 million people)
- Bank nonperforming loans to total gross loans (%)

Disclosure index measures the extent to which investors are protected through disclosure of ownership and financial information. The index ranges from 0 to 10, with higher values indicating more disclosure.

Table 1: Disclosure index

Year	Business extent of disclosure index (0=less disclosure to 10=more disclosure)	New businesses registered (number)	Time required to start a business (days)
2010	-	86,645	-
2011	-	97,405	-
2012	-	103,078	-
2013	6	91,841	33
2014	7	69,841	35
2015	7	80,546	30
2016	7	93,714	29
2017	8	-	30

***Data Source: World Bank Dataset**

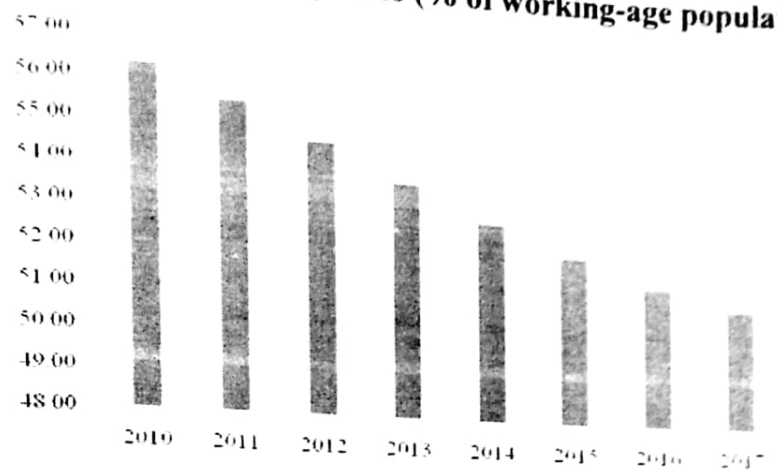
- For arresting the fraudulent financial behavior, government has already introduced the disclosure policy which can be easily seen in the disclosure index
- Rate of starting the new business has been increased since 2010

- Time requirement to start business is declining over the period.

Age dependency ratio

It is the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64.

Figure-8: Age dependency ratio (% of working-age population)

