

# Understanding Innovation by Analyzing the Pillars of the Global Competitiveness Index

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**Abstract**—Global Competitiveness Index (GCI) prepared by World Economic Forum has become a benchmark in studying the competitiveness of countries and for understanding the factors that enable competitiveness. Innovation is a key pillar in competitiveness and has the unique property of enabling exponential economic growth. This paper attempts to analyze how the pillars comprising the Global Competitiveness Index affect innovation and whether GDP growth can directly affect innovation outcomes for a country. The key objective of the study is to identify areas on which governments of developing countries can focus policies and programs to improve their country's innovativeness. We have compiled a panel data set for top innovating countries and large emerging economies called BRICS from 2007-08 to 2014-15 in order to find the significant factors that affect innovation. The results of the regression analysis suggest that government should make policies to improve labor market efficiency, establish sophisticated business networks, provide basic health and primary education to its people and strengthen the quality of higher education and training services in the economy. The achievements of smaller economies on innovation suggest that concerted efforts by governments can counter any size related disadvantage, and in fact can provide greater flexibility and speed in encouraging innovation.

**Keywords**—Innovation, Global Competitiveness Index, BRICS, economic growth.

## I. INTRODUCTION

GLOBALIZATION has compelled firms and countries to explore different ways to cut down the competition. As a result, countries have realized the pressing need to innovate. Innovation is the only way for the countries to stay apart and be unique in the global competitive market. It has been found globally that science, technology and innovation are the major drivers for national development [1]. The combination of science, technology and innovation leads to new value creation. Scientific research utilizes substantial quantity of funds for the creation of knowledge.

Innovation provides solution and thereby helps to convert scientific knowledge into wealth. Innovation thus implies Science and Technology based solutions that are successfully deployed in the economy. Innovation is being assumed to be the critical factor in the developmental goals of a country. In order to sustain in the global market, countries need to formulate their competitiveness strategies that are more focused towards science, technology and innovation. Innovation gives a country competitive edge over others and enhances its competitive position relative to other countries. Thus, realizing the importance of innovation to growth of

economy and to achieve global competitiveness, both high growth countries as well as developing economies are trying to adopt policies and mechanisms focused on innovation and innovation led growth.

The current study focuses on studying the innovativeness of BRICS economies with respect to the top innovating countries in the world. An effort has been made to identify the critical enablers of innovation in these countries, so as to propose policy responses that can help to enhance innovation and in turn lead to greater competitiveness. Such policy prescriptions are especially important for a developing country like India, which has resource constraints but is keen to step up innovation and earn a position for its products in the global market place. The current policy focus on manufacturing led growth in India strengthens the need for pushing innovation in the country. We hope that our findings can throw up some policy prescriptions in this context for India and similarly positioned economies.

During the past decade, the World Economic Forum (WEF) has been publishing the Global Competitiveness Reports (GCRs) annually which rank countries on their competitiveness. The reports contain large and relevant datasets that can be helpful for countries to understand their competitive position with respect to other countries. These reports are used by policy makers as a benchmark to assess their relative performance in achieving competitiveness and in understanding its various components so that they can overcome existing limitations. Competitiveness of any country is viewed as a relative position of the country in the international market, specially comparing at similar economic development levels [2].

The World Economic Forum has developed the Global Competitiveness Index (GCI), to represent the economic factors that determine a country's competitiveness. The components which measure the different determinants of competitiveness are grouped into 12 pillars namely: Institutions, Infrastructure, Macroeconomic environment, Health and primary education, Higher education and training, Goods market efficiency, Labor market efficiency, Financial market development, Technology readiness, Market size, Business Sophistication and Innovation [2]. For our study, we have taken data from the Global Competitiveness Reports from 2007-08 to 2014-15 for the 10 top performing countries on the index, along with the emerging economies called BRICS. These top performing countries have been selected as per their competitiveness in the year 2014-15. The GDP annual Growth rate is also taken as an explanatory factor in our study [3].

