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Innovation And Talent In Driving Startup Performance: A Cross-Country Analysis

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Abstract:
A startup begins with a new idea or innovation and needs to convert that idea into practice. Talented people always provide new perspectives on phenomena and can convert ideas into practice. Thus, the formation of a startup requires innovation and talent. Generally, it is assumed that countries with large populations perform better in terms of startup performance because they have more talent and more opportunities for innovation. This raises the question: what matters more—the size of the population or its potential?
The United States of America (USA), which has the highest number of startups, ranks first in both startup output and startup ecosystem ranking. Though it is the third most populous country, its population is only a fraction of that of the most populous countries (China and India) in the world, and its startup performance is far better than these countries. This research paper tries to find out whether the difference in startup performance lies in population size or the quality of the population. For this a sample of top 20 countries was selected based on total startup output in 2023. The quality of population is assessed in terms of level of innovation and talent in the country and three indices related to quality are constructed – innovation index (II), talent index (TI) and combined innovation and talent index (CITI). The size of the population is measured in by population index (PI) and the startup performance is measured by startup performance index (SPI). Then correlation and multiple regression techniques were used to find out the relation of the startup performance with population size and population quality.
The analysis rejects the general assumption that population size significantly contributes in startup performance and concludes that the quality of population i.e., the level of talent or combined level of innovation and talent significantly determine the startup performance. The benefits of high level of innovation cannot be reaped without talented entrepreneurs and employees. The more the country has talent, the higher will be its startup performance. It is suggested that in order to improve the startup performance countries should control the population size and enhance the quality of their population by promoting talent through providing financial and policy support.
Keywords: *Startup, Innovation, Talent, India, Intellectual Property Rights*

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I. Introduction

Today's business world is very complex and tough to enter. New firms, in the form of startups, need to bring a new idea or product to enter the market, which is simply called innovation. Innovation is not just the introduction of a new product; it can be in any form or at any stage of production or marketing, such as the introduction of new processes, new business models, or services that improve performance, competitiveness, or create new markets. It can also be defined as the successful implementation of a creation ([1]). Innovation enhances the efficiency of operations for resource-constrained startups. Innovation may enable startups to attract investors and external resources by signalling their growth potential ([2]). Innovation is crucial for the success and survival of a small or medium firm in the market ([3], [4], [5]).

At the same time, talented people are also important for creating new ideas or implementing them in the business. In a study of technology startups in Korea, Choi et al. (2020) found that employment quality (as a talent) matters for innovative performance ([6]). A few studies (i.e., [7]) show that talent management influences innovation performance. The effect of talent management appears in innovation outcomes, which then contribute to a firm's performance. The review of other literature suggests that success of startups depend not only on its innovation capacity but also the capacity to attract, retain and develop talent employees ([8],[9]). It is the talent which leads to innovations for startup performance.

There is a general conception that a large country can perform better in startups because it may have a large pool of talent and opportunities for innovation. If a country has a large population, it might have a greater number of researchers, creative people, experienced and talented masses who could create new products, invent new processes and new ideas for business. Here, the question arises: what matters most—the size of the population or its quality?

The United States of America (USA) is performing extremely well in terms of startup performance. It has more than 85,000 startups in 2025 ([10]) and 14 startup clusters in the list of top 40 ([11]). Though its population is just a fraction of the most populous countries in the world (China and India), it produces the highest total startup output (2023) and stands first in the Global Startup Ecosystem Ranking ([12]). India is also performing well in terms of the number of startups, with more than 17000 startups in 2025 ([10]). However, if we look at the total startup output, India stands fourth ([12]), and in the Global Startup Ecosystem Ranking 2025, it is ranked 22nd. China performs far better than India in this regard and stands at 2nd in terms of startup output (2023) and 14th in the Global Startup Ecosystem Ranking 2025.

This research paper looks into whether a country's startup performance is linked to its population size or the talent and innovation of its people. It also conducts a comparative analysis of India's performance in startup output, innovation, and talent with other leading countries.