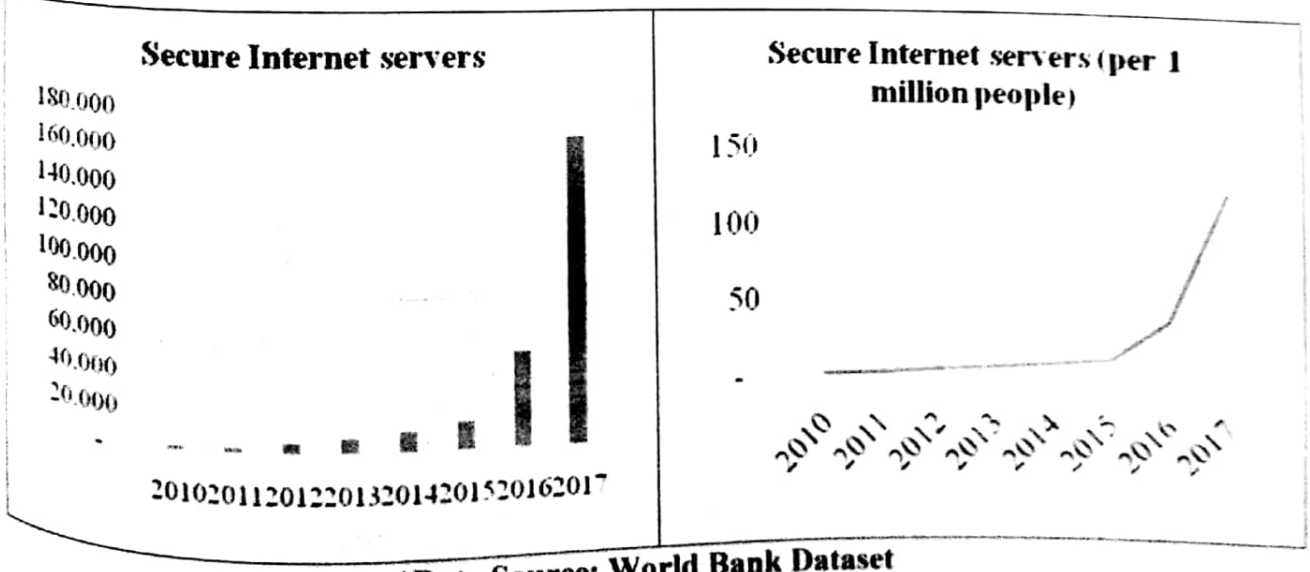


***Data Source: World Bank Dataset**

Age dependency ratio is the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population. It is observed that this ratio is showing the declining trend which is good for India. It also indicates wealthy senior citizens on one hand and slow growth rate of population for age group below 15.

- **Secure Internet servers**

Figure-9: Secure Internet servers



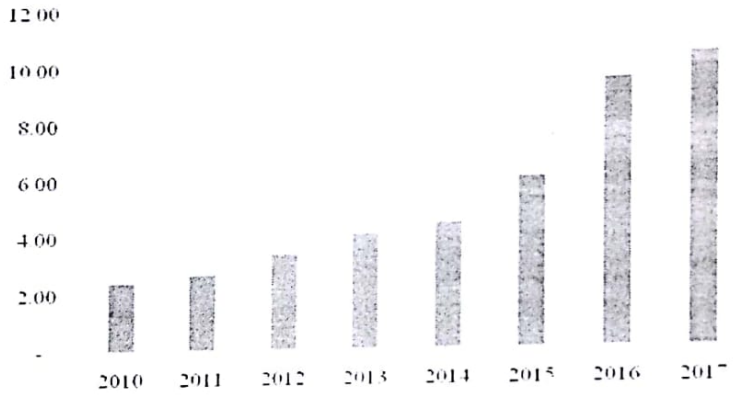
***Data Source: World Bank Dataset**

It can be seen that number of secure internet servers are increased suddenly in 2016 and 2017 to the great extent. This can be due to dramatic revolution in the telephone sector after introduction Reliance JIO. It ensures the better connectivity via Wi-Fi/ internet which is the basic requirement of machine learning and artificial intelligence.

While looking at the technical sector and improvements we should also consider the strength of the financial institution. New economy can be built on the strong foundation of the mobilization of funds.

- **Bank nonperforming loans to total gross loans (%)**

Figure-10: Bank nonperforming loans to total gross loans (%)



***Data Source: World Bank Dataset**

Rise in the non-performing asset can be a crucial point for the financial sector. In near future business house will need a strong support from the financial institutions for welcoming the new technologies. FIs should quantify the future requirement from the industry and reschedule fast recovery the previous bad loans.

Conclusion

Technological change is very natural in the today's world just as our breathing process. We cannot be a "Luddite". No nation can be protective to the economy and need toadopt open door policy as we did in the era of 1991. India has to be prepared to adopt change with time for new technology which may lead to new economic and social reforms. It should be remembered that change comes with the risk and tons of opportunities as well. The risk may be calculated to have feasible and achievable opportunities.

In the above charts, it is observed that we need to upgrade our level of thinking, attitude and aptitude to cope up with changing environment. One has to always remember that when

there is change in the technology, it leads to change in the culture also as after every update number of gadgets added to the population. This is right time to consider the non-human factors such as AI and various gadgets as part of population.

It is seen that Indians have already taken step ahead for matching the expectation of the world. Comparative analysis has also shown the benchmarks or preparation level of its competing economies. Thus at the end,it is essential that we welcome the industrial revolution 4.0 with the expectation that required changes in education. attitude and aptitude of the masswill take place in the journey toward the third world.

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AJANTA ISO 9001: 2008 QMS ISBN/ISSN

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