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In the current era of globalization, competitiveness has become a key factor in the growth of both advanced and developing countries. Due to globalization there is an increase in competition among firms and among countries. To succeed in the globalized world firms and countries need to gain a competitive edge over others. The world has moved towards the knowledge economy and gaining a competitive edge in this scenario can be done by generating knowledge and through innovation. To withstand the competition countries need to innovate. Innovation acts as an important factor to acquire a competitive edge [4]. It has been observed in the Global Competitiveness Reports, that innovation plays a very important role in enhancing the competitiveness of a country [2].

As per the Global Competitiveness Index rankings for the last several years, the competitiveness rank of India showed a decline. India falls far behind the top innovation performing countries as can be seen from Table I. The data clearly suggest that efforts are needed to work on improving the country's competitiveness. We attempt to find the factors which can contribute to increasing the overall competitiveness of the country. The present work is an attempt to understand the key factors that can help India and other emerging economies to improve their competitiveness, especially through a focus on innovation led growth.

TABLE I  
INDIA'S RANK IN THE GLOBAL COMPETITIVENESS INDEX (2007-15)

Year	Rank	Year	Rank
2007-08	48	2011-12	56
2008-09	50	2012-13	59
2009-10	49	2013-14	60
2010-11	51	2014-15	71

Data Source: Global Competitiveness Reports, 2007-08 to 2014-15.

Innovation is found to be a key driver of competitiveness for both businesses and countries. The scores for Global Competitiveness Index (GCI) and Innovation from 2007-08 to 2014-15 for the 15 selected countries are found to have a correlation of 0.93 [2], [5]-[11]. It suggests that if a country is able to step up its innovation outcomes it will also, be more competitive in the global market place.

In order to study the influencers of innovation, we attempt to understand the role of each of the pillars of Global Competitiveness Index and how they affect innovation at a level.

## II. LITERATURE REVIEW

Globalization has brought a lot of change in the global economic scenario. In the past, when the markets were closed, firms were bound to carry out business within their own countries. There existed less competition among firms as there were few players in the market. Customers did not have a lot of product choices; there existed a monopoly of certain companies in producing specific goods. For example there was a kind of monopoly of 'Fiat' and 'Ambassador' cars in the Indian automobile industry or of Indian Airlines in domestic aviation industry.

Due to globalization in the latter part of the 20th century, specifically in post-World War II era, many multinational companies entered the global market and people started getting better quality products at a lower price. Customers could get better value for their money. This led to increased competition among the companies. Companies started finding new ways to attract customers, here the concept of value added service also came into the picture. Companies not only started providing better quality products but also started providing good service to the customer to enhance customer satisfaction. Today consumers drive markets. Globalization has also, led to an increase in the quality of the products, it has made it possible to have quality products available at an affordable price as a virtue of increased competition among firms [12].

Globalization has helped to remove the trade barriers among the countries and resulted in formation of global markets for the firms [13]. The increase in cross border trade has resulted in more competition not only amongst firms but also among the countries. Globalization has not only resulted in the global expansion of multinational companies but has also, brought about the exchange and interplay of new developments in science, technology and products throughout the world. Globalization has enabled most nations of the world to have access to similar information, technology and markets. It depends on the ability of a country to make use of those available resources and innovative ways to gain an edge over others [14], [15].

Competition plays a very important role in economic growth of a country because it necessitates the need for innovation. Competition can be at various levels: competition among individuals, among the organizations, between different regions and between countries [15]. In order to succeed in the global economy a country needs to be highly competitive at all levels. As a result of globalization, competitiveness is critical to the growth of both advanced and developing countries. Countries continuously strive to gain competitive advantage over others. Globalization has created a need for countries to have a framework for analyzing the competitive position of the country in the international market rather than simply focusing on measures to improve internal productivity [16]. The improvement in the competitiveness of business firms and countries is a prior requirement for successful business development in the global market [15].

