Relative Performance of Entrepreneurship Ecosystem for Selected Countries Using a Composite Z-score Technique of Index Estimation

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Article Info:	Abstract
  	The entrepreneurship ecosystem plays a positive role to increase social-economic and environmental development, financial development, technological advancement, and sustainable development in several dimensions. Earlier studies used different indicators for establishing empirical relationship between entrepreneurship ecosystem and macro level indicators. Therefore, there is no universal indicator of entrepreneurship ecosystem in the existing literature to observe its position across countries. Due to stated research gap, this study develops entrepreneurship creativity index (ECI) as an integration of 12 factors which are recommended vital determinants of entrepreneurship ecosystem by Global Entrepreneurship Monitoring (GEM). Accordingly, simple descriptive analytical technique is used to generate ECI across 53 countries during 2010–2018. The descriptive findings indicate that there appeared a significant variation in entrepreneurship ecosystem among the 53 countries. Most developed countries could improve their position in entrepreneurship ecosystem effectively. While most upper and lower middle-income countries could not increase their performance in entrepreneurship ecosystem due to low business opportunities, low transfer of technology, flexibility in IPR regime, R&D infrastructure, low R&D expenditure, and low technological upgradation. Entrepreneurial behavior and attitude, entrepreneurial skills and efficacy, and entrepreneurial education and training help to enhance entrepreneurship ecosystem. FDI inflow and outflow, self-employed and trust of investors on government policies help to nurture a conducive entrepreneurship ecosystem. **Keywords:** *Entrepreneurship ecosystem; Entrepreneurship creativity index; Technology transfer and commercialization; Entrepreneurial behavior and attitude; Social-economic development.*

1- Introduction

Entrepreneurship is defined as owning and managing a business activity (Acs, 2006). The term "Entrepreneurship" can be defined in multiple ways. Scientific research community and international development organization defined entrepreneurship ecosystem as per their own perspective. For instance, Isenberg (2010) defined entrepreneurship in terms of initiation by individual person to apply labour, capital, technology, raw materials to produce goods and services, and create innovation in the market. Therefore, entrepreneurship ecosystem creates new business opportunities for individual person who is known as entrepreneur (Isenberg, 2010). Entrepreneur is the person who take the risk to start a business using different factors of production and earn more profit and make social-economic changes in the market. Therefore, factors that lead to increase favorable environmental for entrepreneurs known as entrepreneurship ecosystem. Entrepreneurship ecosystem is a debatable concept among the researchers, academician and international organizations due to several reasons like scientific research community is unable to provide universally accepted definition, indicators and methods for measuring it (Singh & Ashraf, 2020).

Furthermore, existing scholars also defined entrepreneurship ecosystem as per the availability of different information and data in the area of entrepreneurship. Accordingly, prior studies used different factors or indicators for measuring the entrepreneurship ecosystem across countries (Singh & Ashraf, 2020). For instance, business density rate, new firm creation, number of registered firms, and employment rate are used as proxy variables for entrepreneurship ecosystem by leading research scholars and international organizations. Therefore, measurement of entrepreneurship ecosystem became a controversial issue and difficult for academician (Iversen et al., 2008; Malecki, 2018). Previous studies measured the entrepreneurship ecosystem and its associated factors using different methods (Erken et al., 2018). Although, prior studies and international organizations could not suggest a uniform indicators of entrepreneurship ecosystem and its key drivers. Furthermore, earlier studies claimed that factors related to socio-economic development, research & development activities, technological advancement, innovation, intellectual property rights (IPRs), foreign direct investment, government policies, foreign trade,

business activities, bank rate, monetary policy, infrastructural development and banking sector have an important implication on entrepreneurship ecosystem (Iversen et al., 2008; Fuerlinger et al., 2015; Erken et al., 2018; Audretsch et al., 2019; Singh et al., 2022; Sharma et al., 2023). Therefore, existing researchers do not use uniform indicators and methods for measuring entrepreneurship ecosystem (Adusei, 2017; Zeng & Ren, 2022). Also, most scholars used diversified indicators to assess the position of a country in entrepreneurship ecosystem. For instance, WEF (2013) explained eight different indicators of entrepreneurship ecosystem. Company formation in a financial year also reflect the entrepreneurship ecosystem (Chen, 2014). The World Bank is suggested that new business density rate also describes overall entrepreneurial performance of a country.

Furthermore, few studies considered self-employment ratio with total employment to define entrepreneurship ecosystem (Gleaser, 2007; Box et al., 2014). New business density rate also signifies the entrepreneurship ecosystem (Hameli et al., 2021). Entrepreneurship ecosystem also positively associated with self-employment (Wennekers et al., 2010). Business ownership rate also reflect the conducive entrepreneurship ecosystem. Thus, above-mentioned activities attribute the entrepreneurship ecosystem (Naude, 2011). Number of new businesses registered in a financial year also reveal the progress of entrepreneurship ecosystem (Reynolds et al., 1999). Scientific research community also claimed that ratio of employment rate with labour force in private sector also infers the position of appropriate entrepreneurship ecosystem (Li et al., 2012). Creation of new firms also indicates that entrepreneurship ecosystem (Audretsch et al., 2015). Few studies considered credit to SMEs to define the culture of entrepreneurship ecosystem (Farayibi, 2016). New establishment firms may be used as representative for entrepreneurship ecosystem (Zaki & Rashid, 2016). Number of start-ups also shows the rising trend in entrepreneurship ecosystem. There are some other variables like registered business firms, rate of self-employment and number of people per firms may be used to examine the performance of entrepreneurship ecosystem (Dvouletý, 2017; Dvouletý, 2018). Erken et al. (2018) used number of business owners per worker as an important indicator of entrepreneurship ecosystem in 22 OECD countries. Audretsch et al. (2019) considered economic, technological and societal dimensions of entrepreneurial activities to define entrepreneurship ecosystem. Sabra and Shreteh (2021) considered rate of start-ups growth to explain the performance of entrepreneurship ecosystem.

