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ASSOCIATION OF ENTREPRENEURSHIP ECOSYSTEM WITH ECONOMIC GROWTH IN SELECTED COUNTRIES: AN EMPIRICAL EXPLORATION

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Abstract
This study was created the entrepreneurship ecosystem index (EEI) as an effective tool for measurement of entrepreneurship ecosystem for 34 selected economies during 2000-2017. It was considered EEI as an integrated index of 12 different indicators (i.e. financing for entrepreneurs, governmental support and policies, taxes and bureaucracy, governmental programs, basic school entrepreneurial education and training, post school entrepreneurial education and training, R&D transfer, commercial and professional infrastructure, internal market dynamics, internal market openness, physical and services infrastructure, and cultural and social norms) of entrepreneurship activities. Composite Z-score technique was used to create EEI for undertaken economies. Thereupon, it assesses the association of estimated EEI with socio-economic, science & technology (S&T) and IPRs related factors using correlation coefficient techniques. Estimated values of EEI show that India has 8th position in entrepreneurship ecosystem among the 34 economies. Also, there was found a high diversity in entrepreneurship ecosystem in efficiency, factor and innovation driven economies due to variation in 12 indicators of entrepreneurship ecosystem and socio-economic activities. Accordingly, it investigates the causal relationship between EEI and per capita GDP using linear, non-linear and log-linear regression models at country-wise panel data. Empirical results imply that per capita GDP is significantly associated with entrepreneurship ecosystem, socio-economic, S&T and IPRs related indicators. Entrepreneurship ecosystem have a causal relationship with per capita GDP. Entrepreneurship ecosystem is significantly associated with socio-economic development and S&T and IPRs related indicators. It brings several practical policy proposals to create effective entrepreneurship ecosystem, and to sustain economic and social development in India.

Research paper

Keywords: Entrepreneurship ecosystem; Science & Technology, Intellectual property rights; Per capita GDP; Economic development; India; Developed and developing economies

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Introduction

Existing studies have highlighted that entrepreneurship ecosystem is helpful to create a vital mechanism to increase economic and social structural of a country (Chen, 2014; Dhahri and Omri, 2018). It is also observed that entrepreneurship ecosystem is a main driver to increase the economic growth and development of a nation (Dvouletý et al., 2018; Dhahri and Omri, 2018; Ács et al., 2018; Tunali and Sener, 2019). Furthermore, sufficient literature has explained that entrepreneurial activities would be beneficial to create new products and services which are essential to increase production scale, and to create new market and jobs (Shabani, 2016; Sousa et al., 2017; Tunali and Sener, 2019; Chitsaz et al., 2019; Salamzadeh, 2020 a,b). Prior studies have argued that entrepreneurship ecosystem have a significant contribution to maintain the economic performance of a country (Wennekers et al., 2010; Box et al., 2014; Audretsch et al., 2015; Zaki and Rashid, 2016). Existing researchers have also reported the importance of tech-based and non-tech entrepreneurship in economic development. Existing studies have also claimed that tech-based entrepreneurship have a crucial contribution to increase economic development (Song et al., 2008; Dhahri and Omri, 2018; Singh and Ashraf, 2019; Jyoti and Singh, 2020). Also, entrepreneurial firms may be considered as an engine of economic development (Chen, 2014; Dvouletý, 2017; Bellavitis et al., 2017; Rusu and Roman, 2017). Moreover, entrepreneurship ecosystem works as a catalyst for structural change and institutional development in a country (Naudé, 2013). Entrepreneurship is defined *as the construction of a new business organizations or new entry*

into a self-employment (Szerb et al., 2018). It is a *set of interdependent actors and factors that are coordinated in a way that they enable productive entrepreneurship within a particular territory* (Stam and Spigel, 2016). Existing researchers have explained the concept of entrepreneurship in different ways (Iversen et al., 2008; Dvouletý, 2018). There are two types of entrepreneurship i.e. formal and informal (Dau and Cuervo-Cazurra, 2014). Formal entrepreneurship is associated with creation of new businesses which are legally registered (Adusei, 2016). Creation of new business activities which are not registered through law but are legal in all aspects may be considered as informal entrepreneurship (Dau and Cuervo-Cazurra, 2014). Entrepreneurship ecosystem is situation in which social and economic development is reflected by business activities of a country. Entrepreneurship activities provide the incentives to individuals or organizations to take initiatives towards business activities.

It is observed that entrepreneurship ecosystem is useful to maintain economic growth and development (Kar and Özşahin, 2016; Salamzadeh et al., 2013, 2017; Bellavitis et al., 2017; Acs et al., 2018). It is also a prime determinant to discover new technologies and innovation, and new products which are useful to create industries and markets (Zaki and Rashid, 2016; Omoruyi et al., 2017; Singh et al., 2020). Furthermore, innovation is useful to increase productivity of human, environmental, financial, social, physical, and institutional resources in tech-based enterprises (Omoruyi et al., 2017; Rusu and Roman, 2017). Also, it is useful to enhance high capacity of business innovative-ness and makes more material resources with effective

managerial skills (Jha, 2013; Rukuižienė, 2016). Consequently, it is an essential activity to increase competition among the entrepreneurs, and nurture the growth of newly business. Moreover, early stage of new firms is useful to increase the growth of manufacturing sector (Yamada, 1996; Jha, 2013; Farayibi, 2016). Thus, entrepreneurship ecosystem is useful to boost industrialization, and promote export-trade and capital formation of a country (Farayibi, 2016). Hence, entrepreneurship ecosystem increases the economic capacity of population and reduce poverty (Omoruyi et al., 2017), and it is useful to control rural-urban migration (Dvouletý, 2017) and helpful to reduce economic inequality (Rusu and Roman, 2017). Thus, it may be effective to maintain the path of sustainable development (Hall et al., 2010). Entrepreneurship ecosystem is an essential component for decentralization, economic restructuring and create a market based economy (Farayibi, 2016).

2. Empirical Review

2.1. Entrepreneurship Ecosystem and Economic Development

Several studies have claimed that entrepreneurship ecosystem play a significant role to increases the economic development of a nation (Chitsaz et al., 2019). However, existing researchers have used similar variable to capture the influence of entrepreneurship ecosystem on economic development. Thus, this section provides the brief review of related studies which have assessed the impact of entrepreneurship ecosystem on socio-economic development in different countries. Wennekers et al. (2010) have investigat-

ed the relationship between self-employment or business ownership and economic development. It observed U-shaped relationship between start-up rates of enterprise and economic development. In this study self-employment was used as a proxy for entrepreneurship ecosystem. Ács and Szerb (2012) have assessed the impact of GEDI on economic development. It found that entrepreneurship ecosystem and economic development have less mildly S-shaped association. Chen (2014) have assessed the association of entrepreneurship ecosystem with economic growth, and employment in Taiwan. It was perceived that entrepreneurship ecosystem is an important driver to stimulate economic growth. Box et al. (2014) have examined the relationship between self-employment and economic growth in Sweden. It was detected that entrepreneurship ecosystem have a positive impact on economic development. Dau and Cuervo-Cazurra (2014) have observed that economic liberalization was positively associated with entrepreneurship ecosystem in 51 economies. Bhat and Khan (2014) have observed that better implementation of government policies, taxation and other regulatory policies have a contribution to create entrepreneurship ecosystem in India. Tajpour and Hossini (2014) have assessed the academic entrepreneurship affecting factors in University of Tehran. It found that there was an insignificant association between institutional trust and academic entrepreneurship.

Audretsch et al. (2015) have estimated the association of new firm start-ups with economic development in 127 European cities. It found that economic development was significantly associated with new firm start-ups. Farayibi (2016) have measured the importance of entrepreneurship in eco-

nomic growth in Nigeria. It witnessed that SMEs play a significant role to maintain economic growth. Adusei (2016) have reported that entrepreneurship ecosystem was positively associated with growth processes in 12 African countries. Bashir and Akhtar (2016) have estimated the correlation coefficients of global competitiveness index with gross domestic product in G20 economies. It is detected that entrepreneurship ecosystem and innovation have a positive impact on economic growth. Zaki and Rashid (2016) have assessed the impact of entrepreneurship on economic growth in Egypt, Hungry, India, Mexico, Indonesia, Turkey and Romania. It was observed negative relationship of entrepreneurship ecosystem with economic growth. Omoruyi et al. (2017) have assessed the impact of entrepreneurship ecosystem on economic prosperity in Africa. It found that entrepreneurship ecosystem work as an important driver to increase employment growth and economic prosperity. Dvouletý (2017) have estimated the relationship between unemployment and entrepreneurship ecosystem in Czech regions. Rusu and Roman (2017) have assessed the impact of macro-economic and business environments on entrepreneurship activities in 18 European economies. It observed that entrepreneurship activities were significantly associated with inflation rate, foreign direct investments, access to finance and total tax.

Tasnim and ibne Afzal (2018) have explored the impact of efficiency level on entrepreneurship ecosystem in 59 countries. It reported that entrepreneurship ecosystem has a significant impact on GDP. Dhahri and Omri (2018) have reconnoitered the role of entrepreneurial activity in economic growth and sustainable development in 20 developing economies. It found

that entrepreneurship ecosystem has a positive impact on economic and social development (Salamzadeh and Kawamorita, 2017). Dvouletý (2018) have appraised the measurement of entrepreneurship and its determinants in 11 European countries. It is concluded that institutional and economic environment have a positive influence on growth of early-stage enterprises. As previous studies have perceived positive and negative impact of entrepreneurship ecosystem on economic and social development in different economies (Naudé, 2013; Audretsch et al., 2015; Bashir and Akhtar, 2016; Zaki and Rashid, 2016; Rusu and Roman, 2017). Furthermore, limited studies have assessed the determinants of entrepreneurship ecosystem and its relationship with socio-economic development (Box et al., 2014; Calá et al., 2015). Thus, there needs a research to get clear understanding on relationship of entrepreneurship ecosystem with economic development and vice-versa in developing and developed countries.