### A. Need for Innovation

In the traditional economy framework competitive edge was gained through access to cheap labor, abundant natural resources, etc. However, today the world has moved towards a Knowledge economy. In knowledge based systems, the growth of the economy is based on the production and use of knowledge [17].

In today's knowledge era and innovation driven global economy, scientific and technological knowledge are the key drivers of production and growth [18]. In order to succeed in the knowledge economy countries need to generate knowledge and thereby innovate different ways to cut down the

competition. Countries which work towards knowledge production, its usage and adopt innovative ways by making use of science and technology to cut down the competition grow their economy well and have more likelihood to become a global leader. For long term economic growth and sustainable competitiveness, countries need to develop global competitiveness strategies which are focused towards Science, Technology and Innovation [19]. Many researchers have found that technological change and innovation are the major drivers of economic growth and act as the important factors for achieving competitiveness [20]. Technology plays a vital role in enhancing national economy and international competitiveness; it is also a key source in increasing profitability and growth of the companies [21].

It has been found in many studies that technological developments help the firms of a country to improve their profitability, give them competitive edge over others and thus, contribute to the growth of the firms. This in turn helps to boost the economy and competitiveness of a country. On the basis of technological development; companies, industries and countries can foster their competitive capabilities and increase their competitive advantage [16]. It has been found that the firms that innovate have better productivity levels and economic growth as compared to the non-innovating firms [20].

According to a Boston Consulting Group (BCG) study (2015), innovative companies excel in the market and innovation remains as a top agenda for these companies. In this study, maximum respondents ranked innovation as the top-most priority for their company. The results of the study reveal that the top officials of the companies around the world believe that innovation plays an important role for the organizations to acquire competitive advantage and profitability. Science and Technology act as an important basis for innovation. The leading companies at the top of the list of innovation like: Apple, Google, Tesla Motors, Microsoft Corp., Samsung Group, Toyota, BMW and such are making use of science and technology and innovative methods such as: emphasis on speed, well run (very often lean) research and development processes, use of technological platforms and the systemic exploration of adjacent markets [22]. The BCG study also specifies that out of the top 50 performing list of companies, 29 of these belong to United States of America, 11 of them belong to Europe and 10 belong to Asia. While most of the companies are from developed countries, companies from the emerging markets have also found a place in this list. In the case of the emerging markets 3 companies are from China and 1 is from India; companies from developing countries also use innovative ideas and techniques to compete in the global market. Thus, it can be concluded that by making use of science, technology and innovation companies can outperform in the market [22].

The Global Competitiveness Report 2013-14 also shows that the top performing countries like Switzerland, Singapore, Finland, Germany, United States of America, Sweden, Hong Kong SAR etc. are putting a lot of efforts into development of high quality education, research and development and making

use of highly sophisticated advanced technology. It appears that the use of innovative technologies by their companies helps to make them the top productive and competitive economies [2]. A country can attain economic growth and prosperity by its competitive technologies and innovation [23]. Therefore, countries need to increasingly invest in generating scientific knowledge and try to be technologically advanced which will lead to innovation and thereby add to the competitiveness of their country.

According to the Global Competitiveness Report of 2013-14, due to the financial crisis of 2008-09, emerging economies have gained importance because of which a notable shift in the global economy has taken place. As a result of the financial crisis, growth across many economies had slowed down. To overcome the crisis countries tried to identify the critical areas that need investment and to develop a prosperous environment in the country. Countries have to identify and strengthen the forces that will make a marked change in driving their economic growth. It was recommended that countries should develop the ability to create value added products, processes and business models through innovation. Accordingly, instead of distinguishing countries as being developed or developing, countries will be distinguished on whether they are "innovation rich" or "innovation poor". Thus, the report specifies the need for collaboration among business, government and civil society to create the enabling environment that will promote innovation.