Moreover, most scholars focused their investigation to develop composite index of those variables which are essential to nurture entrepreneurship ecosystem. For instance, Singh and Ashraf (2020) develop entrepreneurship creative index which is the integration of 12 factors in the area of entrepreneurship. Singh et al. (2022) also applied index-based estimation to assess the interaction of entrepreneurship with sustainable development. Singh et al. (2023a) also examined the causal association between entrepreneurship and economic development. Singh & Jyoti (2023a) observed the casualty between digitalization and entrepreneurship as creating digitalization index and entrepreneurship index. Singh et al. (2023b) provided policy suggestions to increase the sustainable future of society based on estimating entrepreneurship ecosystem index. Above mentioned review infers that existing researchers are unable to provide the universally accepted indicators of entrepreneurship ecosystem. We, therefore, can be concluded that existing literature could not develop the effective measurement of entrepreneurship ecosystem. Furthermore, research academia is searching the answers for following research questions:

- What must be the best method to assess the position of entrepreneurship ecosystem across countries?
- Which indicators are useful to measure the position of entrepreneurship ecosystem?
- Which are essential socio-economic activities to boost the entrepreneurship ecosystem?
- How global countries can improve their position in entrepreneurship ecosystem?
- What may be implications of entrepreneurship ecosystem on entrepreneurial behaviors & attitudes.

The present study is attained following objectives:

- To create entrepreneurship creativity index (ECI) across 53 countries.
- To assess the association of ECI with economic growth and entrepreneurial behaviors & attitudes related indicators using correlation coefficients analytical technique.
- To pronounce effective policy proposals to create a favorable entrepreneurship ecosystem in global countries.

1.1 Theoretical Perspectives of Entrepreneurship Ecosystem and Its Implications

Schumpeter (1947) is pioneer economist who provide the theoretical perspective of entrepreneurship and its contribution for creation of value-added goods and services through innovation and entrepreneurship (Erken et al., 2018). Accordingly, economic growth and development are increased significantly due to entrepreneurship ecosystem at global level (Fuerlinger et al., 2015; Adusei, 2017; Memon et al., 2019; Singh & Kumar, 2022a; Singh et al., 2023a; Sharma et al., 2023). Earlier evidence indicate that entrepreneurship ecosystem is supportive to improve entrepreneurial activity, subsequently, it contributes towards economic growth and prosperity (Memon et al., 2019). Entrepreneurial ecosystem is also effective to contribute sustainability in different resources (Audretsch et al., 2019; Singh et al., 2022). For instance, sustainability in economic, social and environmental resources increase positively due to increase in green entrepreneurship ecosystem (Singh et al., 2023d). Singh et al. (2022) highlighted the significant contribution of entrepreneurship in sustainable development. Singh et al. (2023c) reported a positive impact of green entrepreneurship in economic sustainability.

Entrepreneurship is a significant driver to create new markets and increase market mechanism efficiency, and develop infrastructure (Audretsch et al., 2019). Entrepreneurship ecosystem helps to increase innovation and competition, and discover advance technologies for manufacturing sector (Acs, 2006; Adusei, 2017; Singh & Jyoti, 2023a). Innovation is useful to discover innovative goods and services and play a key to generate jobs and reduce unemployment rate (Audretsch et al., 2015; Singh & Kumar, 2022a). Furthermore, innovation is also positive to increase productivity and efficiency of resources (Acs, 2006; Singh & Ashraf, 2019). Innovation is also effective to create new business which provide jobs for skilled and unskilled workers. Accordingly, entrepreneurship ecosystem is helpful to increase purchasing power of economic agents and enhance their participation in markets. Further, marketing play a positive role to increase the growth of manufacturing sector (Singh et al., 2019a; Singh & Jyoti, 2020). Subsequently, entrepreneurship ecosystem also reinforces the industrial growth and development (Singh & Jyoti, 2021), and enhances the financial inclusion (Sharma et al., 2023). It is, therefore, helps to inspire social-economic and financial development (Chen, 2014; Singh et al., 2023a).

1.2 Components and Indicators of Entrepreneurship Ecosystem

Available theoretical literature provides five major components of new venture or start-up or firm which help to increase entrepreneurship ecosystem (Song et al., 2008; Jyoti & Singh, 2020). Few studies observed six key components of entrepreneurship ecosystem (Zaki & Rashid, 2016). Entrepreneurship ecosystem also lies in six domains (Fuerlinger et al., 2015; Memon et al., 2019). Moreover, aforesaid components have an interrelationship and interconnections with each other. The detail of each component is given as:

Table 1: Brief overview indicators of entrepreneurship ecosystem

Indicator	Category of Indicator	Sub-indicators
Regulatory Framework	Administrative	Government guideline; operating cost, needs of capital, legal process to start a venture; number of days required to start a business, taxes
	Bankruptcy and Rules	Bankruptcy recovery rate and guideline to start a business
	Product & Labour Market	Viability of new products, restriction in labour market, innovation in the market
	Court & Legal Framework	Social justice, social security, basic amenities, health security
	Social and Health Security	
	Income/Wealth/Taxes	Tax regime on income and wealth
	Business and Capital Taxes	Taxation and government policies for small scale enterprises, formation of capital
	Provision of protection of intellectual property of individual	Intellectual property rights (IPRs) regime, and property rights
Affordability of Market	Anti-trust Laws	Network policies, global value chain, foreign trade, licensing provision, fiscal and monetary policy
	Competition	
	Access to Foreign Markets	
	Public Involvement	
	Private Demand	
Access to Finance	Access to Debt Financing	Venture capital - early stage, expansion stage, buyouts, capitalization of primary and secondary stock market, investor protection
	Access to Venture Capital	
	Stock Markets	
Creation and Diffusion of Knowledge	R&D	Research & development (R&D) expenditure by public and private players, R&D in public and private institutions, etc.
	Technology transfer and commercialization	Source of innovation, university/industry research collaboration
	Co-operation Among Firms	
	Technology availability and advancement of technologies	Digitalization, ICTs, digital technologies, technological up-gradation, technological adoption capacity

Entrepreneurial Capabilities s	Business and Entrepreneurship training & education	Student start-ups in higher education, financial support for student start-ups, entrepreneurial training and education
	Immigration	Money flow, labour migration, transfer of capital, foreign direct investment inflow, etc.
Entrepreneurship Culture	Entrepreneurship education	Make entrepreneurs are job creators through entrepreneurial skills and education

Source: Stam and Spigel (2016); Rukuižienė (2016); Szerb et al. (2018a); Dvouletý (2018); Singh et al. (2020); Jyoti and Singh (2020); Singh and Kumar (2022b); Singh & Jyoti (2023b).