2.2. Measurement of Entrepreneurship Ecosystem

Entrepreneurship ecosystem have a multi-dimensional and complex association with socio-economic, science & technology, intellectual property rights regime, political stability, government policies and international network in a country (Jyoti and Singh, 2020). Therefore, measurement of entrepreneurship ecosystem is debatable for researchers and international development organizations (Iversen et al., 2008; Szerb et al., 2018). There are two main approaches which may be useful for measurement of entrepreneurship ecosystem. First approach includes the opinion of randomly select-

ed individuals on entrepreneurship, while second approach is based on number of business registries in a country (Dvouletý, 2018). Furthermore, existing researchers have measured entrepreneurship ecosystem using different techniques. Naudé (2011); Li et al. (2012); Jafari Moghadam et al., (2012); Chen (2014); Box et al. (2014); Stangler and Bell-Masterson (2015); Calá et al. (2015); Zaki and Rashid (2016); Kar and Özşahin (2016); Fritsch and Wyrwich (2017); Audretsch and Belitski (2017); Dhahri and Omri (2018); Dvouletý (2018) have used a single indicator such as number of business start-ups, number of small and medium enterprises, registration of new firms, start-ups rate, new business firms, business ownership, business density, new small and medium enterprises, entry employment by the industry and employment rate as a measurement of for entrepreneurship ecosystem.

The Organization for Economic Co-operation and Development (OECD) have recognized 6 indicators (i.e., regulatory framework, market conditions, access to finance, creation and diffusion of knowledge, entrepreneurial capabilities, and entrepreneurship culture) of entrepreneurship ecosystem.[1] International Labour Organization (ILO) was considered number of self-employment person as a proxy for entrepreneurship ecosystem. World Bank was considered registration of new firms, while Global Entrepreneurship Monitor (GEM) was used start-ups rate of new firms as a measurement of entrepreneurship ecosystem (Naudé, 2013). Additionally, GEM was also reported 12 different indicators of entrepreneurship ecosystem.

[1]http://www.oecd.org/std/business-stats/indicatorsofentrepreneurialdeterminants.htm.

Naudé (2011) have argued that rates of new business formation, self-employment and business ownership may be used as an indicator of entrepreneurship ecosystem. Ghani et al. (2014) have used entry employment in industries as an entrepreneurship ecosystem in India. Box et al. (2014) was explained that self-employment can be used as an indicator of entrepreneurship ecosystem. Calá et al. (2015) have used business density (number of newly registered companies with limited liability per 1,000 people aged 15-64) as a proxy for entrepreneurship ecosystem. Dhahri and Omri (2018) have considered ratio of new registers and unregistered business with working-age population as a measures of entrepreneurship ecosystem in economies. Chen (2014) have used number of new company as a representation of entrepreneurship ecosystem in Taiwan.

Stangler and Bell-Masterson (2015) have appealed that business density, fluidity, connectivity and diversity are the four indicators of entrepreneurship ecosystem. Audretsch et al. (2015) have used new-firms as proxy for entrepreneurship ecosystem. Bashir and Akhtar (2016) have considered competitiveness index as a proxy for entrepreneurship ecosystem in G20 economies. Zaki and Rashid (2016) have comprised number of new firms as a measure of entrepreneurship ecosystem. Kar and Özşahin (2016) have used the number of new business registrations per 1000 people in 17 economies. Fritsch and Wyrwich (2017) have used self-employment rate as a proxy for entrepreneurship ecosystem in Germany. Audretsch and Belitski (2017) have compiled share of start-ups as an entrepreneurship ecosystem in European cities. Rusu and Roman (2017) have considered total entrepre-

neurial activity rate (TEA) as substitution for entrepreneurship ecosystem in 18 European economies. Dvouletý (2018) have used self-employment activity, self-employment rate, and established business ownership rate and total early-stage entrepreneurial activity as a determinants of entrepreneurship ecosystem. Singh, Arya and Jyoti (2019) have used total self-employed, economic freedom score and start-up procedure as a business activity in Asian economies. Tunali and Sener (2019) have assessed the determinants of entrepreneurship in Turkey. It provides an evidence that demographic and economic variables have a significant impact on entrepreneurship ecosystem. Furthermore, few researchers have developed several indexes such as Global Entrepreneurship Index (GEI), Global Entrepreneurship and Development Index (GEDI) and Economic Freedom Index for measurement of entrepreneurship ecosystem across countries. Acs et al. (2018) have used GEI as a proxy for entrepreneurship ecosystem. Tasnim and ibne Afzal (2018) have claimed that GEI is a multidimensional nature of entrepreneurship ecosystem, thus it may be used as an effective tool to measure the entrepreneurship ecosystem.

2.3. Research Gap, Research Questions and Purpose of Study

As earlier studies have used single indicator of entrepreneurship ecosystem to assess its impact on socio-economic development in different economies. Most studies have observed that entrepreneurship ecosystem have a positive impact on economic growth in largely industrial and emerging economies. Since, single indicator may not be effective to assess the

performance of entrepreneurship ecosystem of a country. Thus, it is essential to integrate most related factors in an index to assess the performance of entrepreneurship ecosystem. Furthermore, earlier studies could not have examined the integrated impact of entrepreneurship ecosystem on social and economic development and vice-versa. Few studies urged to existing researchers and scientific research community to investigate the determinants of entrepreneurship ecosystem and its association with socio-economic activities in developed and developing economies (Dvouletý, 2017; Tunali and Sener, 2019). Thus, this study is a substantial effort to find the answers on few research questions in the area of entrepreneurship ecosystem and its association with per capita GDP in selected countries. These research questions are specified as: (i) What must be the best measurement of entrepreneurship ecosystem?; (ii) How scientific research community can measure the entrepreneurship ecosystem?; (iii) What is causal relationship between entrepreneurship ecosystem and per capita GDP?; (iv) How socio-economic activities do affect entrepreneurship ecosystem?; (v) How entrepreneurship ecosystem is useful to improve socio-economic development?

Pertinent to above-mentioned research questions, this study is achieved following objectives: (i) To develop country-wise entrepreneurship ecosystem index (*EEI*) for selected 34 economies during 2000–2017 using *Composite Z-score* technique; (ii) To explain the relative performance of undertaken economies in entrepreneurship ecosystem; (iii) To investigate the impact of per capita GDP on *EEI* and vice-versa using linear, non-linear and log-linear regression models; (iv) To provide policy suggestions to in-

crease the India's position in entrepreneurship ecosystem based on empirical findings of this study and previous literature.

2.4. Importance of the Study

In this study, *EEI* was considered as an effective tool to recognize the entrepreneurship ecosystem of a country. Here, *EEI* was defined as single number which value lies between 0–1 and it shows the relative progress of undertaken countries in entrepreneurship ecosystem. Highest value of estimated *EEI* of a country, imply that the country has a better entrepreneurship ecosystem than other countries. Lowest value of *EEI* of an economy, exhibits that the country is in deprived position in entrepreneurship ecosystem. Thus, it works as an effective policy tool for policy makers to take an effective policy initiative to maintain the entrepreneurship ecosystem of a nation. Estimated values of *EEI* also provides the possible way to determine the overall entrepreneurial progress of a country (Szerb et al., 2013). Hence, *EEI* deliver policy proposals for those economies which wish to improve their position in entrepreneurship ecosystem. Therefore, findings of this study are useful for policy makers to take an effective policy action to increase the entrepreneurship ecosystem.

3. Research Methodology

3.1. Process for Selection of Economies

As this study is proposed to create entrepreneurship ecosystem index (*EEI*) and assess its impact on per capita GDP and vice-versa. Therefore, it

was very complex and critical challenge to select the economies. Thus, it applied two methods to select the economies and socio-economic factors. In first process, it includes only those economies which had the data of 12 indicators of entrepreneurship activities which are recognized by GEM during 2000–2017. In second process, only those economies were considered which have the data on socio-economic, intellectual property rights and science & technology related factors. Finally, only 34 countries were found suitable to create *EEI* and to examine its association with per capita GDP (Refer to Table – 1). Interpolation and extrapolation techniques were used to fill the missing values in data series (Zarea and Salamzadeh, 2012; Radovic Markovic, 2012; Kumar et al., 2015, Kumar, Sharma and Ambrammal, 2015; Kumar et al., 2017; Sharma and Singh, 2017; Singh et al., 2017a,b; Singh and Issac, 2018; Singh et al., 2019). SPSS and STATA statistical software were used to run the regression models.

Table 1. List of selected countries

Countries	Group of the Country
Croatia, Hong Kong, Singapore	High income: non-OECD
Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, South Korea, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States	High income: OECD
India	Lower middle income
Argentina, Brazil, Chile, China, Mexico, South Africa, Thailand	Upper middle income

3.2. Explanation on Data Sources

All required data on 12 indicators of entrepreneurship ecosystem, socio-economic, S&T and IPRs related variables for selected economies were taken from website of World Development Indicators (World Bank), World Intellectual Property Organization, Global Entrepreneurship Monitor (GEM), World Economic Forum, Deloitte Touche Tohmatsu Limited and U.S. Council on Competitiveness, Economist Intelligence Unit Limited, Cornell University and INSEAD, and other international organizations.