The Global Innovative Index (GII) is an annual ranking of countries with respect to capacity for innovation and related outcomes. The GII is a collaborative effort of Cornell University, INSEAD and World Intellectual Property Organization along with other organizations and institutions. The focus of Global Innovation Index (GII) is to improve the ways to measure innovation and to understand it. It also focuses on identifying targeted policies and various practices to increase innovation in a country. In Global innovation index four measures are calculated namely: 1. Overall Global Innovation Index, 2. Innovation Input Sub-Index, 3. Innovation Output Sub-Index and 4. Innovation Efficiency Ratio. The overall Global Innovation score is calculated by taking the simple average of Input and Output Sub-Index scores. Innovation Input Sub-Index comprises five input pillars that calculate the elements of the national economy that enable innovation activities: 1. Institutions, 2. Human Capital and Research 3. Infrastructure 4. Market Sophistication and 5. Business Sophistication. Whereas, the Innovation Output Sub-Index gives the information about the outputs that are the results of innovative activities within the economy. There are two output pillars 6. Knowledge and Technology outputs and 7. Creative outputs. Innovation Efficiency Ratio is the ratio of the Output Sub-Index score to Input-Sub Index score [24].

As per The 'Global Innovation Index- 2015: Effective Innovation Policies for Development', innovation is being considered as an important factor of all economic activities around the world. Both advanced as well as developing economies have understood the importance of innovation and also, that it plays a key role in driving the economic growth of

a country. So, the countries are trying to formulate policies that support innovation led growth. The developing countries are also, no longer falling behind the high-income-countries in formulating the policies that will increase their innovation capacity. The main findings of Global Innovation Index 2015 reports show that: Among the Top performers or High income groups the quality of innovation plays a crucial role. Due to the world – class universities, countries like USA and United Kingdom stay ahead in their economic group. The middle-income-countries such as China and Malaysia are the champions among their peers and are fast rising in innovation ranking and even have performed at par with the lower tier of high income countries. The Institution pillar is found to be the most important and a crucial factor to increase the innovation performance of a country. To have a good innovation policy there is a need to have good supporting institutions in the country. Among the poor economies business sophistication pillar is found to be the important factor that enhances the level of innovation in these countries. Among the top 10 middle-income-economies, BRICS economies are at the top in terms of innovation quality. Within BRICS countries, China has shown a lot of progress in terms of innovation quality and has left other countries in the group far behind [24].

An Australian study also supports the fact that innovation acts as a basic driver for sustainable productive growth and social wellbeing [25]. The increase in the level of competition in the global economy has become a driving force for businesses to become more innovative. In turn, the capacity for innovation has become an important factor for the success of the individual firm and also for improving the competitiveness of the country in the current global economy [15]. Capacity to innovate plays a very important role for countries to survive in the global market place. Also, countries can gain prosperity and growth by making use of their innovative capacity [24], [26].

To be recognized in the global market place, countries need to identify and understand their competitive position among other countries and to strengthen their competitiveness by becoming more innovative.

### *B. Competitiveness*

According to the Global Competitiveness Report (2014-15) the competitiveness of a nation is defined as, “The set of institutions, policies and factors that determine the level of productivity of the country” or as per the OECD definition “the degree to which it can under free and fair market conditions, produce goods and services that meet the national standards of international markets while simultaneously expanding the real income of the citizens, thus improving their quality of life” [27]. The level of productivity sets the level of prosperity that can be reached by an economy. A more competitive economy tends to grow faster over time.

Every year the World Economic Forum (WEF) publishes Global Competitiveness Reports which help the countries to understand their competitive position with respect to other countries in the world. These reports serve as benchmarks for national policymakers to assess the relative performance of

each country in achieving competitiveness as represented by the accepted indices, so that countries can overcome the barriers to improve the competitiveness. The competitiveness of a country can be viewed as the position of the country in the international market as compared to the other countries especially in similar states of economic development. According to the Global Competitiveness reports there are many determinants that drive productivity and competitiveness like education and training, technological progress, macroeconomic stability, good governance, firm sophistication, market efficiency, etc. which are often mutually supportive.