(i) Entrepreneurship and Entrepreneurial Team: It is team of peoples who take initiative to start a new venture or start-ups in the technological and non-technological fields (Song et al., 2008; Jyoti & Singh, 2020). Entrepreneur is a significant initiator to start a new venture and take the risk and make economic profit. The entrepreneurial team includes members' characteristics, experience, knowledge, and skills, values and benefits, and behaviors and leadership styles of entrepreneurs (Jha, 2013; Zaki & Rashid, 2016).

(ii) Enterprise Culture: Enterprise culture is positively associated with social and cultural of business families (Jha, 2013; Zaki & Rashid, 2016; Audretsch & Belitski, 2017). It incentivizes to new entrepreneurs to start their own business or venture. Occupation of the family is the key driver to create an enterprise culture.

(iii) Entrepreneurship Opportunity: It is situation in which entrepreneurship activities have a high tendency to grow in a systematic and scientific ways. It also increases ability of entrepreneurial team to develop new goods to sell in market and recover the cost of production (Song et al., 2008). Opportunity dimensions (i.e., types, form and sources of opportunity), environmental characteristics (i.e., environmental dynamics and heterogeneity) and market potential (i.e., market growth, completion intensity, entry barriers, buyers and supplier power, and consumer sophistication) create entrepreneurship opportunities.

(iv) Entrepreneurship Resources: Availability of finance (i.e., financial support from government and non-governmental bodies, and R&D investment), intellectual property rights (i.e., patent protection, licensing process, exclusive rights), partnership and networks (i.e., R&D alliance, partnership with research organizations), and institutional framework (i.e., firm age and size, geographical location)

also enhance entrepreneurship activities (Song et al., 2008; Sharma et al., 2013; Zaki & Rashid, 2016; Singh & Kumar, 2022b).

(v) Entrepreneurship Strategy and Fit: It maintains association among competitive strategy, structure, process and system in a new venture or start-ups (Song et al., 2008). It is helpful for entrepreneurial team to start a sector specific new venture (Zaki & Rashid, 2016; Jyoti & Singh, 2020).

(vi) Entrepreneurship Performance: To better performance of a start-up is an essential to nurture an entrepreneurship ecosystem (Song et al., 2008; Zaki & Rashid, 2016; Jyoti & Singh, 2020). The brief overview of indicators of entrepreneurship ecosystem is given in Table 1.

2- Conceptual Review

Entrepreneurship and entrepreneurship ecosystem are not new in the academic literature. The previous studies examined the impact of entrepreneurship ecosystem on several macro level indicators like economic development, economic growth, financial inclusion, employment rate, technological development, market creation, and technology transfer and commercialization (Box et al., 2014). While another group of studies observed the impact of macro level indicators on entrepreneurship ecosystem across countries. Existing studies identified the impact of entrepreneurship ecosystem on social development, economic development, financial development, technology transfer and commercialization in developed and development countries. The existing scholars used diverse indicators to explicate the impact of entrepreneurship ecosystem on economic development. The findings of Wennekers et al. (2010) suggested that self-employment and business ownership have a positive association with economic development. The empirical findings of this study also claimed that start-up rates of enterprises have a positive impact on economic development. Similar results are also produced by Chen (2014) in Taiwan. This study is considered company formation as a representative indicator for entrepreneurship ecosystem. It reported that entrepreneurship ecosystem is essential to promote employment rate.

Box et al. (2014) used self-employment rate as a proxy variable for entrepreneurship ecosystem for estimating its association with economic growth in Sweden. Audretsch et al. (2015) considered

new firms as a representative variable for entrepreneurship ecosystem. Farayibi (2016) highlighted that role of entrepreneurship ecosystem to promote economic growth. This study used SMEs as useful indicator for entrepreneurship ecosystem. Bashir and Akhtar (2016) applied correlation coefficient investigative technique to estimate the association between economic development and entrepreneurship in G20 countries using. Another study by Zaki and Rashid (2016) also investigated the role of entrepreneurship in economic growth in 7 different income group countries. It used linear regression model to identify the interconnection between entrepreneurship and economic development. Adusei (2017) concluded that entrepreneurship ecosystem plays a positive role to promote growth pattern in 12 African countries.

Omoruyi et al. (2017) also found a significant impact of entrepreneurship ecosystem on economic growth in Africa. Dvouletý (2017) observed the influence of entrepreneurship on unemployment rate in Czech regions. It is recommended that entrepreneurial activities are effective to reduce high unemployment rate. While Rusu and Roman (2017) measured the impact of diverse business factors on entrepreneurship ecosystem in EU countries. It claimed a significant contribution of entrepreneurship ecosystem in financial activities in European countries. Dhahri and Omri (2018) investigated the implication of entrepreneurial activity to create possibilities of sustainable development. Erken et al. (2018) claimed that entrepreneurship ecosystem has a significant influence on economic development. Afzal et al. (2018) attempted to examine the determinants of entrepreneurial capabilities in 5 Asian countries. It exhibited that entrepreneurial capability depends on perceived opportunities, IPRs, education system in higher education and technology transfer.

Szerb et al. (2018b) also observed that how the different types of entrepreneurships i.e., quantity and quality of entrepreneurship have a positive impact on regional development. It reported that entrepreneurship ecosystem has an important impact on economic outcomes. Sabra and Shreteh (2021) assessed the impact of new startups on economic growth in Middle East and North African countries. It advised that economic growth is positively associated with entrepreneurship ecosystem. Other groups of studies examine the impact of social, economic, technological, financial and environmental indicators, and government policies and trade openness on entrepreneurship ecosystem. For instance, Fuerlinger et al. (2015) investigated the role of

government in reinforce the entrepreneurship ecosystem in Germany. Inflation, price stability, money flow, IPRs regime, tax rate, innovation, human skills, R&D expenditure, association of industries with research organizations, banking and financial institutions, infrastructural development etc. are also vital to nurture a favorable entrepreneurship ecosystem (Singh et al., 2020).

There is also observed a positive causal relationship between economic development and entrepreneurship ecosystem in different income group countries (Singh & Kumar, 2022a; Singh et al., 2022; Singh et al., 2023a). Entrepreneurial development of a country also depends on regional disparities and cultural diversity. For instance, India is a good example which have high diversity in entrepreneurial development due to diversity in cultural and demographical diversification, geography across Indian states. Financial development is also an important determinates of entrepreneurship ecosystem (Hameli et al., 2021). Moya-Clemente et al. (2020) observed the implications of environmental and economic activities on sustainable entrepreneurship. Sharma et al. (2023) detected a positive association between entrepreneurship ecosystem and composite index of financial indicators. Galindo-Martin et al. (2023) investigated the impact of digitalization on entrepreneurship. Above-mentioned review provides a confirmation that scientific research community could not suggest a uniform techniques and empirical model to examine the impact of entrepreneurship ecosystem on different macro level indicators and vice-versa.