3.3. Formation of Entrepreneurship Ecosystem Index (EEI)

Earlier researchers and developmental organizations have used several techniques such as simple descriptive method, composite Z-score technique, principle components analysis and factor components analysis to generate various indexes. Simple descriptive techniques include the average sum of normalization values of undertaken variables to create an index. This technique does not include the weightage of each variable in an index estimation. It is useful to make appropriate comparison across entities (Singh, Singh and Negi, 2020). Although, a researcher may assign weightage to each arbitrary variable as per their understanding (Kumar et al., 2017; Singh et al., 2020). As this technique produce positive and negative values in magnitude of final index, thus, it may be unscientific to provide the interpretation of indexes. Simple descriptive method has used in estimation of global entrepreneurship and development index (*GEDI*), and global entrepreneurship index (GEI). For instance, Ács and Szerb (2012) have integrated

31 variables to estimate GEDI for 79 economies estimation using a descriptive technique. Furthermore, previous researchers have considered the averages values of fourteen pillar of entrepreneurship ecosystem to create GEDI and GEI. Thus, GEDI and GEI may be criticized by scientific research community. Since, principle and factor component analysis automatically include the weightage of each variable in index estimation. But, these techniques produce negative and positive weightage of each arbitrary variable. Thus, estimated values of index may provide wrong interpretation of statistical findings. While, weightage for each variable may be assigned using a statistical technique in *Composite Z-score* method, thus, this method has a consistency. *Composite Z-score* technique was used to create entrepreneurship ecosystem index (*EEI*) in this study. The technique comprises the linear sum of *composite-indexes* which was multiplied by weightage of associated variables for economic, social, business, entrepreneurship, environmental, intellectual property rights, science & technological development related activities (Kumar et al., 2015; Kumar et al., 2017; Singh et al., 2017; Sharma and Singh, 2017; Singh and Issac, 2018; Singh et al., 2019; Singh et al., 2020; Singh, Singh and Negi, 2020). As earlier studies have used various factors to estimate the GEI and GEDI. Though, this study could not use similar factors in *EEI* estimation due to unavailability of data of these factors during 2000-2017. So, it could use 12 different factors which were recognized by GEM to evaluate the performance of entrepreneurship ecosystem (GEM, 2017). These factors were also identified as a crucial determinant to

strengthen the entrepreneurship ecosystem of a country. For this, it accepts that *EEI* is a function of 12 factors (see Table: 2) which was specified as:

$$EEI = f\,(FE, GSP, TB, GP, BSEET, PSEET, RDT, CPI, IMD, IMO, PSI, CSN) \quad (1)$$

Here, *EEI* is entrepreneurship ecosystem index, while explanation of other variables is presented in Table: 2. *EEI* was a linear sum of composite-index of above-said factors, while it was multiplied by weightage of corresponding variables. Thus, final *EEI* was measured as:

$$[EEI]_{c,t} = [W_1 \times FE\_CI]_{c,t} + [W_2 \times GSP\_CI]_{c,t} + [W_3 \times TB\_CI]_{c,t} + [W_4 \times GP\_CI]_{c,t} + [W_5 \times BSEET\_CI]_{c,t} + [W_6 \times PSEET\_CI]_{c,t} + [W_7 \times RDT\_CI]_{c,t} + [W_8 \times CPI\_CI]_{c,t} + [W_9 \times IMD\_CI]_{c,t} + [W_{10} \times IMO\_CI]_{c,t} + [W_{11} \times PSI\_CI]_{c,t} + [W_{12} \times CSN\_CI]_{c,t} \quad (2)$$

Here, *Wi* is the weightage of i^{th} variable; *CI* is *composite-index* of i^{th} variable; *c* is cross-sectional country; *t* is time period (i.e. 2000–17). *Composite-index* was assessed as:

$$[CI]_{i,c,t} = \{[(X)_{i,c,t} - Min\ (X)_{i,c,t}]/[Max\ (X)_{i,c,t} - Min\ (X)_{i,c,t}]\} \quad (3)$$

Here, $CI_{i,c,t}$ is a *composite–index* for i^{th} variable in cross-sectional country (*c*) in time (*t*). $(X)_{i,c,t}$, $Min\ (X)_{i,c,t}$ and $Max\ (X)_{i,c,t}$ are the actual, lowest and highest values respectively in each series of a specific variable across country (*c*) in time (*t*). Above-mentioned process was used recursively for each variable individually with every year. Estimated values of *CI* for a variable lies between 0 to 1 (Kumar and Sharma, 2013; Kumar et al., 2015; Kumar et al., 2017; Sharma and Singh, 2017; Singh et al., 2017; Dhahri and Omri, 2018; Singh and Issac, 2018). In equation (3), W_i for each variable was estimated as:

$$Wi = \frac{K}{[\sqrt{Var\ (CIc,t)}]} \quad (4)$$

Here, *Var* is variance across *CIs* for a specific variable, while K value was calculated as:

Here, $K = \frac{1}{\left\{\sum_{i=1}^{n} \frac{1}{\sqrt{Var\,(CIc,t)}}\right\}}$ (5)

Table 2. Brief explanation of *EEI* associated variables

Indicators	Symbol	Unit
Financing for entrepreneurs	*FE_CI*	Number
Governmental support and policies	*GSP_CI*	Number
Taxes and bureaucracy	*TB_CI*	Number
Governmental programs	*GP_CI*	Number
Basic school entrepreneurial education and training	*BSEET_CI*	Number
Post school entrepreneurial education and training	*PSEET_CI*	Number
R&D transfer	*RDT_CI*	Number
Commercial and professional infrastructure	*CPI_CI*	Number
Internal market dynamics	*IMD_CI*	Number
Internal market openness	*IMO_CI*	Number
Physical and services infrastructure	*PSI_CI*	Number
Cultural and social norms	*CSN_CI*	Number

Source: GEM (2017).

4. Empirical Analysis

4.1. Formulation of Empirical Model for EEI and Socio-economic Factors

Earlier studies such as Sattar and Mahmood (2011); Kumar and Sharma (2013); Kumar et al. (2015); Bashir and Akhtar (2016); Sharma and Singh (2017); Kumar et al. (2017); Rusu and Roman (2017); Singh et al. (2017a,b); Dvouletý et al. (2018); Dhahri and Omri (2018); Singh and Issac (2018); Tasnim and ibne Afzal (2018); Singh et al. (2019); Büyüksarıkula and Kahramanoğlu (2019); Singh et al. (2020); Singh, Singh and Negi (2020) have used estimated indexes as a dependent and independent variables for different empirical investigations in different economies. Since, this

study assesses the association of *EEI* with per capita GDP and other socio-economic variables. Thus, *EEI* was used as a dependent variable, and as a function of socio-economic which was specified as:

$$EEI = f\,(gdppc, gdppcg, fdino, setpte, eepgni, ftsphp, htepme, mtpgdp, rdepgdp, pat) \quad (5)$$

Here, *EEI* is entrepreneurship ecosystem index (in number); *gdppc* is GDP per capita (constant 2010 US$); *gdppcg* is GDP per capita growth (annual %); *fdino* is Foreign direct investment net outflows (% of GDP); *setpte* is Self-employed (% of total employment); *eepgni* is Education expenditure (% of GNI); *ftsphp* is Fixed telephone subscribers (per 100 people); *htepme* is High-technology exports (% of manufactured exports); *mtpgdp* is Merchandise trade (% of GDP); *rdepgdp* is R&D expenditure (% of GDP); *pat* is Patent applications total (Residents+Non-residents) (See Table: 3). The linear regression model was used as:

$$(EEI)_{ct} = \alpha_0 + \alpha_1 (gdppc)_{ct} + \alpha_2 (gdppcg)_{ct} + \alpha_3 (fdino)_{ct} + \alpha_4 (setpte)_{ct} + \alpha_5 (eepgni)_{ct} + \alpha_6 (ftsphp)_{ct} + \alpha_7 (htepme)_{ct} + \alpha_8 (mtpgdp)_{ct} + \alpha_9 (rdepgdp)_{ct} + \alpha_{10} (pat)_{ct} + \mu_{ct} \quad (6)$$

Here, α_0 is the constant term; $\alpha_1 \ldots \alpha_{10}$ are the regression coefficients of associated variables; and μ_{ct} error term in equation (6). Non-linear and log-linear regression models were used as:

$$(EEI)_{ct} = \beta_0 + \beta_1 (gdppc)_{ct} + \beta_2 (\text{Sq. } gdppc)_{ct} + \beta_3 (gdppcg)_{ct} + \beta_4 (\text{Sq. } gdppcg)_{ct} + \beta_5 (fdino)_{ct} + \beta_6 (\text{Sq. } fdino)_{ct} + \beta_7 (setpte)_{ct} + \beta_8 (\text{Sq. } setpte)_{ct} + \beta_9 (eepgni)_{ct} + \beta_{10} (\text{Sq. } eepgni)_{ct} + \beta_{11} (ftsphp)_{ct} + \beta_{12} (\text{Sq. } ftsphp)_{ct} + \beta_{13} (htepme)_{ct} + \beta_{14} (\text{Sq. } htepme)_{ct} + \beta_{15} (mtpgdp)_{ct} + \beta_{16} (\text{Sq. } mtpgdp)_{ct} + \beta_{17} (rdepgdp)_{ct} + \beta_{18} (\text{Sq. } rdepgdp)_{ct} + \beta_{19} (pat)_{ct} + \beta_{20} (\text{Sq. } pat)_{ct} + \lambda_{ct} \quad (7)$$

Here, β_0 is the constant term; $\beta_1 \ldots \beta_{20}$ are the regression coefficients of associated variables; and λ_{ct} error term in equation (7).

$$log(EEI)_{ct} = \epsilon_0 + \epsilon_1\ log(gdppc)_{ct} + \epsilon_2\ log(gdppcg)_{ct} + \epsilon_3\ log(fdino)_{ct} + \epsilon_4\ log(setpte)_{ct} + \epsilon_5\ log(eepgni)_{ct} + \epsilon_6\ log(ftsphp)_{ct} + \epsilon_7\ log(htepme)_{ct} + \epsilon_8\ log(mtpgdp)_{ct} + \epsilon_9\ log(rdepgdp)_{ct} + \epsilon_{10}\ log(pat)_{ct} + \zeta_{ct} \quad (8)$$

Here, *log* is the natural logarithm of associated variables; ϵ_0 is constant term; ϵ_1 ... ϵ_{10} are the expected regression coefficients of associated variables; and ζ_{ct} error term in equation (8).

Table 3. Descriptions of *EEI* and explanatory variables

Description of Variables	Symbol	Unit	Category of variables
Entrepreneurship ecosystem index	*EEI*	Number	Entrepreneurship ecosystem
Per capita GDP (constant 2010 US$)	*gdppc*	US $	Economic development
Per capita GDP growth (annual %)	*gdppcg*	%	
Foreign direct investment net outflows (% of GDP)	*fdino*		
Self-employed as a % of total employment	*setpte*		
Education expenditure as a % of GNI	*eepgni*		Social development
Fixed telephone subscribers (per 100 people)	*ftsphp*	Numbers	
High-technology exports as a % of manufactured exports	*htepme*	%	Science & technology
Merchandise trade (% of GDP)	*mtpgdp*		
Research and development (R&D) expenditure as a % of GDP	*rdepgdp*		
Patent applications	*pat*	Number	IPRs

Source: Singh et al. (2020); Singh, Singh and Negi (2020).