### *C. Description of the 12 Pillars of Global Competitiveness Index*

The twelve pillars are combined as a weighted average to calculate the Global Competitiveness Index. Innovation is a key pillar and as per review of existing studies a positive relationship is expected between innovation and the other eleven pillars of the Global Competitiveness Index.

#### 1. Institutions

According to the Global Competitiveness Report 2014-15, the institutional environment is determined by the legal and administrative framework in a country, within which institutions, firms and government interact to generate wealth. The report specifies that it is important for the countries to have a sound and fair institutional environment. The quality of institutions is supposed to have a strong impact on competitiveness and the growth of a country [28], [29]. The quality of institutions not only influence the investment decision and organization of production but also play an important role in the manner in which societies distribute benefits and bear the cost of development strategies and policies. It also, includes government attitude towards markets and market efficiency. Stringent rules and regulations, corruption, lack of transparency, inability to provide appropriate services to the business sector, act as barriers and slow down innovation and the economic growth of a country. [11].

#### 2. Infrastructure

Well-developed transport and communications network including effective modes of transportation like: good roads, railway tracks, port and air transport, adequate electricity supply and an efficient telecommunication system. These are useful for efficient conduct of business [11]. A developed infrastructure network has a significant effect on economic growth of a country; it also helps in reducing the inequality in income and poverty in several ways [30], [31].

#### 3. Macroeconomic Environment

A stable macroeconomic environment in the country is important for harboring business development [32]. While productivity cannot be increased by macroeconomic stability alone but instability can prove detrimental to business performance and economic growth [11].

#### 4. Health and Primary Education

A country having a strong and healthy work force is essential for achieving labor productivity and competitiveness. A less educated work force in a country will be a constraint for it to use more advanced and innovative technologies. Therefore, it is imperative for a country to take measures to impart quality basic education to its citizens [11].

#### 5. Higher Education and Training

In today's era of globalization, it has become extremely important for countries to nurture a pool of well educated workers who can do complex jobs and are capable of adapting to the changing environment and needs of the production system. As per research, quality of higher education and training is most essential for the countries whose aim is to excel in innovations and complex technological process and products [33], [34]. Higher education and training includes secondary and tertiary enrolment rates of education. These along with extent of vocational and continuous-on-job training are important to ensure constant upgrading of the skills of the workers [11].

#### 6. Goods Market Efficiency

A healthy competition in the market is important to drive the market efficiency and business productivity. Minimum government intervention in the processes that affects the business activities is required for an efficient environment of exchange of goods. Countries which have efficient goods market are well positioned in the market. These companies produce the right mix of products and services as per the supply and demand of goods in the market. Market efficiency also depends on demand condition like customer orientation and buyer sophistication [11].

#### 7. Labor Market Efficiency

The efficiency and flexibility of the labor market is considered as an important factor in innovation and competitiveness. It should be ensured that workers are allocated to jobs where they can perform their best. There should be flexibility in the labor market so that workers can easily be shifted from one economic activity to another and the flexibility in wages can minimize the disruption in production process and systems. In an efficient labor market, clear and strong incentives must be provided to the workers, workers should be promoted on the basis of their meritorious performance, the business environment should be fair and non-discriminatory [11].

#### 8. Financial Market Development

A sound and well-functioning financial sector is very important for carrying out the economic activities efficiently. An efficient financial sector allocates the resources saved by the citizens and those received from other countries to their most productive use, the financial resources are provided to the entrepreneurial and investment projects that have highest expected rate of return. A thorough assessment of risk is an essential and important part of sound financial markets. Since business investments are critical for enhancing productivity,

economies need to have sophisticated financial markets that can make capital available for investment by the private sector. The financial markets need to have appropriate rules and regulations to protect the interest of investors and others players in an economy [11].

#### 9. Technology Readiness

The technology readiness factors measure how fast an economy adopts the existing technologies to enhance the productivity of its firms. It also has a strong emphasis on the capacity of the economy to take full advantage of information and communication technology (ICT) in its day to day activity and in production processes in order to increase efficiency and enable innovations [11], [35].