3- Research Method and Materials

3.1 Introduction of Study Area

This study is anticipated to measure the relative appearance of entrepreneurship ecosystem for selected 53 countries during 2010–2018. For this, it creates entrepreneurship creativity index (*ECI*) using 12 different factors which are identified as prime drivers of entrepreneurship ecosystem by Global Entrepreneurship Monitoring (GEM) (Kelley et al., 2015/16). The summary of these 12 variables is given in Table: 3. Previous studies also used similar variables to explain the progress of selected countries in entrepreneurship (Ashraf & Singh, 2019; Singh & Jyoti, 2023a). In the present research, therefore, we include only those countries which have the statistics of 12 factors during aforesaid period (Table: 2). While, the missing values for few variables are estimated using interpolation and extrapolation methods to complete the time series (Ashraf & Singh, 2019).

Finally, 53 countries are found suitable to considered in this study (Table: 2). These countries are located in different regions.

Table 2: List of selected countries

Countries	Income Group	Region
Singapore and United Arab Emirates	High Income: non-OECD	Asia
Japan and South Korea	High Income: OECD	
India and Indonesia	Lower Middle income	
China, Malaysia and Thailand		
Kazakhstan, Latvia, North Macedonia, Russia and Turkey	Upper Middle income	Europe & Central Asia
Croatia	High Income: non-OECD	European Countries
Austria, Belgium, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Netherlands, Norway, Poland, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom	High Income: OECD	
Bosnia and Herzegovina	Upper Middle income	
Guatemala	Lower Middle income	Latin America & Caribbean
Argentina, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico, Panama, Peru and Uruguay	Upper Middle income	
Canada and United States	High Income: OECD	North America
Australia		Oceania
Angola and Egypt	Lower Middle income	Sub-Saharan Africa
Iran and South Africa	Upper Middle income	

Source: Author's compilation.

3.2 Description and Source of Data

This study is used data on entrepreneurship ecosystem and its associated factors for 53 countries (Table: 2) during 2010–2018. Data for 12 indicators of entrepreneurship ecosystem are taken from the online database of Global Entrepreneurship Monitor (GEM) (Table: 3). Data for other macro level variables are taken from the World Development Indicators (World Bank), World Economic Forum, UNDP, and Economist Intelligence Units.

3.3 Theoretical Foundation of Index Based Estimation

Previous studies and international organizations formed diverse indexes to assess the strength of socio-economic development, sustainable development, financial stability, political stability, democracy power, science & technological progress, intellectual property awareness, innovation, environmental development, human capital, peace, market potential, economic freedom, digitalization, information & communication technology, and others at global level (Ashraf &

Singh, 2019; Kumar et al., 2017; Singh & Ashraf, 2017; Singh & Jyoti, 2023a; Jyoti & Singh, 2023). Existing researchers and international organizations used *composite Z-score* method and factors component investigation to estimate a desire index (Tripathi, 2017; Singh & Ashraf, 2017; Singh et al., 2017; Singh & Sharma, 2018). Many activities such as entrepreneurship ecosystem, intellectual property regime, innovative power, political stability, human capital, peace, digitalization, market stability and others may not be measured easily due to their multiple association with other variables (Tripathi, 2017; Singh and Sharma, 2018; Singh & Ashraf, 2020; Singh et al., 2022; Singh & Jyoti, 2023b).

Index- based estimation, therefore, may be an effective policy tool to assess the absolute or comparative progress of aforementioned activities in a set of countries or regions or states (Sharma & Singh, 2017). In above perspectives, several indexes like human capital index, global peace index, democracy index, global food security index, climate vulnerability index, environmental sustainability index, global slavery index, global innovation index, and information & communication technology index etc. are created by leading scholars and international organizations (Chinnadurai et al., 2012; Tripathi, 2017; Singh & Issac, 2018; Singh & Sharma, 2018). Entrepreneurship ecosystem, therefore, of an economy may not be delineated by a single variable. Thus, earlier studies also developed global entrepreneurship development index, reginal entrepreneurship and development index, green entrepreneurship index to determine the strength of entrepreneurship ecosystem and green entrepreneurship (Rukuižienė, 2016; Audretsch & Belitski, 2017; Singh & Ashraf, 2020; Singh et al., 2022). Hence, this study also develops entrepreneurship creativity index (*ECI*) as an integration of 12 variables which help to increase entrepreneurship ecosystem for selected 53 countries.

3.4 Measurement of Entrepreneurship Creativity Index (*ECI*)

Entrepreneurship creativity index (*ECI*) is created to assess the relative performance of selected 53 countries in entrepreneurship ecosystem in this study. *Composite Z-score* method is employed to integrate 12 different factors of entrepreneurship ecosystem as an index. The detail description of variables is presented in Table: 3. The *Composite Z-score* method is based on standardization index of a specific variable (Chinnadurai et al., 2012; Kumar et al., 2015; Tripathi, 2017; Dhahri & Omri, 2018). Thereupon, linear average sum of all estimated standardized index is measured

as an entrepreneurship creativity index (*ECI*). The *ECI* is predicted as: $[ECI]_{c,t}=[(SI\_FinEnt)_{c,t}+(SI\_GovSupPol)_{c,t}$ $+(SI\_TaxBur)_{c,t}+(SI\_GovPro)_{c,t}+(SI\_BasSchEntEduTra)_{c,t}+(SI\_PosSchEntEduTra)_{c,t}+(SI\_R\&DTra)_{c,t}+(SI\_ComProInf)_{c,t}+(SI\_IntMarDyn)_{c,t}+(SI\_IntMarOpe)_{c,t}+(SI\_PhySerInf)_{c,t}+(SI\_CulSocNor)_{c,t}]/N$ (1)