4.2. Formulation of Empirical Model for Per Capita GDP and EEI

Previous studies such as Dvouletý et al. (2018) have also examined the impact of entrepreneurship ecosystem on HDI, GDP and GNI in 48 countries. Audretsch et al. (2015) have comprised per capita GDP as a dependent variable and it was regressed with new-firm start-ups in European economies. Bashir and Akhtar (2016) have also used global competitiveness

index as a proxy for entrepreneurship ecosystem to assess its influence on per capita GDP in G20 economies. Zaki and Rashid (2016) have comprised GDP growth as an output, while number of new firms as a proxy for entrepreneurship ecosystem. Tasnim and ibne Afzal (2018) have also used GDP as output and it was regressed with gross capital formation, labour force and GEI in 59 cross economies. Büyüksarıkula and Kahramanoğlu (2019) have examined the association of prosperity index with economic growth in Turkey. Therefore, in this study, per capita GDP was used as a dependent variable, while *EEI* and other factors were considered as independent variables. For this, the regression model was used as:

$$(gdppc)_{ct} = £_0 + £_1 (EEI)_{ct} + £_2 (gdpppe)_{ct} + £_3 (setpte)_{ct} + £_4 (fdino)_{ct} + £_5 (igdpd)_{ct} + £_6 (eepgni)_{ct} + £_7 (ftsphp)_{ct} + £_8 (iuipp)_{ct} + £_9 (pat)_{ct} + £_{10} (rdepgdp)_{ct} + \varepsilon_{ct} \quad (9)$$

Here, *gdppc* is GDP per capita (constant 2010 US$); *EEI* is Entrepreneurship ecosystem index (in number); *gdpppe* is GDP per person employed (constant 2011 PPP $); *setpte* is Self-employed total (% of total employment); *fdino* is Foreign direct investment net outflows (% of GDP); *igdpd* is Inflation GDP deflator (annual %); *eepgni* is Education expenditure (% of GNI); *ftsphp* is Fixed telephone subscribers (per 100 people); *iuipp* is Individuals using the internet (% of population); *pat* is Patent applications total (Residents + Non-residents); *rdepgdp* is R&D expenditure (% of GDP). $£_0$ is the constant coefficient; $£_1 \ldots £_{10}$ are the regression coefficient of respective explanatory variables; and ε_{ct} is the error term in equation (9) (See Table: 4).

Table 4. Descriptions of per capita GDP and explanatory variables

Description of Variables	Symbol	Unit	Category of variables
Per capita GDP (constant 2010 US$)	*gdppc*	US $	Economic development
Entrepreneurship ecosystem index	*EEI*	Number	Entrepreneurship ecosystem
GDP per person employed (constant 2011 PPP $)	*gdpppe*	US $	Economic development
Self-employed as a % of total employment	*setpte*	%	
Foreign direct investment net outflows (% of GDP)	*fdino*		
Inflation GDP deflator (annual %)	*igdpd*		
Education Expenditure as a % of GNI	*eepgni*		Social development
Fixed telephone subscribers (per 100 people)	*ftsphp*	Number	
Individuals using the internet as a % of total population	*iuipp*	%	
Research and development expenditure as a % of GDP	*rdepgdp*		Science & technology
Patent applications (total)	*pat*	Number	Intellectual property rights

Source: Singh et al. (2020); Singh, Singh and Negi (2020).

Non-linear and log-linear regression models were also applied as:

$$(gdppc)_{ct} = \gamma_0 + \gamma_1 (EEI)_{ct} + \gamma_2 (\text{Sq. } EEI)_{ct} + \gamma_3 (gdpppe)_{ct} + \gamma_4 (\text{Sq. } gdpppe)_{ct} + \gamma_5 (setpte)_{ct} + \gamma_6 (\text{Sq. } setpte)_{ct} + \gamma_7 (fdino)_{ct} + \gamma_8 (\text{Sq. } fdino)_{ct} + \gamma_9 (igdpd)_{ct} + \gamma_{10} (\text{Sq. } igdpd)_{ct} + \gamma_{11} (eepgni)_{ct} + \gamma_{12} (\text{Sq. } eepgni)_{ct} + \gamma_{13} (ftsphp)_{ct} + \gamma_{14} (\text{Sq. } ftsphp)_{ct} + \gamma_{15} (iuipp)_{ct} + \gamma_{16} (\text{Sq. } iuipp)_{ct} + \gamma_{17} (pat)_{ct} + \gamma_{18} (\text{Sq. } pat)_{ct} + \gamma_{19} (rdepgdp)_{ct} + \gamma_{20} (\text{Sq. } rdepgdp)_{ct} + \theta_{ct} \quad (10)$$

Here, γ_0 is the constant coefficient; $\gamma_1 \ldots \gamma_{20}$ are the regression coefficients of corresponding independent variables; and θ_{ct} is error term in equation (10).

$$log(gdppc)_{ct} = \delta_0 + \delta_1 log(EEI)_{ct} + \delta_2 log(gdpppe)_{ct} + \delta_3 log(setpte)_{ct} + \delta_4 log(fdino)_{ct} + \delta_5 log(igdpd)_{ct} + \delta_6 log(eepgni)_{ct} + \delta_7 log(ftsphp)_{ct} + \delta_8 log(iuipp)_{ct} + \delta_9 log(pat)_{ct} + \delta_{10} log(rdepgdp)_{ct} + \eta_{ct} \quad (11)$$

Here, *log* is the natural logarithm of associated variables; δ_0 is the constant coefficient; $\delta_1 \ldots \delta_{10}$ are the regression coefficients of corresponding variables; and η_{ct} is error term in equation (11).

4.3. Process to Select an Appropriate Model

As the present study was included linear, non-linear and log-linear regression models to estimate the regression coefficients of explanatory variables. It assembles county-wise panel data of dependent and explanatory variables during 2000–2017. So, it was necessary to choose a suitable model which produce a better empirical results. Ramsay RESET test was applied to determine the suitability of functional forms of the models (Singh, 2018; Jyoti and Singh, 2020). Akaike Information Criterion (*AIC*) and Schwarz Information Criteria (*BIC*) were used to recognize the consistency of regression coefficients (Audretsch and Belitski, 2017; Sharma and Singh, 2017; Singh, 2018; Singh and Issac, 2018). Furthermore, it was essential to select an appropriate econometric model to avoid the misinterpretation of empirical findings. Thus, it recognizes the presence of panel unit root in each series of data through Im-Pesaran-Shin unit-root test (Kumar and Sharma, 2013; Kumar and Sharma, 2014; Kumar, Sharma and Ambrammal, 2015; Kumar et al., 2016; Singh et al., 2017a,b; Sharma and Singh, 2017; Dhahri and Omri, 2018). Accordingly, random and fixed effect models were applied to estimate the country and time effect on output in panel data (Kar and Özşahin, 2016; Singh and Issac, 2018). Suitability of proposed models were tested through Hausman specification and Breusch Pagan Lagrange

Multiplier test (Kumar, Sharma and Ambrammal, 2015; Kumar et al., 2017). Cross-sectional dependency was recognized using Pesaran's test in each panel data (Sharma and Singh, 2017; Singh et al., 2017a,b). Modified Wald test was used to identify the prevalence of heteroskedasticity in panel data (Kumar, Sharma and Ambrammal, 2015; Kar and Özşahin, 2016). Lagram-Multiplier test was used to detect the presence of serial-correlation and auto-correlation in each panel data (Singh and Issac, 2018; Dvouletý, 2018). Prior studies have claimed that linear regression correlated panels corrected standard errors (*PCSEs*) model is useful to reduce the presence of cross-sectional dependency, heteroskedasticity, serial-correlation and auto-correlation in panel data (Kumar, Sharma and Ambrammal, 2015; Singh et al., 2019; Singh, Singh and Negi, 2020). Thus, *PCSEs* model was used to estimate the regression coefficients of explanatory variables in all regression models.

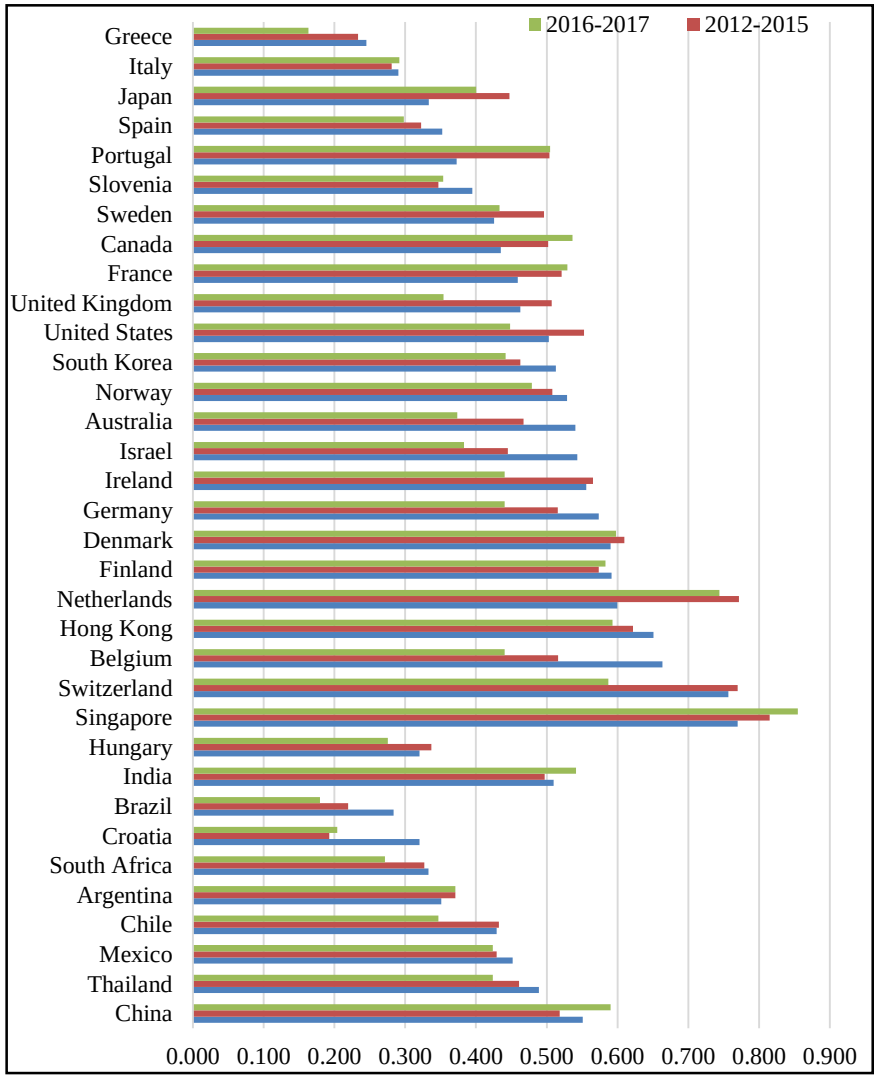
5. Discussion on Descriptive Results

5.1. Performance of Selected Economies in Entrepreneurship Ecosystem

The mean values of estimated *EEI* during 2008-2011, 2012-2015, and 2016-17 is presented in Figure: 1. Estimated mean values of *EEI* lies between 0.20-0.86 during 2016-2017, thus it infers that there was high variation in entrepreneurship ecosystem across economies. It was also seemed that high variation in entrepreneurship ecosystem occurs due to high diversity in education expenditure, foreign direct investment net inflow and outflows, GDP per capita, GDP per capita growth, GDP per person employed,