This research paper has six sections. The first section is the Introduction, which sets the background of the study. The second section explains the objectives, and the third section presents the hypotheses. The fourth section elaborates on the research methodology, the fifth section discusses the results, and the sixth section provides the conclusion and suggestions.

II. Objectives

- To compare the performances of selected top countries in terms of startup output, innovation, and talent.
- To determine whether the size or quality of the population influence startup performance in a country.

III. Hypothesis

1. H_0: Startup performance is not significantly correlated with population size of a country and it does not significantly contribute to its startup performance.
   H_a: Startup performance is significantly correlated with population size of a country and it significantly contributes to its startup performance.
2. H_0: Startup performance is not significantly correlated with the level of innovation and talent in a country and it does not significantly contribute to its startup performance.
   H_a: Startup performance is significantly correlated with the level of innovation and talent in a country and it significantly contributes to its startup performance.

IV. Research Methodology

The present research is a secondary data-based study. A sample of the top 20 countries was selected on the basis of their total startup output in 2023 ([12]) as per the latest available data. These countries include the USA, China, UK, India, Germany, Canada, France, Israel, Japan, Brazil, Spain, Australia, Sweden, the Netherlands, Russia, the Republic of Korea, Singapore, Indonesia, Switzerland, and Italy. The startup performance in a country was assessed by startup output per million population. The level of innovation in a country is ascertained through two variables: intellectual property rights and research publications and these two variables are captured by various indicators. These indicators are- total patent grants per million population, total trademark registrations per million population, total design registrations per million population, total geographical indications in force per million population, total utility model grants per million population, scientific and technical articles per billion GDP in dollars (purchasing power parity) and citable documents H-index. Similarly, the level of Talent in a country was assessed with the help of four indicators - knowledge-intensive employment (percentage of workforce of above the age of 15 years), graduates in science and engineering (percentage of total tertiary graduates), Researchers (full time equivalent) per million population, average score of top 3 universities in QS university ranking. Data were collected from the online databases of the World Intellectual Property Organization (WIPO), World Bank, UNESCO, Global Innovation Index 2024 Economy Profiles, and Startup Blink.

To combat the problem of different measurement units, values of all variables and indicators are normalized to 0 to 1 scale with the help of the following formula = $\frac{Actual\ Value - Minimum\ Value}{Maximum\ Value - Minimum\ Value}$.

The values for startup performance and population indicators were also normalised with the help of this formula and they were named as Startup Performance Index and Population Index. Three indices related to innovation and talent were computed for the analysis: Innovation Index (II), Talent Index (TI), and Combined Innovation and Talent Index (CITI).

These indices were computed by taking the simple average of the normalised values (xi) of the concerned indicators.

Index $= \frac{\sum_{i=1}^{n} xi}{n}$ where, xi= normalised value on the ith indicator for a country, and n= number of indicators considered for computing that specific index.

The Pearson's Correlation Coefficient is computed, and two multiple regression models are fitted to determine the significance of the contributions of innovation, talent, and population to startup performance. The first regression model with Startup Performance Index (SPI) as dependent variable and Population Index (PI) and Combined Innovation and Talent Index (CITI) as two independent variables was used to analyse the contribution of population and joint contribution of Innovation and talent in startup performance. The second model assessed the roles of innovation and talent separately in startup performance by taking startup performance index (SPI) as the dependent variable and the Innovation Index (II), Talent Index (TI), and Population Index (PI) as three independent variables.