Here, *ECI* is entrepreneurship creativity index, *c* is a specific country and *t* is time, *SI* is standardization-index of associated factors in equation (1). While the description of *FinEnt*, *GovSupPol*, *TaxBur*, *GovPro*, *BasSchEntEduTra*, *PosSchEntEduTra*, *R&DTra*, *ComProInf*, *IntMarDyn*, *IntMarOpe*, *PhySerInf*, and *CulSocNor* are presented in Table: 3. While, standardization-index is estimated as:

$$[SI]i,c,t = \{[(X)i,c,t - Min (X)i,c,t]/[Max (X)i,c,t - Min (X)i,c,t]\} \quad (2)$$

Here, *SI* is standardization-index for *i*th variable in a specific country (*c*), and *t* is time. *X* is actual value, *Min* (*X*) is the minimum value, *Max* (*X*) is the maximum value for a variable in a specific year across countries in equation (2). Estimated values of *SI'*s lies between 0 – 1 (Chinnadurai et al., 2012; Tripathi, 2017; Dhahri & Omri, 2018; Singh et al., 2019a). Since, *ECI* is created during 2010 – 2018, therefore, we pursue above- mentioned process simultaneously for each variable and year across countries.

Table 3: Brief explanation of 12 factors of entrepreneurship ecosystem

Explanation and Justification	Factors	Symbol
Financial availability for SMEs helps to increase ability of entrepreneurs to start new venture and nurture appropriate entrepreneurship ecosystem.	Financing for entrepreneurs	*FinEnt*
Government policies are also positive to increase entrepreneurship and reduce monetary crisis in the financial market. Thus, government policies and support nurture a conducive entrepreneurship ecosystem.	Governmental support and policies	*GovSupPol*
High tax rate is caused to reduce intention of producer to increase production scale. Thus, taxes and bureaucracy also have a substantial implication on entrepreneurship ecosystem.	Taxes and bureaucracy	*TaxBur*
Organizing government programs for new entrepreneurs to increase their understanding towards various policies in SMEs are also favorable to increase entrepreneurship ecosystem.	Governmental programs	*GovPro*

Entrepreneurial trainings, education and programs in higher educational institutions, and for new businessman and new entrepreneurs also enhance entrepreneurship ecosystem.	Basic school entrepreneurial education and training	*BasSchEnt EduTra*
Commencement of entrepreneurial education and training programs for the students in pre-education, post-education and higher academic institutions would be conducive to increase entrepreneurship ecosystem. It would also create innovative opportunities for SMEs and increase entrepreneurial skills among the students.	Post school entrepreneurial education and training	*PosSchEnt EduTra*
It is a useful determinant to meet the technological requirement of SMEs and manufacturing sector. It may be supportive to create new market and increase more commercial opportunities for new businessman.	R&D transfer	*R&DTra*
It also ensures the promotion of SMEs through implementing property rights, and providing the legal security of commercial practices.	Commercial and professional infrastructure	*ComProInf*
It provides free rights to the new businessman to entry and exist the market.	Internal market dynamics	*IntMarDyn*
It cultivates a perfect competition in the market and brings more entrepreneurial opportunities for new entrepreneurs.	Internal market openness	*IntMarOpe*
Easy accessibility of physical resources and infrastructure for businessman help to increase growth of SMEs and raising a conducive path of entrepreneurship ecosystem.	Physical and services infrastructure	*PhySerInf*
Cultural and social norms have a positive impact on entrepreneurship ecosystem. It is also beneficial to create wealth and income for new entrepreneurs.	Cultural and social norms	*CulSocNor*

Source: Adopted from the Website of Global Entrepreneurship Monitor (GEM).

4- Results and Discussion

4.1 Relative Performance of Included Countries in Terms of Estimated Values of *ECI*

The relative performance of entrepreneurship ecosystem for 53 countries is measured in term of mean values of *ECI* during 2010 – 2018 (Figure: 1). The mean values of *ECI* lies between 0.18–0.81 across countries. Thus, performance of entrepreneurship ecosystem is not similar in 53 countries. The variation in the values of *ECI* across countries is due to high diversity in 12 indicators which are included to create it. The figure also infers that Singapore, Netherlands, and Switzerland have 1st, 2nd and 3rd position, respectively in entrepreneurship ecosystem among the 53 countries. These countries have highest values of 12 indicators; therefore, it is obvious that these countries have highest values of *ECI*. While, Egypt, Angola, and Iran have 51st, 52nd, and

53rd position in entrepreneurship ecosystem among 53 countries. Thus, these countries could not improve the performance in entrepreneurship ecosystem. Furthermore, included countries are separated in four groups (i.e., best, better, average and poor) as per the observed values of *ECI* (Table: 4).

Table 4: Relative position of across countries in entrepreneurship ecosystem

Position of entrepreneurship ecosystem	Countries
Best (*ECI* values are more than 0.60)	Singapore, Netherlands, Switzerland, Indonesia, United Arab Emirates, Malaysia and India
Better (*ECI* values lies 0.50–0.60)	Finland, Canada, Austria, United States, Belgium, Ireland, Germany, France, China, Latvia and Norway
Average (*ECI* values lies between 0.40–0.49)	Sweden, South Korea, United Kingdom, Thailand, Australia, Israel, Kazakhstan, Mexico, Japan, Turkey, Poland, Chile, North Macedonia, Colombia and Jamaica
Poorest (*ECI* values lies less than 0.40)	Ecuador, Uruguay, Slovenia, Spain, Panama, Peru, Hungary, Slovakia, South Africa, Russia, Italy, Bosnia and Herzegovina, Guatemala, Greece, Brazil, Croatia, Egypt, Angola and Iran

Source: Author's estimation.