consumer prices inflation, inflation GDP deflator, fixed telephone subscribers, individuals using the internet, high-technology exports, numbers of medium and high-tech industries, merchandise trade, R&D expenditure in public and private research organizations and industries in the selected countries. Aforementioned factors were found main drivers to increase or decrease the entrepreneurship ecosystem. Estimated values of *EEI* were also expressed that Singapore have a better position in entrepreneurship ecosystem among the 34 economies. Netherlands, Denmark, Hong Kong, China, Switzerland, Finland, India, Canada, France, Portugal have a values of *EEI* more than 0.50 during 2016–2017. Thus, these economies have relatively better position in entrepreneurship ecosystem. Since, these economies have better position in financing for entrepreneurs, governmental support and policies, taxes and bureaucracy, governmental programs, basic school entrepreneurial education and training, post school entrepreneurial education and training, R&D transfer, commercial and professional infrastructure, internal market dynamics, internal market openness, physical and services infrastructure, and cultural and social norms. As *EEI* was an integrated index of aforementioned activities, thus, these countries could maintain their better position in entrepreneurship ecosystem in the 34 countries. There were many factors such as low population growth, high per capita GDP, low poverty and income inequality, transparent government policies towards industrial sector, effective technological development, technological commercialization, strong IPRs regime were helpful for their countries to maintain their better position in entrepreneurship ecosystem.

Figure 1. Position of Selected Economies in Entrepreneurship Ecosystem



Source: Author's estimation.

India has 8th rank as per the estimated value of *EEI* during 2016–2017. Hence, India has a relatively lower position in entrepreneurship ecosystem as compared to Singapore, China and Hong Kong in Asia and other

developed economies like Netherlands, Denmark, Switzerland and Finland. Here, it is argued that India could not maintain its position in entrepreneurship ecosystem due to overwhelming urbanization, high population growth, low number of researchers and scientists in research institutions, low R&D expenditure in research organizations, low technology transfer from research organizations and laboratories to industries and manufacturing firms, low technology commercialization, low technological development, low association of research institutions with manufacturing firms, low trust of industries to buy technologies from research organizations, insignificant association between medium and small firms in manufacturing sector, insignificant financial supports from government for newly born industries, and ineffective and unfair government policies. Thus, it is crucial to consider above activities in policy formulation to strengthening the entrepreneurship ecosystem for India.

Norway, United States, South Korea, Ireland, Belgium, Germany, Sweden, Thailand, Mexico, Japan, Israel, Australia, Argentina, United Kingdom, Slovenia and Chile have the values of *EEI* between 0.31-0.49 during 2016–2017. Thus, these economies are required to improve their position in entrepreneurship ecosystem through adopting effective policies. Further, it was appeared that Spain, Italy, Hungry, South Korea, Croatia and Brazil have the values of *EEI* less than 0.31 during 2016-17. Hence, these economies have a lower position in entrepreneurship ecosystem as compared to other economies. Greece has 34th position in estimated value of *EEI* during 2016 – 2017. Therefore, it was found as a poorest country in entre-

preneurship ecosystem in the 34 countries. Furthermore, the mean values of *EEI* for undertaken economies (except Singapore) are varied during 2008-2011, 2012-2015, and 2016-17. Thus, it clearly indicates that socio-economic structure, government policies and science & technological development play a significant role to boost the entrepreneurship ecosystem.

5.2. Entrepreneurship Ecosystem in Efficiency, Innovation and Factor Driven Economies

Global Entrepreneurship Monitor (GEM) have divided global economies in three categories i.e. (i) Factor–driven economies, (ii) Efficiency-driven economies, and (iii) Innovation–driven economies (Ács and Szerb, 2010).[2] Factor driven economies are the developing economies which are largely agrarian based economies. This is the 1st stage of development in which agriculture sector is prime source of employment in an economy (Ács and Szerb, 2010). It includes the large number of unskilled labour with ample availability of natural resources. There would be a high competition in production process with better quality of output in efficiency–driven economies. This is 2nd stage of development in which industries produce basic goods and services (Ács and Szerb, 2010). Innovation–driven economies are the knowledge oriented country in which service sector is a prime source for employment. This is 3rd stage of development in which knowledge of peoples consider as a key inputs in production of goods and services (Ács and Szerb, 2010).

[2] https://www.gemconsortium.org/wiki/1367

In this study, undertaken economies were divided in factor-driven, efficiency-driven and innovation-driven economies based on estimated values of *EEI* during 2008–2011, 2012-2015 and 2016–2017 (Refer to Table: 5). It is useful to make cross comparison of economies in entrepreneurship ecosystem in different time span. Mean values of estimated *EEI* for during three different time periods (i.e., 2008-2011, 2012-2015 and 2016-2017) were used to make the cross comparison of economies in entrepreneurship ecosystem. For this, the comparison of economies was also based on GEM report published in 2017–18. According to this report, India and Hungary were the factor-driven economies, thus both the economies have insignificant position in entrepreneurship ecosystem. India has a better position in entrepreneurship ecosystem than Hungary. India's rank in entrepreneurship ecosystem was increased form 15th position during 2008–2011 to 8th position during 2016–2017. Thus, India have given a significant effort to make conducive entrepreneurship ecosystem. China, Thailand, Mexico, Chile, Argentina, South Africa, Croatia and Brazil were the efficiency-driven economies. In these economies (except China) the estimated values of *EEI* lie between 0.18–0.42 during 2016-2017. Ranking of efficiency-driven economies (except Argentina) in *EEI* were decreased after 2008. Hence, these economies required to focus to increase their position in entrepreneurship ecosystem. China has a best entrepreneurship ecosystem among the efficiency-driven economies. China could improve its position in entrepreneurship ecosystem as its ranks was increased from 10th position in 2008–2011 to 5th position in 2016–17. Brazil has a lowest value of *EEI* during

2008-2011, 2012–2015 and 2016–2017 among the efficiency-driven economies. Thus, it has a very poor position in entrepreneurship ecosystem in this group.

Singapore, Switzerland, Belgium, Hong Kong, Netherlands, Finland, Denmark, Germany, Ireland, Israel, Australia, Norway, South Korea, United States, United Kingdom, France, Canada, Sweden, Slovenia, Portugal, Spain, Japan, Italy and Greece are innovation-driven economies. As the estimated values of *EEI* for these economies lie between 0.163-0.855 during 2016-2017. Hence, it was specified that there is high diversity in entrepreneurship ecosystem in these economies. Furthermore, most economies like Singapore, Switzerland, Hong Kong, Netherlands, Finland, Denmark, France, Canada and Portugal have created a suitable entrepreneurship ecosystem. As these economies have values of *EEI* more than 0.50 during 2016-2017. Hence, these economies have a better position in entrepreneurship ecosystem among the innovation–driven economies. Singapore and Netherland have a 1st and 2nd position in entrepreneurship ecosystem as per the estimated values of *EEI* during 2016-2017. Thus, both the Singapore and Netherland have a better position in entrepreneurship ecosystem among the 34 economies. Results also indicate that Singapore and Hong Kong were found efficient to maintain the better entrepreneurship ecosystem during 2008–2017.

Table 5. Groups of countries in factor, efficiency and innovation driven economies

Category of Economies	**Country/Year**	**2008–2011**		**2012–2015**		**2016–2017**	
		Value	Rank	Value	Rank	Value	Rank
Efficiency-driven economies	China	0.551	10	0.518	10	0.590	5
	Thailand	0.489	17	0.461	21	0.424	19
	Mexico	0.452	20	0.429	25	0.424	20
	Chile	0.429	22	0.432	24	0.347	27
	Argentina	0.351	27	0.371	26	0.371	24
	South Africa	0.333	29	0.327	29	0.271	31
	Croatia	0.320	30	0.192	34	0.204	32
	Brazil	0.284	33	0.219	33	0.180	33
Factor driven economies	India	0.510	15	0.497	17	0.541	8
	Hungary	0.320	31	0.337	28	0.275	30
Innovation-driven economies	Singapore	0.770	1	0.815	1	0.855	1
	Switzerland	0.757	2	0.770	3	0.587	6
	Belgium	0.663	3	0.516	11	0.440	16
	Hong Kong	0.651	4	0.622	4	0.593	4
	Netherlands	0.600	5	0.772	2	0.744	2
	Finland	0.591	6	0.573	6	0.583	7
	Denmark	0.590	7	0.610	5	0.598	3
	Germany	0.573	8	0.515	12	0.440	17
	Ireland	0.556	9	0.565	7	0.441	15
	Israel	0.543	11	0.445	23	0.383	22
	Australia	0.540	12	0.467	19	0.374	23
	Norway	0.529	13	0.508	13	0.479	12
	South Korea	0.513	14	0.462	20	0.442	14
	United States	0.503	16	0.553	8	0.448	13
	United Kingdom	0.463	18	0.507	14	0.354	25
	France	0.459	19	0.521	9	0.529	10
	Canada	0.435	21	0.502	16	0.536	9
	Sweden	0.426	23	0.496	18	0.433	18
	Slovenia	0.395	24	0.347	27	0.354	26
	Portugal	0.373	25	0.504	15	0.505	11
	Spain	0.352	26	0.322	30	0.298	28
	Japan	0.333	28	0.447	22	0.400	21
	Italy	0.290	32	0.281	31	0.292	29
	Greece	0.245	34	0.233	32	0.163	34

Source: Author's estimation.