#### 10. Market Size

The size of the market affects the productivity of a firm. If the size of the market is large, firms will produce and sell more quantity of goods that will result in reduced production cost; i.e. firms will be benefited due to economies of scale [11]. Globalization has made it possible for the firms to carry out their business operations not only within the geographical boundaries of their own nation but throughout the world. Studies have shown that the openness of trade has a positive relationship with the growth of an economy. It has also, been observed that trade has a positive relation with growth especially for the countries having small domestic markets [36]-[39]. For the countries having small size of domestic market, they can export the products in order to gain better market access.

#### 11. Business Sophistication

Business sophistication is thought to be mainly dependent on: quality of a country's overall business networks, quality of individual firm operations and strategies and interplay between all these. The quality of business network is measured by the quality and quantity of local suppliers and the extent of interaction between business networks and local suppliers. Efficient networks enhance business performance and result in more opportunity for innovation of processes and products. They help in reducing the barriers to the entry of new firms [11]. By increasing competition, business sophistication encourages firms to produce unique products and be innovative.

#### 12. Innovation

This factor in GCI focuses on technological innovations. Non-technological innovations which arise from know-how, skills and working conditions and are embedded in the organization are largely covered under the factor of business sophistication. The Global Competitiveness Report, 2014-15 discussed that although a large amount of progress can be made by a country through carrying out improvements in: institutions, infrastructure, macroeconomic stability etc. but these gains keep on diminishing over time. This is also true for gains from efficiency of labor, financial markets and goods market. It is technological innovation alone that leads to enhanced standard of living in the long run and does not

exhibit diminishing gains. Innovation plays a very important role in the economic growth of a country. Countries must provide an environment that facilitates innovative activities carried out by companies so that their companies design and develop cutting edge products and processes to gain a global advantage. This requires the private and public sector to make sufficient investment in research and development (R&D) [11].

### III. METHODOLOGY

In the present paper, we have compiled the data on all the 12 pillars, influencing factors, of Global Competitiveness Index (GCI) as mentioned in the Global Competitiveness Report 2014-15 for the top 10 countries on the basis of their competitiveness for the period of 8 years i.e. (2007-08 to 2014-15). These 10 top performing countries have been selected as per their rank in the 2014-15 competitiveness index. In order to identify the key factors that influence innovation the empirical analysis also, considers data from the big emerging economies called BRICS. The BRICS countries are not high on innovation performance but they have high GDP growth rate. We have included these 5 nations as they are large, emerging economies and can help us to study if high income growth rates have an important effect on innovativeness. The value of GDP annual Growth rate for all countries for the period 2008 to 2015 is taken from the World Bank data [3]. The data is arranged in panel form and then analyzed to identify the significant variables that determine a country's innovativeness. Table II provides variable and variable abbreviations used in the study for purpose of data analysis.

TABLE II  
VARIABLE ABBREVIATIONS USED IN THE REGRESSION

Variable	Variable Abbreviation
Innovation	INNOV
Business Sophistication	BUS SOP
Market Size	MKTSIZE
Technology Readiness	TECRED
Financial Market Development	FINMKTDEV
Labor Market Efficiency	LABMKTEFF
Goods Market Efficiency	GODMKTEFF
Health and Primary Education	HEA/PRIEDU
Higher Education and Training	HIGEDU/TRA
Macroeconomic environment	MACECOENV
Infrastructure	INFR
Institutions	INSTI
GDP growth rate	GDPGRWRT

A regression model was fitted to the data in order to understand the determinants of innovation. Along with the twelve GCI pillars of competitiveness and GDP growth rate for the countries is being taken from World Data Bank [3]. GDP is an important explanatory factor of innovation [40].