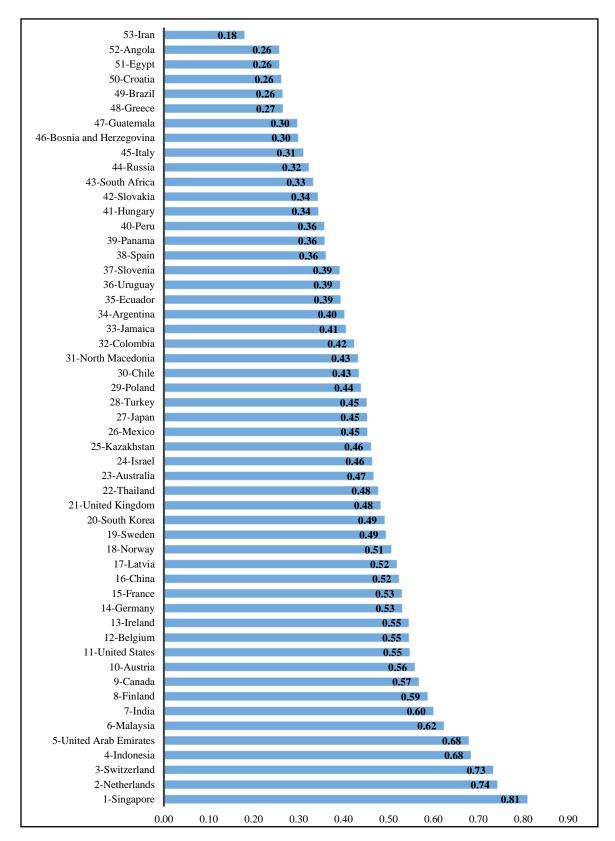**Table 5:** Relative position of high-income countries in entrepreneurship ecosystem

Position of entrepreneurship ecosystem	Countries
Best (*ECI* values are more than 0.60)	Singapore, Netherlands, Switzerland and United Arab Emirates
Better Entrepreneurship Ecosystem (*ECI* values lies 0.50–0.60)	Finland, Canada, Austria, United States, Belgium, Ireland, Germany, France and Norway
Average (*ECI* values lies between 0.40–0.49)	Sweden, South Korea, United Kingdom, Australia, Israel, Japan and Poland
Poorest (*ECI* values lies less than 0.40)	Slovenia, Spain, Hungry, Slovakia, Italy, Greece and Croatia

Source: Author's estimation.

The values of *ECI* lie between 0.26-0.81 for high income countries, thus, entrepreneurship ecosystem is also varied in high income countries. High-income countries are be divided in four groups based on the estimated values of *ECI* ((Table: 5).

Figure 1. Comparison of 53 countries as per estimated entrepreneurship creative index (*ECI*)

Singapore, Netherlands, Switzerland, United Arab Emirates, Finland, Canada, Austria, United States, Belgium, Ireland, Germany, France, and Norway have a better entrepreneurship ecosystem among the high-income countries. While, Slovenia, Spain, Hungry, Slovakia, Italy, Greece and Croatia have poor position in entrepreneurship ecosystem. Malaysia has the best position in entrepreneurship ecosystem in the upper middle-income countries. The values of *ECI* lies between 0.18–0.62 across upper middle-income countries. Thus, it indicates that upper-middle countries have a high diversity in entrepreneurship ecosystem. Upper middle-income countries are also divided in four groups (Table: 6).

Table 6: Relative position of upper middle-income countries in entrepreneurship ecosystem

Position of entrepreneurship ecosystem	Countries
Best (*ECI* values are more than 0.60)	Malaysia
Better entrepreneurship ecosystem (*ECI* values lies 0.50–0.60)	China and Latvia
Average (*ECI* values lies between 0.40–0.49)	Thailand, Kazakhstan, Mexico, Turkey, Chile, North Macedonia, Colombia, Jamaica, and Argentina
Poorest (*ECI* values lies less than 0.40)	Ecuador, Uruguay, Panama, Peru, South Africa, Russia, Bosnia and Herzegovina, Brazil, and Iran

Source: Author's estimation.

The values of *ECI* for lower middle-income countries lies between 0.68 – 0.26. Thus, the estimates reveal that entrepreneurship ecosystem is not similar in this group of countries. Indonesia and India have *ECI*'s values of 0.68 and 0.60 respectively. Thus, both countries have a better entrepreneurship ecosystem as compared to Guatemala, Egypt and Angola. Guatemala, Egypt and Angola have the *ECI*'s values of 0.30, 0.26 and 0.26, respectively.

4.2 Reliability of Entrepreneurship Creative Index (*ECI*)

This study creates entrepreneurship creativity index (*ECI*) for 53 countries during 2010–2018. While, *ECI* is an integration of 12 different factors (Table: 3). Hence, it is a compulsory to check the validity of estimated *ECI* to make the unanimity among the academician and existing researchers (Kumar & Sharma, 2013; Tripathi, 2017; Ashraf & Singh, 2019). Previous studies reasoned that an index may be effective when its correlation coefficients with internal or external

variables are detected statistically significant. Thus, correlation coefficients of *ECI* with several external variables are estimated to check the consistency of it (Table: 7).

The results show that entrepreneurship creativity index is positively associated with perceived opportunities (*PerOpp*), entrepreneurial employee activity (*EntEmpAct*), motivational index (*MotInd*), female/male TEA (*FemMalTEA*), female/male opportunity-driven TEA (*FemMalOppDriTEA*), high job creation expectation (*HigJobCreExp*), innovation (Inn), business services sector (*BuSerSec*). These are crucial indicators of entrepreneurial behaviors. Hence, the results reveal that indicators related to entrepreneurial behaviors are supportive increase entrepreneurship ecosystem.

Indicators	ECI	PerOpp	EntEmpAct	MotInd	FemMalTEA	FemMalOppDriTEA	HigJobCreExp	Inn	BuSerSec	AccEle
ECI	1									
PerOpp	0.1228*	1								
EntEmpAct	0.3110*	0.2299*	1							
MotInd	0.4160*	0.2816*	0.5238*	1						
FemMalTEA	0.0940*	0.2969*	-0.2392*	0.0108	1					
FemMalOppDriTEA	0.0639	0.0288	0.1144*	0.0799	-0.0409	1				
HigJobCreExp	0.0422	-0.0853	0.1258*	0.0027	-0.3961*	0.05	1			
Inn	0.2318*	0.0979*	0.2511*	-0.005	-0.1528*	0.0202	0.2034*	1		
BuSerSec	0.2972*	-0.1219*	0.6807*	0.4273*	-0.3352*	0.1127*	0.1776*	0.3065*	1	
AccEle	0.2100*	-0.3112*	0.2114*	0.1426*	-0.2281*	0.0221	0.1852*	0.0767	0.3259*	1
BurCusPro	0.5917*	-0.0459	0.5219*	0.4723*	-0.2230*	0.0297	0.1815*	0.3255*	0.5802*	0.4369*
FDINI	0.2686*	-0.0337	0.1085*	0.0917*	-0.0174	0.0086	0.0894	0.067	0.1029*	0.0960*
FDINO	0.32	-	0.2166*	0.17	-0.0415	0.0274	0.0442	0.10	0.2210	0.07