Entrepreneurship ecosystem in Netherlands, Denmark, Norway, United States, France, Canada and Portugal were significantly improved in 2016-17 as compared to 2008-2011. Moreover, the estimated values of *EEI* was less than 0.50 for Belgium, Germany, Ireland, Israel, Australia, Norway, South Korea, United States, United Kingdom, Sweden, Slovenia, Spain, Japan, Italy and Greece during 2016-2017. Germany, Ireland, Australia, Norway, South Korea and United States were in better position in entrepreneurship ecosystem during 2008-2011. Hence, it indicates that entrepreneurship ecosystem of these economies were declined after 2011. Greece and Brazil have the 34th and 33rd position in estimated value of *EEI* during 2016-2017. Thus, both the economies were found in deprived position in entrepreneurship ecosystem. Hence, here it can be concluded that entrepreneurship ecosystems were varies across economies and across years.

5.3. Rationality of Estimated Country-wise EEI

This study was generated *EEI* as an integration of its 12 indicators of entrepreneurship ecosystem using *Composite Z-score* technique for selected 34 economies. Since, previous studies have urged that estimated index may be used as a policy tool after its authentication (Singh, Singh and Negi, 2020; Singh et al., 2020). Thus, it was compulsory to check the viability and consistency of *EEI*. Kumar et al. (2013); Kumar et al. (2017); Singh et al. (2017a); Singh et al. (2018); Singh and Issac (2018); Singh et al. (2019) have also tested authenticity of estimated indexes using statistical techniques. Also, aforesaid researchers have claimed that an index may be valid

if it has a positive or negative but statistically significant correlation with its internal and external related variables. Internal and external variables with relevance to estimated index can be selected form the existing literature. Hence, Karl Pearson correlation coefficient of *EEI* with GDP per capita, GDP per capita growth, GDP per person employed, FDI net outflows, consumer prices inflation, inflation GDP deflator, fixed telephone subscribers, individuals using the internet, high-technology exports, medium and high-tech industry, merchandise trade; R&D expenditure, and patent applications were calculated to check the validity of *EEI* (Refer to Table: 6). Coefficients indicate that *EEI* was positively correlated with GDP per capita, GDP per capita growth, GDP per person employed, FDI net outflows, fixed telephone subscriber, individuals using the internet, high-technology exports, medium and high-tech industry, merchandise trade, R&D expenditure and patent applications. Conversely, *EEI* was negatively correlated with consumer prices inflation and inflation GDP deflator. Thus, here it is clear that estimated values of *EEI* has a validity and *EEI* can be considered for empirical investigation.

Table 6. Correlation coefficients of *EEI* with socio-economic variables

Indicators	*EEI*	*gdppc*	*gdppcg*	*gdpppe*	*fdino*	*cpi*	*igdpd*	*ftsphp*	*iuipp*	*htepme*	*mhtipmva*	*mtpgdp*	*rdepgdp*	*pat*
EEI	1													
gdppc	0.43**	1												
gdppcg	0.07*	-0.35**	1											
gdpppe	0.44**	0.88**	-0.32**	1										
fdino	0.33**	0.26**	0.08*	0.36**	1									
Cpi	-0.21**	-0.41**	0.12**	-0.41**	-0.11**	1								
igdpd	-0.22	-0.34	0.22**	-0.34*	-0.12	0.57**	1							

	**	**		*	**										
ftsphp	0.31**	0.59**	-0.21**	0.62**	0.23**	-0.38**	-0.35**	1							
iuipp	0.29**	0.70**	-0.37**	0.67**	0.22**	-0.41**	-0.33**	0.46**	1						
htep-me	0.51**	0.24**	0.13**	0.32**	0.18**	-0.18**	-0.18**	0.23**	0.12**	1					
mhtipmva	0.46**	0.45**	-0.04	0.49**	0.19**	-0.27**	-0.31**	0.28**	0.41**	0.69**	1				
mtpgdp	0.41**	0.05	0.08*	0.31**	0.52**	-0.09*	-0.14**	0.15**	0.16**	0.37**	0.31**	1			
rdepgdp	0.32**	0.55**	-0.23**	0.47**	-0.01	-0.37**	-0.37**	0.48**	0.59**	0.25**	0.56**	-0.07*	1		
pat	0.11**	-0.02	0.09*	-0.06	-0.13**	-0.11**	-0.10**	0.02	0.07*	0.18**	0.12**	-0.19**	0.27**	1	

Source: Author's estimation. **Note:** **: Correlation coefficient is statistically significant at the 1% level and *: Correlation coefficient is statistically significant at the 5% level. Explanation of Variables: *EEI* - Entrepreneurship ecosystem index; *gdppc* - GDP per capita (constant 2010 US$); *gdppcg* - GDP per capita growth (annual %); *gdpppe* - GDP per person employed (constant 2011 PPP $); *fdino* - Foreign direct investment net outflows (% of GDP); *cpi* - Consumer price inflation (annual %); *igdpd* – Inflation GDP deflator (annual %); *ftsphp* - Fixed telephone subscribers (per 100 people); *iuipp* - Individuals using the internet (% of population); *htepme* - High-technology exports (% of manufactured exports); *mhtipmva* - Medium and high-tech industry (% manufacturing value added); *mtpgdp* - Merchandise trade (% of GDP); *rdepgdp* - Research and development expenditure (% of GDP); *pat* - Patent applications total (Residents + Non-residents).

6. Discussion on Empirical Results

6.1. Impact of Per Capita GDP and Socio-economic Variables on EEI

Regression coefficients of explanatory variables with *EEI* is presented in Table: 7. Linear, non-linear and log-linear regression models were applied to check the viability and reliability of regression coefficients of explanatory variables. As log-linear regression model was produced a lower value of *AIC* and *BIC* than linear and non-linear regression models, thus, this model produce better results. Also, the model has a value of variance inflation factor (*VIF*) less than 10, thus, this model does not have multi-correlation. So, regression coefficients of *EEI* with explanatory variables were estimated using a log-linear regression model under linear regression

correlated panels corrected standard errors (*PCSEs*) model. The detail of estimated regression coefficients with *EEI* is given here:

Per capita GDP (gdppc) and per capita GDP growth (gdppcg): Per capita GDP is an important determinant to increase the attention of people to be entrepreneurs. Thus, per dy such as Dvouletý et al. (2018) which have also perceived positive impacapita GDP show positive impact on *EEI*. The result is similar to previous stuct of entrepreneurship ecosystem on GDP in 48 economies. Box et al. (2014); Dhahri and Omri (2018) have also found positive association of economic growth and per capita income with entrepreneurship ecosystem. Furthermore, it is also expected that high income of population is useful to increase investment possibilities, consequently per capita GDP will be helpful to create favourable entrepreneurship ecosystem.

Foreign direct investment (FDI) net outflows (fdino): FDI net outflows showed a positive impact on *EEI*. This result can be explained in way that FDI net outflows would be useful to increase entrepreneurship possibilities. Thus, FDI may be helpful to create an effective entrepreneurship ecosystem. The result is consistent with previous study such as Rusu and Roman (2017) which have found positive effect of FDI on entrepreneurial activities in European economies.

Self-employed as a % of total employment (setpte): The regression coefficient of self-employed with *EEI* was found positive. Therefore, there was a positive association of self-employed with entrepreneurship ecosystem in this study. Previous studies such as Naudé (2011); Box et al. (2014);

Wyrwich (2017); Fritsch and Wyrwich (2017) which have also argued that self-employed is a prime driver to boost entrepreneurship ecosystem.

Education Expenditure as a % of GNI (eepgni): Regression coefficient of education expenditure was positively associated with *EEI*. Here, it is recommended that education expenditure is useful to increase skills and knowledge of population, thereby dwellers of a country may be better entrepreneurs. As education is a supportive to increase the skills and knowledge of people in a country. Odilpova (2016) have also suggested that educated people would get more incentive to start their own business to increase their economic capacity.

Fixed telephone subscribers (per 100 people) (ftsphp): The regression coefficient of fixed telephone subscribers with *EEI* was found positive. Thus, it is useful to sustain entrepreneurship ecosystem. In this study, telephone subscribers were used as proxy for social media. Earlier studies such as Apenteng and Doe (2014), Srinivasan et al. (2016), Kumarasamy and Srinivasan (2017), Salamzadeh and Arbatani (2020), Salamzadeh and Dana, (2020) have claimed that social media works as an effective driver to boost entrepreneurship ecosystem. Lakshmi et al. (2017); Kumar and Ayedee (2018) have also reported that growth of SMEs is positively associated with enlargement of social media.

High-technology exports as a % of manufactured exports (htepme) and merchandise trade as a % of GDP (mtpgdp): Regression coefficients of high-technology exports and merchandise trade with *EEI* were seemed positive. Thus, it is proposed that high-technology is helpful to sustain en-

trepreneurship ecosystem. As high-tech goods and merchandise trade are the fruit of science & technological advancement. Earlier studies like Singh et al. (2017a,b) have argued that S&T may be useful to produce high-tech goods and services. Thus, exports of high-tech goods and services, and merchandise trade are helpful to increase entrepreneurship ecosystem.