#### A. Model and Findings

INNOV = f (BUS SOP, MKTSIZE, TECRED, FINMKTDEV, LABMKTEFF, GODMKTEFF, HEA/PRIEDU, HIGEDU/TRA, MACECOENV, INFR, INSTI, GDPGRWRT)

TABLE III  
REGRESSION RESULTS

Variables	Coefficient	T-Statistic	Significance (P> t )
BUS SOP	0.46	2.92	0.004***
MKTSIZE	-2.263	-2.68	0.009***
TECRED	2.027	0.5	0.619
FINMKTDEV	-0.0009	-0.02	0.986
LABMKTEFF	0.386	3.87	0.00***
GODMKTEFF	0.043	0.27	0.791
HEA/PRIEDU	0.184	1.77	0.08*
HIGEDU/TRA	0.263	2.6	0.011**
MACECOENV	-0.043	-0.98	0.332
INFR	0.014	0.23	0.821
INSTI	-0.149	-1.21	0.229
GDPGRWRT	0.003	-0.66	0.511
CONSTANT	0.005	0.01	0.996

$R^2 = 0.7826$ ; \*\*\*Significant at 0.01 level, \*\*Significant at 0.05 level, Significant at 0.1 level

The fitted regression model was a good fit and yielded the following results: of all the 12 explanatory variables considered in the model, only five variables were found to be significant. Out of these five variables; four variables have a direct effect on improving the innovative ability of the country viz. BUS SOP, LABMKTEFF, HIGEDU/TRA, HEA/PRIEDU. Among them two variables, namely: BUS SOP i.e. Business Sophistication (coefficient= 0.46) which is a measure of Business Sophistication in a country and LABMKTEFF i.e. Labor market efficiency (coefficient= 0.386) which is a measure of efficiency and flexibility of Labor Market of a country were found to be significant at 1% level of significance and were directly related to innovation. HIGEDU/TRA i.e. Higher Education and Training which is a measure of the secondary and tertiary enrolment rate of students for higher education, the quality of education and extent of training in a country was significant at 5% level (coefficient 0.263) and HEA/PRIEDU (coefficient 0.184) i.e. Health and Primary Education which is a measure of Health facilities provided to the workforce and the quality and quantity of basic education received by the population of a country was found to be significant at 10% level of significance. Both these variables exercised a positive influence on innovation.

The variable MKTSIZE i.e. Market Size (coefficient= -0.263) which is a measure of the size of both domestic and international markets available to the firms of a country was significant at 1% level of significance. However, market size is inversely related to innovation in our model. This suggests that increases in the size of the market reduce the innovation by a country.

### IV. INTERPRETATION OF RESULTS

Based on the results of the regression analysis, it can be concluded that the innovation ability of a country is significantly affected by the quality of the 5 significant explanatory variables:

1. The quality of a country's business networks, supporting industries and quality of individual firm operations and

strategies determine the level of Business Sophistication. In order to enhance the quality of business networks, a country needs to focus on enhancing the quality and quantity of local suppliers and increasing the interaction between suppliers and business entities. Companies need to have more than one local supplier, to obtain quality raw material which will lead to the production of quality products. The local suppliers should be located close to the production unit of the company to have timely supply of the raw material with low transportation costs. This will help in producing better quality products at lesser price and in less time. The geographical proximity between companies and local suppliers will help to increase the mutual interaction between both the parties that will result in increased operational efficiency. It will also help to create a greater opportunity for producing innovative products and processes and increase the level of innovation in the country. It will also reduce the barrier for the entry of new firms in the market. Thus, increasing the level of business sophistication in the country will enhance the innovative ability of the country.