	13*	0.0156		47*				22*	*	32
GDPPerCap	0.4973*	0.0498	0.6907*	0.5997*	-0.2616*	0.0772	0.1037*	0.2328*	0.7853*	0.2762*
GDPPerEmp	0.4511*	-0.1496*	0.5994*	0.5027*	-0.3482*	0.0817	0.2326*	0.2132*	0.7699*	0.3669*
GroCapFor	0.1791*	0.1316*	-0.1629*	0.0055	0.1423*	0.0161	-0.0394	-0.1505*	-0.2675*	-0.1603*
ManValAdd	0.2161*	-0.2617*	-0.1203*	-0.1009*	-0.0114	0.0067	0.0243	0.042	-0.0955*	0.2261*
MerTra	0.3571*	-0.2669*	0.1189*	0.1854*	-0.0914*	-0.0211	0.1306*	-0.0068	0.1764*	0.0965*
TotUne	-0.3967*	-0.3166*	-0.1501*	-0.3169*	-0.2957*	-0.0366	0.0797	-0.0763	-0.0246	0.0166
TotWagSalWor	0.2232*	-0.2810*	0.5015*	0.3295*	-0.3382*	0.0868	0.2730*	0.1430*	0.6783*	0.5387*

Source: Author's estimation. * Indicates that correlation coefficients are statistically significant at 1% significance **level.**

Indicators	BurCusPro	FDINI	FDINO	GDPPerCap	GDPPerEmp	GroCapFor	ManValAdd	MerTra	TotUne	TotWagSalWor
BurCusPro	1									
FDINI	0.2312*	1								
FDINO	0.2672*	0.8871*	1							
GDPPerCap	0.6832*	0.1769*	0.3107*	1						
GDPPerEmp	0.6984*	0.2401*	0.3216*	0.9067*	1					
GroCapFor	-0.0081	0.0169	-0.0241	-0.1301*	-0.1445*	1				
ManValAdd	0.1319*	0.0765	0.1105*	-0.0649	-0.0179	0.2187*	1			
MerTra	0.4462*	0.2519*	0.2203*	0.1552*	0.3243*	0.0221	0.2102*	1		
TotUne	-0.1831*	-0.0463	-0.0758	-0.2058*	-0.0843	-0.2712*	-0.2728*	-0.0457	1	
TotWagSalWor	0.5737*	0.088	0.1537*	0.6442*	0.7293*	-0.3759*	-0.1093*	0.2983*	0.1063*	1

Source: Author's estimation. * Indicates that correlation coefficients are statistically significant at 1% significance level. **Note-** *ECI*: Entrepreneurship Creativity Index, *PerOpp*: Perceived opportunities, *EntEmpAct*:

Entrepreneurial Employee Activity, *MotInd*: Motivational Index, *FemMalTEA*: Female/Male TEA, *FemMalOppDriTEA*: Female/Male Opportunity-Driven TEA, *HigJobCreExp*: High Job Creation Expectation, *Inn*: Innovation, *BuSerSec*: Business Services Sector, *AccEle*: Access to electricity (% of population), *BurCusPro*: Burden of customs procedure, WEF (1=extremely inefficient to 7=extremely efficient), *FDINI*: Foreign direct investment, net inflows (% of GDP), *FDINO*: Foreign direct investment, net outflows (% of GDP), *GDPPerCap*: GDP per capita (constant 2010 US$), *GDPPerEmp*: GDP per person employed (constant 2011 PPP $), *GroCapFor*: Gross capital formation (% of GD, *ManValAdd*: Manufacturing value added (% of GDP), *MerTra*: Merchandise trade (% of GDP), *TotUne*: Total unemployment (% of total labor force), *TotWagSalWor*: Total wage and salaried workers (% of total employment).

Also, access to electricity (% of population) (*AccEle*), burden of customs procedure (*BurCusPro*), foreign direct investment (FDI) net inflows (% of GDP) (*FDINI*), foreign direct investment (FDI) net outflows (% of GDP) (*FDINO*), GDP per capita (constant 2010 US$) (*GDPPerCap*), GDP per person employed (*GDPPerEmp*), gross capital formation (% of GDP) (*GroCapFor*), manufacturing value added (% of GDP) (*ManValAdd*), merchandise trade (% of GDP) (*MerTra*), total wage and salaried workers (% of total employment) (*TotWagSalWor*) have a positive association with *ECI*. Since, the correlation coefficients of aforesaid factors with *ECI* are statistically significant. Hence, it can be recognized that *ECI* have a consistency and *ECI* can be used for further policy decision.

As perceived opportunities, entrepreneurial employee activity, motivational index, female/male TEA, female/male opportunity-driven TEA, job creation possibilities, innovation and business services sector are the crucial driver of entrepreneurship behavior and attitudes. Hence, the estimates suggested that entrepreneurship behaviors and attitude related activities are operative role to boost the entrepreneurship ecosystem. Access to electricity is positively correlated with *ECI*. Access to electricity is the good representative of infrastructural development. Thus, the estimate shows that entrepreneurship ecosystem to be improved as the accessibility of people to use electricity increases. Further, global investors will be incentivized to start their business in those countries which have efficient and transparent custom process. Thus, efficient customs procedure is positively correlated with *ECI*.

Foreign direct investment net inflow and outflow create a new business opportunity within a country and outside the country. Thus, FDI is found crucial determinant of entrepreneurship ecosystem. FDI is also useful to improve financial and human capital, and other resources in a country (Audretsch et al., 2019). Entrepreneurship ecosystem also improved as per capita GDP and GDP per person employed increase (Adusei, 2017; Dhahri & Omri, 2018). Furthermore,

manufacturing sector is also observed as a prime sector to create a conducive entrepreneurship ecosystem. Thus, policy makers are desirable to give significant priority to increase the growth of manufacturing sector. Accordingly, the growth of manufacturing sector would assist to create an appropriate entrepreneurship ecosystem. Unemployment rate is negatively correlated with *ECI*. Thus, the estimate infers that a country needs to avoid high unemployment rate to maintain a suitable entrepreneurship ecosystem.