Table 7. Effect of economic, S&T and IPRs related indicators on *EEI*

Model's Name	***Linear RM***		***Non-linear RM***		***Log-linear RM***	
No. of obs.	610		610		561	
Mean of VIF	1.98		20.18		2.87	
R-squared	0.4855		0.5470		0.4372	
Wald Chi2(15)	1559.90		1738.01		4365.69	
Prob>Chi2	0.0000		0.0000		0.0000	
AIC	-962.9101		-1024.628		-60.86111	
BIC	-914.3621		-940.7719		-108.488	
Ramsey RESET[F-Value]	50.666		1.72		2.90	
Prob > F	0.0000		0.1627		0.0343	
Variables	*Reg. Coe.*	*P>|t|*	*Reg. Coe.*	*P>|t|*	*Reg. Coe.*	*P>|t|*
gdppc	0.0012	0.000	0.0023	0.000	0.1017	0.0000
(*gdppc*)^2	-	-	0.0056	0.000	-	-
gdppcg	0.0075	0.000	0.0097	0.004	0.0271	0.0200
(*gdppcg*)^2	-	-	0.0001	0.891	-	-
fdino	0.0007	0.184	0.0049	0.000	0.0347	0.0030
(*fdino*)^2	-	-	-0.0010	0.000	-	-
setpte	0.0025	0.000	0.0012	0.108	0.0081	0.6340
(*setpte*)^2	-	-	0.0002	0.694	-	-
eepgni	0.0118	0.004	-0.0106	0.591	0.0329	0.3670
(*eepgni*)^2	-	-	0.0012	0.509	-	-
ftsphp	0.0003	0.352	-0.0092	0.000	-0.1267	0.0000
(*ftsphp*)^2	-	-	0.0001	0.000	-	-
htepme	0.0033	0.000	0.0053	0.000	0.1345	0.0000
(*htepme*)^2	-	-	-0.0001	0.000	-	-
mtpgdp	0.0008	0.000	0.0012	0.000	0.1815	0.0000
(*mtpgdp*)^2	-	-	0.0000	0.001	-	-
rdepgdp	0.0166	0.002	0.0439	0.007	0.0597	0.0190
(*rdepgdp*)^2	-	-	-0.0070	0.026	-	-
pat	0.0020	0.060	0.0005	0.271	0.0373	0.0000
(*pat*)^2	-	-	0.0007	0.929	-	-
Con. Coef.	0.0726	0.027	0.2464	0.000	-2.9446	0.0000

Source: Author's Estimation. Entrepreneurship ecosystem index (EEI): Dependent Variable 71

Research and development (R&D) expenditure as a % of GDP (rdepgdp): Regression coefficient of R&D expenditure with *EEI* was found positive. The result can be explained as R&D activities are helpful to create an innovative ideas and knowledge of the engineers, scientists and researchers. Innovative idea and knowledge prepare the platform for technological advancement which is supportive to discover and produce new goods and services, and to create new ventures. Singh, Arya and Jyoti (2019); Singh, Ashraf and Arya (2019); Singh et al. (2020) have also found the positive role of R&D expenditure in technological advancement. Hence, R&D expenditure is a driver to create entrepreneurship ecosystem in a country.

Patent applications total (pat): Regression coefficient of patent applications with *EEI* was found positive. In this study, patent applications were used as a representative of IPRs regime and innovation capacity of an economy. Previous studied such as Naudé (2011); Yang et al. (2014); Chen (2014); Odilpova (2016); Bashir and Akhtar (2016); Omoruyi et al. (2017) have also used patent applications as proxy for IPRs regime. Further, result clearly indicates that innovation is necessary to create entrepreneurship ecosystem. The result is consistent with previous studies such as Bashir and Akhtar (2016); Odilpova (2016); Omoruyi et al. (2017); Jyoti and Singh (2020) which have argued that patent applications signify the innovative capacity of a nation that may be helpful to create entrepreneurship ecosystem.

Also, empirical results based on non-linear regression model indicate that *EEI* has a linear and non-linear relationship with explanatory variables.

Per capita GDP, per capita GDP growth, self-employed person, merchandise trade and patent applications have a linear relationship with *EEI*. It demonstrates that entrepreneurship ecosystem increases linearly as increase in aforesaid variables. Further, estimates also infer that *EEI* have a hilly-shaped association with FDI net outflows and high-technology exports. *EEI* showed U-shaped relationship with education expenditure, fixed telephone subscribers and R&D expenditure.

6.2. Impact of EEI and other Variables on Per Capita GDP

Regression coefficients of explanatory variables with per capita GDP is presented in Table 8, while these were measured using linear, non-linear and log-linear regression models. Log-linear regression model has a lowest value of *AIC* and *BIC*; thus this model produces better results. Narrative on relationship of percapita GDP and explanatory variable is as follows:

Entrepreneurship ecosystem index (EEI): Regression coefficient of *EEI* with per capita GDP was appeared positive. It shows that entrepreneurship ecosystem is positively associated with economic growth and development. Similar result was also found by Zaki and Rashid (2016); Farayibi (2016); Arafat and Saleem (2017); Omoruyi et al. (2017); Rusu and Roman (2017); Acs et al. (2018). Furthermore, Ács and Szerb (2012) have perceived that entrepreneurship ecosystem have a positive impact on economic development in 79 cross economies.

GDP per person employed (gdpppe): GDP per person employed was showed a positive impact on per capita GDP. Thus, it is also useful to im-

prove per capita GDP and economic growth. GDP per person employed is a measures of total factor productivity. Hence, it also shows that total factor productivity is also helpful to increase per capita GDP.

Self-employed as a % of total employment (setpte): Self-employed have a positive impact on per capita GDP. This result is consistent with earlier study such as Wennekers et al. (2010) which have also reported ***positive*** effect of self-employed on per capita GDP. Further, it can be clarified that self-employment is a crucial to create additional jobs for skill and un-skilled labours. Consequently, it is helpful to increase per capita GDP.

Foreign direct investment (FDI) net outflows as a % of GDP (fdino): Regression coefficient of FDI net outflows with per capita GDP was found negative. This result can be defendable as FDI net inflows and outflows may be useful to maintain the international networks of entrepreneurs across economies. FDI is effective to create possibilities for entrepreneurs to start new business. Thus, FDI net inflows and outflows have a positive impact on per capita GDP. Hoda and Rai (2014); Wei and Balasubramanyam, (2015) have also noticed the significant impact of FDI on growth of manufacturing sector.

Inflation GDP deflator (igdpd): Regression coefficient of inflation GDP deflator with per capita GDP was found negative. Estimate indicates that inflation would cause to reduce per capita GDP. Result also implies that inflation has a negative impact on GDP growth and per capita GDP. Estimate is consistent with earlier studies such as Datta and Mukhopadhyay (2011); Jayathileke and Rathnayake (2013); Kasidi and Nwakanemela

(2013); Barro (2013); Wei and Balasubramanyam (2015); Adusei (2016); Rusu and Roman (2017) which have claimed that high inflation may be caused to reduce investment rate and per capita GDP.

Table 8. Effect of *EEI* and economic related indicators on Per Capita GDP

Model's Name	***Linear RM***		***Non-linear RM***		***Log-linear RM***	
No. of obs.	610		610		561	
Mean of VIF	2.07		25.70		2.66	
R-squared	0.8350		0.8661		0.9538	
Wald Chi2(15)	17614.59		46839.31		174064.98	
Prob>Chi2	0.0000		0.0000		0.0000	
AIC	-12775.84		-12668.62		-148.9142	
BIC	-12824.39		-12761.31		-101.2873	
Ramsey RESET [F-Value]	28.71		48.02		17.49	
Prob > F	0.0000		0.0000		0.0000	
Variables	*Reg. Coe.*	*P>|t|*	*Reg. Coe.*	*P>|t|*	*Reg. Coe.*	*P>|t|*
EEI	8663.3180	0.001	28006.980	0.000	0.06532	0.000
(*EEI*)^2	-	-	-26355.620	0.002	-	-
gdpppe	0.5255	0.000	0.55738	0.000	1.10652	0.000
(*gdpppe*)^2	-	-	0.0000	0.709	-	-
setpte	237.1383	0.000	235.3355	0.000	0.00246	0.931
(*setpte*)^2	-	-	-0.8873	0.224	-	-
fdino	-51.3153	0.075	51.8363	0.621	0.00662	0.211
(*fdino*)^2	-	-	-2.1753	0.278	-	-
igdpd	81.7511	0.360	643.3747	0.002	-0.02210	0.066
(*igdpd*)^2	-	-	-17.1586	0.002	-	-
eepgni	3727.5740	0.000	614.3707	0.287	0.27534	0.000
(*eepgni*)^2	-	-	241.5962	0.000	-	-
ftsphp	153.1054	0.000	-179.6774	0.047	0.26957	0.000
(*ftsphp*)^2	-	-	4.4812	0.000	-	-
iuipp	86.2476	0.001	-319.5759	0.000	0.04076	0.001
(*iuipp*)^2	-	-	3.8964	0.000	-	-
rdepgdp	1046.4930	0.001	9934.4190	0.000	0.13734	0.000
(*rdepgdp*)^2	-	-	-2054.710	0.000	-	-
pat	0.0095	0.000	0.0109	0.000	0.00963	0.000
(*pat*)^2	-	-	0.0000	0.214	-	-
Con. Coef.	-44346.1500	0.000	-34668.090	0.000	-3.73103	0.000

Source: Author's Estimation. Per Capita GDP: Dependent Variable

Education expenditure as a % of GNI (eepgni): Regression coefficient of education expenditure with per capita GDP was appeared positive. Here, it is reasonable that educated people have a more skills to choose various sources of income to sustain their livelihood security. Thus, education is a crucial element to increase social and economic development of people. Previous study like Odilpova (2016) have also found positive impact of schooling of people on GDP growth in 88 cross economies.

Fixed telephone subscribers per 100 people (ftsphp) and individuals using the internet as a % of total population (iuipp): Regression coefficients of fixed telephone subscribers and individual using internet with per capita GDP were seemed positive. Thus, it is expected that both the factors are useful to increase the communication of people across regions. Subsequently, it would be helpful to increase per capita GDP.

Research and development (R&D) expenditure as a % of GDP (rdepgdp): Regression coefficient of R&D expenditure with per capita GDP was found positive. Previous studies such as Zaki and Rashid (2016); Singh et al. (2017a,b) have also concluded that R&D expenditure have a positive impact on per capita GDP. It is also seemed that R&D expenditure is useful to enhance technological development and innovation. Further, technological development is useful to boost the growth of manufacturing sector and per capita GDP.