2. The efficiency and flexibility of labor market (Labor Market Efficiency): To enhance the labor market efficiency in the country, workers should be provided incentives in order to motivate them to perform their best. This will help to retain quality workers in the company and result in enhanced total factor productivity for the company. Workers should be skilled to perform more than one job so that the company will have a pool of skilled workers that will enhance the possibility of making innovative products and will support any changes required to innovate. This can also, be enabled through job rotation. In some cases, job rotation helps the company to shift the workers easily in less time and in less cost and makes it easy for a company to address the labor requirements of products or process innovation. Labor Market Efficiency has positive relation with innovation i.e. by increasing the level of labor market efficiency in a country the innovation ability of the country will also increase.
3. Quality of higher education and training in a country (Higher education and training): Increasing the level of higher education and training in a country will help the labor force to come up with new ideas, develop innovative products and advance technologies. More emphasis can be given for vocational and on-the-job training to enhance the skills of the work force. This will help a country to have a pool of workers who will be able to carry out complex jobs and who can adapt easily to the changing environment and upcoming needs of the production system, thereby contributing to the overall growth of the economy.
4. Adequate health facilities to the workforce and the quality and quantity of basic education received by the population of the country (Health and primary education): In order to increase the level of Health and Primary Education in the country, efforts need to be made to provide better health

services to the citizens that will help to enhance the productivity and competitiveness of the country. Unhealthy workers cannot perform well and will be less productive, that will lead to loss of income and output for business and the economy. Better health services will decrease the rate of absenteeism and improve productivity and performance.

5. Market size: The negative correlation observed between market size and innovation is significant. As a pillar in the Global Competitiveness Index market size offer advantages of economies of scale and resultant efficiency gains help to make products competitive. The inverse relation of market size and innovation in our study can be attributed in part to the nature of the data. The 5 BRICS economies are big markets but not high on innovation. The smaller economies in our analysis represent developed countries which are high on innovation. A focus on converting research into innovations, integrating the economy into the globalized arena, along with government policies that support technological development with supportive institutions can help economies to innovate effectively [41].

#### V. CONCLUSION AND RECOMMENDATIONS

The paper attempts to study the factors that are important influencers of innovation at the macro level. Innovation appears to be a key driver of competitiveness and growth, with the unique feature that it can contribute to exponential growth of a country.

Our findings suggest that government policies should focus on improving labor market efficiency and flexibility. In case of India inefficient and rigid labor markets have for long been attributed as a cause for poor productivity and business performance. They have been an impediment in attracting Foreign Direct Investment (FDI), curbing the advantages from being an emerging, fast growing market. In the current government budget for India (2017-18) mention is made that legislative reforms will be undertaken to simplify, rationalize and amalgamate the existing labor laws into four codes – wages, industrial relations, social security and welfare and working conditions. Such efforts in this regard would help to improve innovativeness for India [42].

Market needs and profit considerations guide the development of both firm and industry level operation and strategies. Businesses establish linkages, associations and networks that help to promote their business. However, governments can provide support by putting in place regulations and institutions that reduce the risk of creating business networks and enable grounds for interaction and discussion between businesses across industries and regions.

Promotion of higher education has now become an important objective for all developing countries. Efforts to provide both quality and quantity in this regard are being implemented so as to create a 'global workforce'. In India the present government's Skill India Initiative is a step in this direction. This policy also, focuses on developing vocational skills which can directly contribute to supporting innovation in

products and processes at the micro level. Benchmarking with international standards is also, a feature of the Skill India policy.

In fact, while higher education is generally available at lower costs in developing countries relative to the developed west, quality concerns have been a serious issue for long. Thus, adopting quality standards in this area would be essential to create a work force that is more productive and is able to benefit from global job opportunities. An added advantage would accrue when members of a country's work force gain experience globally and return to share and adopt 'best practices' at home.

Basic needs of primary education and health have to be promoted as a necessary condition for a productive labor force. There are huge resource challenges in this context for economies like India and China, with the largest populations in the world, as also for other BRICS nations like Brazil. Nevertheless these are essential areas of focus to enable the other influencers to work on improving innovation in the country. Perhaps innovations in health products and service provision and progress in using technology to reach basic education to the masses can support government efforts to bring about more visible and quick outcomes.

Large markets provide an opportunity to reach markets for innovations but we find that often the advantage to innovate rests with smaller economies. Recent examples of high innovations from Israel and Scandinavian countries suggests that concerted efforts towards R&D investment, flexibility to adopt new ideas and scope for quick commercialization can offset the advantages of market size.

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