5- Conclusion and Policy Guidelines

The present study creates entrepreneurship creativity index (*ECI*) for selected 53 countries during 2010 – 2018. *ECI* is measured as an integration of 12 different factors associated with entrepreneurial ecosystem which are identified as a key indicators of entrepreneurship ecosystem by the Global Entrepreneurship Monitoring (GEM) (Kelley et al., 2015/16). *ECI* is created using *composite Z-score* technique. Thereupon, the present study examines the association of *ECI* with entrepreneurship behavior and attitude related activities and other macro-economic indicators using correlation coefficient technique. Finally, it come with several policy proposals which may be apply to nurture a conducive entrepreneurship ecosystem in global countries. The descriptive results based on estimated values of *ECI*, imply that entrepreneurship ecosystem is diverse across 53 countries due to high diversity in 12 factors of entrepreneurial activities. Included 53 countries are segregated in following four groups:

(i) **Best Entrepreneurship Ecosystem** (*ECI* values are more than 0.60): Singapore, Netherlands, Switzerland, Indonesia, United Arab Emirates, Malaysia and India.

(ii) Better Entrepreneurship Ecosystem (*ECI* values lies 0.50–0.60): Finland, Canada, Austria, United States, Belgium, Ireland, Germany, France, China, Latvia and Norway.

(iii) Average Entrepreneurship Ecosystem (*ECI* values lies between 0.40–0.49): Sweden, South Korea, United Kingdom, Thailand, Australia, Israel, Kazakhstan, Mexico, Japan, Turkey, Poland, Chile, North Macedonia, Colombia and Jamaica.

(iv) Poorest Entrepreneurship Ecosystem (*ECI* values lies less than 0.40): Ecuador, Uruguay, Slovenia, Spain, Panama, Peru, Hungary, Slovakia, South Africa, Russia, Italy, Bosnia and Herzegovina, Guatemala, Greece, Brazil, Croatia, Egypt, Angola and Iran.

The estimates also imply that Singapore, Netherlands and Switzerland best position in entrepreneurship ecosystem. While, Egypt, Angola, and Iran have 51st, 52nd, and 53rd position, respectively in entrepreneurship ecosystem among the 53 countries. The estimated values of *ECI* of this study can be used as a policy tool to assess the relative performance of these countries in entrepreneurship ecosystem. Accordingly, low ranking countries can implement effective and conducive policies to expand their position in entrepreneurship ecosystem. The Karl-Pearson correlation coefficients of *ECI* with other variables showed that entrepreneurship ecosystem is positively associated with perceived opportunities, motivation index, innovation, and business services sector. Therefore, entrepreneurship ecosystem of a country will be improved as increase in entrepreneurial behaviors related indicators. FDI inflow and outflow, economic development, GDP per person employed, gross capital formation, manufacturing value added, and merchandise trade are found crucial determinants of entrepreneurship ecosystem (Singh et al., 2019b). FDI inflow and outflow will be supportive to create physical assets and would increase global network of a county. Subsequently, FDI will provide more employment opportunities, and maintain technology transfer and commercialization across countries (Acs, 2006; Singh et al., 2019b, 2019c; Singh & Kumar, 2022b; Singh & Jyoti, 2021). FDI may be useful to increase technological advancement and significantly contribute towards entrepreneurship ecosystem. Unemployment rate is negatively associated with entrepreneurship ecosystem. Hence, global countries should reduce high unemployment rate to reduce its adverse impact on entrepreneurship ecosystem.

The government should take a significant initiative towards entrepreneurship ecosystem like increase scientific staff, establish technology transfer offices to increase technology commercialization, provide appropriate financial support to entrepreneurs, increase involvement of private investment in business activities (Fuerlinger et al., 2015; Adusei, 2017). The developing countries are required to give more focus to strengthen the small-scale enterprises to create a favorable entrepreneurship ecosystem (Acs, 2006). It would be a important driver to increase self-employed people in developed and developing countries. Entrepreneurial education for youth and skilled workers will help to create a conducive entrepreneurship ecosystem (Acs, 2006; Fuerlinger et al., 2015; Adusei, 2017). Education and training for entrepreneurship at elementary and secondary level in the pre-schools and post-schools would be beneficial to nurture an appropriate entrepreneurship ecosystem (Acs, 2006).

Aforementioned suggestions would be imperative to promote academic entrepreneurship and tech-based start-ups in developing countries (Singh et al., 2019a; Jyoti & Singh, 2020). Thus, it would be suitable to create start-ups and entrepreneurship ecosystem. Further, it would maintain the collaboration of research organizations with existing industries (Singh & Kumar, 2022b).

The developing countries should increase public research funding for increasing the discovery of more technologies and facilitate research organization to increase their participation in IPRs regime, technology transfer and commercialization (Fuerlinger et al., 2015; Singh et al., 2019c). Technology transfer and commercialization will be favorable to enhance entrepreneurship ecosystem (Singh et al., 2019c). Therefore, the developing countries should give attention towards technology transfer and commercialization to meet the technological requirement of manufacturing sector (Singh & Ashraf, 2019). Technology transfer and knowledge exchange will also enhance innovation and develop a smooth network among the small and large firms within a county and across countries. Financial accessibility for entrepreneurs is also a driver to increase their intention towards business activities. Thus, the government should provide extensive fund to the business community. In addition, the government must provide management assistance, training and fare regulatory burdens for new entrepreneurs to cultivate an appropriate entrepreneurship ecosystem (Singh & Kumar, 2022b). The government should pursue fair tax policy to adjust the demand and supply components in the product market. Hence, monetary and fiscal polices should be devoted to increase the active participation of producers and consumers in the economic production activities.

As entrepreneurship ecosystem cannot be measured by specific indicators. Therefore, in this research we develop entrepreneurship creative index (*ECI*) for 53 countries. For said investigations, we compile 12 indicators for *ECI* estimation. While the rationality of this index is tested as estimating its correlation coefficients with internal and external variables. In this study, *ECI* is considered as a crucial tool to assess the comparative performance of these countries in entrepreneurship ecosystem. However, *ECI* values may be changed as inclusion or deletion of a single variable in its estimation. The ranking and values of *ECI* for a country may not be remained same due to inclusion of more countries. Thus, it is obvious that ranking and relative position of a country in entrepreneurship ecosystem would be changed automatically. Furthermore, the value of *ECI* for a specific county also depend on applied methods and

empirical model. Accordingly, descriptive findings of this research may not be applicable for those countries which are not included in it. Therefore, above-mentioned issues are considered as limitations of this study. Further research can be considered to estimate the association among the indicators related to entrepreneurship ecosystem and entrepreneurial behaviors & attitudes using robust empirical investigation.

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