Patent applications total (pat): Patent applications was used as a proxy for IPRs regime to assess its impact on per capita GDP in this study. Regression coefficient of patent application with per capita GDP was found

positive. It specifies that IPRs regime is useful to enhance the economic growth of a country. Prior studies such as Laik (2005); Falvey and Foster (2006); Yang et al. (2014); Odilpova (2016); Singh et al. (2017a,b); Singh, Arya and Jyoti (2019); Singh, Ashraf and Arya (2019); Singh et al. (2020) have also reported that IPRs regime is useful to enhance technological transmission.

Also, results based on non-linear regression model shows that per capita GDP have a linear and non-linear relationship with explanatory variables. GDP per person employed, education expenditure and patent applications have a linear relationship with per capita GDP. It infers that per capita GDP increases linearly as increase in GDP per person employed, education expenditure and patent applications in an economy. *EEI*, self-employed as a % of total employment, FDI net outflows as a % of GDP, inflation GDP deflator and R&D expenditure as a % of GDP have a hilly-shaped relationship with per capita GDP. Per capita GDP have a U-shaped association with fixed telephone subscribers per 100 people and individuals using the internet as a % of total population.

7. Conclusion and Policy Proposals

The main objective of this study was to create country-wise entrepreneurship ecosystem index (*EEI*) for selected 34 economies during 2000–2017 using *Composite Z-score* technique. Thereupon, it explains the relative performance of undertaken economies in entrepreneurship ecosystem. Accordingly, it explores the impact of per capita GDP and vice-versa on esti-

mated country-wise *EEI* using linear, non-linear and log-linear regression models through county-wise panel data. Finally, it brings with several policy recommendations to create the appropriate entrepreneurship ecosystem in India. Descriptive results based on estimated *EEI*, provide a confirmation that there was existence of high variation in entrepreneurship ecosystem across economies. Estimated values of *EEI* also show that Singapore have a better position in entrepreneurship ecosystem among the 34 economies. Norway, Portugal, India, Canada, United Nations, Ireland, France, China, Finland, Denmark, Hong Kong, Switzerland and Nederland have a value of *EEI* more than 0.50. Thus, these economies have a suitable entrepreneurship ecosystem. India has an 8^{th} position in entrepreneurship ecosystem among the 34 economies. Thus, India must improve its position in entrepreneurship ecosystem through adopting an effective policy. Results also infer that innovation-driven economies have the better position in entrepreneurship ecosystem as compared to efficiency-driven and factor–driven economies. However, there was significant diversity in entrepreneurship ecosystem among the factor-driven, efficiency- driven and innovation-driven economies. China has a better positon in entrepreneurship ecosystem among the efficiency-driven economies. It is also suggested that Asian economies needs to pursue similar policies which was adopted by China to improve their position in entrepreneurship ecosystem.

Results based on Pearson Karl correlation coefficients proposed that socio-economic, IPRs and S&T related factors were responsible to increase high diversity in entrepreneurship ecosystem across economies. Estimates

also indicate that *EEI* was positively correlated with GDP per capita, GDP per capita growth, GDP per person employed, FDI net outflows, fixed telephone subscribers, individuals using the internet, high-tech exports, medium and high tech industry, merchandise trade, R&D expenditure and patent applications. Fixed telephone subscribers and individuals using the internet were found crucial measures of social media. Social media also maintains the communication among the people. Hence, it is argued that social media plays a vital role to increase entrepreneurship ecosystem. Moreover, S&T and IPRs related activities such as high-tech exports, medium and high tech industries, merchandise trade, R&D expenditure and patent applications have a positive association with *EEI*. Thus, S&T and IPRs related factors have a potential contribution in creation of entrepreneurship ecosystem. In contrary, consumer price inflation and inflation GDP deflator have a negative impact on *EEI*.

Empirical results exposed that entrepreneurship ecosystem would be improved as increase in per capita GDP, GDP per capita growth, FDI net outflows, self-employed, education expenditure, fixed telephone subscribers, high-technology exports, merchandise trade, R&D expenditure and patent applications in a country. In addition, results demonstrate that per capita GDP was positively associated with *EEI*, GDP per person employed, self-employed, education expenditure, fixed telephone subscribers, individuals using the internet, R&D expenditure and patent applications. Furthermore, estimates showed that per capita GDP will increase as increase in these variables. FDI outflows have a negative impact on per capita GDP. Per capita

GDP and *EEI* have a positive relationship and vice-versa, thus entrepreneurship ecosystem has a causal relationship with per capita GDP. Empirical findings of this study increase the attention of Indian and global policy makers, and development thinkers to adopt an effective policy to increase the use of technological development and IPRs regime to maintain entrepreneurship ecosystem.

At present India has a highest unemployment rate with largest youth population in the world (Singh et al., 2017b). Thus, India has a several challenges to create jobs for youth population. Hence, for the Government of India (GoI), it is essential to give free rights to entrepreneurs to start a new start-up and business. Further, it is perceived that non-tech entrepreneurship is useful to increase high-value added jobs, creation of wealth and new firms. Moreover, high-tech firms have higher sustainability as compared to non-tech entrepreneurship (Wennekers et al., 2010; Bashir and Akhtar, 2016; Jyoti and Singh, 2020). Thus, innovative entrepreneurship would be useful to enhance technological progress of industries and firms. Therefore, it would be a better proposed for GoI to give effective efforts to establish more innovative enterprises in India (Jha, 2013). It may be useful to increase the flow of innovative business ideas to attract the attention of private and public players in India (OECD, 2016). Also, it would increase the attention of foreign investors to increase their investment in Indian manufacturing firms.

Also, GoI needs to provide extensive financial support with affordable interest rate to new entrepreneurs to maintain their production and eco-

nomic activities (Colombo et al., 2004; Colombo and Grilli, 2005; Naudé et al., 2008; Mazanai and Fatoki, 2012; Jha, 2013; Farayibi, 2016; Singh, Ashraf and Arya, 2019). Moreover, as highly innovative economies like China, South Korea, Denmark, USA and Japan are capable to produce high-tech goods and services through utilizing extensive R&D activities (Bashir and Akhtar, 2016; Singh et al., 2020). In these economies, large number of researchers and scientists are doing research in emerging area of research. Consequently, these economies have a good position in technological development, and technology transfer and commercialization. Conversely, India has only 2% share, USA and China have more than 20% share in world's R&D activities (MHRD (GoI), 2013). Further, India has only 2.2% share in world's R&D investment, and contribution of public and private sectors in R&D expenditure is low in India (MHRD (GoI), 2013). Thus, India is required to increase R&D expenditure, and researchers and scientists in research universities. It would be helpful for manufacturing units to reduce their dependency of foreign technologies in India (Singh, Ashraf and Arya, 2019; Naderibeni et al., 2020). India also needs to increase proper transparency in government policies (e.g., tax reduction, environmental related concern, bank loan facility, and others). It would be useful to increase the awareness of foreign investors to increase their investment in Indian manufacturing sector. Furthermore, India should control high inflation to increase the contribution of businessmen and financial organizations in money and capital market. Also, industrial training for new entrepreneurs

must be mandatory to increase growth of MSMEs sector in India (Bhat and Khan, 2014).

In India, most of research institutions and universities do not have technology transfer offices (TTOs). Thus, technologies are not being transferred from research academia or laboratory to industries in India (Singh, Ashraf and Arya, 2019). Thus, commercialization of technologies could not generate enough revenue in research organizations and universities. Hence, it is essential to establish more TTOs in research organizations and universities to improve technology commercialization and transfer in India (Singh and Ashraf, 2019; Singh et al., 2020). It would create academic start-ups and entrepreneurship ecosystem in India (Singh, Ashraf and Arya, 2019). Moreover, it would also incentivize to entrepreneurs to start a new business in India. It is observed that around 40% of Indian graduates were found suitable for clerical and secretarial position in public and private organizations (Jha, 2013). Thus, Indian engineers have low capability to maintain international standards in job market (Jha, 2013). For this, India need to increase the skills of engineers and graduate students in all streams of academic organizations. India is a rural intensive economy, thus India requires to implement effective and conducive policy to boost rural entrepreneurship (Sharma et al., 2013). Thus, rural entrepreneurship would be useful for poverty eradication and to increase economic development in India.

7.1. Limitation of this Study and Suggestions for Further Researches

EEI estimation is a great contribution in this study. As entrepreneurship ecosystem includes several activities of a country. Thus, measurement of entrepreneurship ecosystem is controversial and it is difficult to provide a uniform and universally acceptable definition on entrepreneurship ecosystem. Socio-economic, IPRs and S&T related factors have a significant impact on entrepreneurship ecosystem. Therefore, measurement of entrepreneurship ecosystem of a country is a challenge for scientific research community. Hence, index based estimation of entrepreneurship ecosystem is an effective tool. In this study, *EEI* was created through a *Composite Z-score* method that more effective to reduce the statistical drawback of other techniques. Though, this technique has one limitation i.e. ranking of economies automatically change as every minor data revision. Also, ranking of countries depends upon number of factors which are included in index estimation. So, estimated index may be ineffective for inter-temporal comparisons of countries. Thus, the ranking and values of estimated *EEI* of this study might be differ from the values of GEI and GEDI. As this study includes 34 economies to estimate the entrepreneurship ecosystem index (*EEI*). Therefore, estimated values of *EEI* may not be similar with earlier studies which included more than 34 economies in measurement of entrepreneurship ecosystem. Also, included economies have significant diversity in socio-economic, S&T, IPRs and cultural activities. Thus, existing researchers can check the validity of empirical finding of this study using micro level of a specific economy. As this study creates the *EEI* for a specific time period,

and it is useful to see the trend in entrepreneurship ecosystem for respective economies. However, this study could not assess the factors which reflect the fluctuation in entrepreneurship ecosystem. Existing researchers may also consider this issue as a research gap for further study. Entrepreneurship ecosystem of an economy may be changed due to increase the role of private and public players in business activities. However, this study could not capture the influence of private and public players, and government policies on entrepreneurship ecosystem. Thus, it may be a crucial research direction for further study.

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