Model 1: $\mathrm{SPI} = b1 * \mathrm{CITI} + b2 * \mathrm{PI} + \varepsilon$

Model 2: $\mathrm{SPI} = b1 * \mathrm{II} + b2 * \mathrm{TI} + b3 * \mathrm{PI} + \varepsilon$

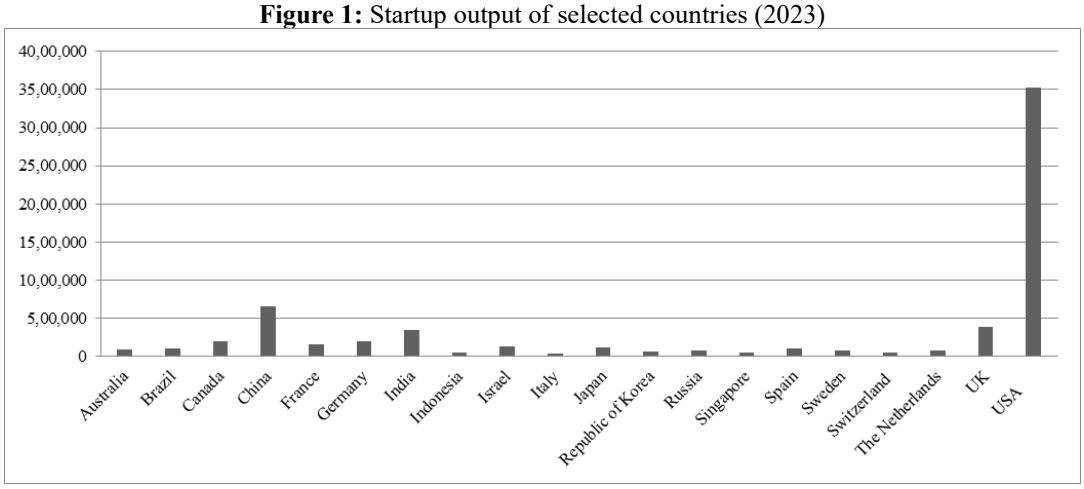
IBM Statistics SPSS 21 software is used for data analysis. Grammarly and AI copy editor is used for correction of grammar, punctuation, spelling and style errors.

V. Results And Discussion

Comparative analysis of startup performance, population, innovation, and talent in selected countries

The startup outputs of 20 selected top-performing countries are presented in Figure 1. The USA, UK, China, and India are the top four performers in this regard. However, the startup output of the USA, the best performer, is far ahead of that of the other three countries. The USA's startup output is approximately seven times larger than that of China, the second-best performer. Canada, Germany, France, and Israel follow, while the remaining countries are listed afterward.

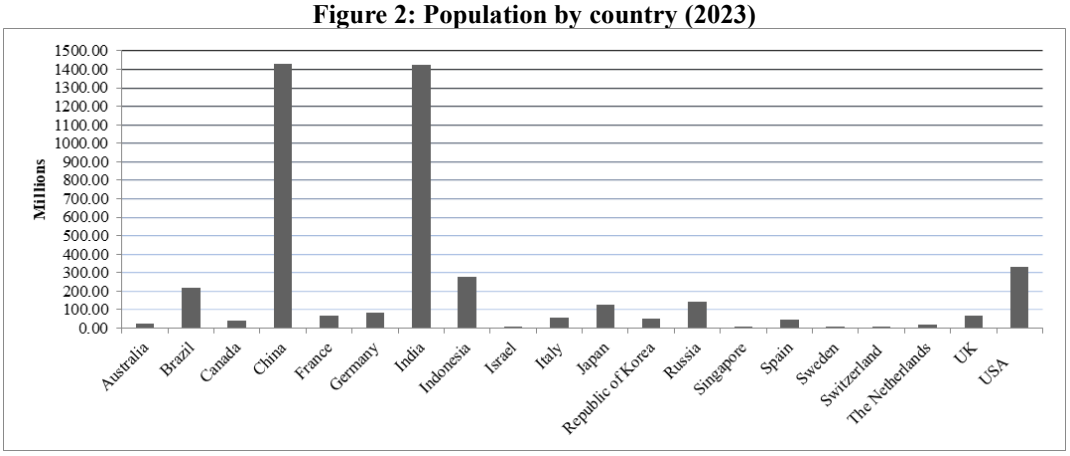
Figure 1: Startup output of selected countries (2023)



Source: [12]

Thus, these top 20 performers vary in startup performance, as shown in Figure 1. Now, it is important to determine whether they also vary in population size and whether the top startup output performers possess the largest population share.

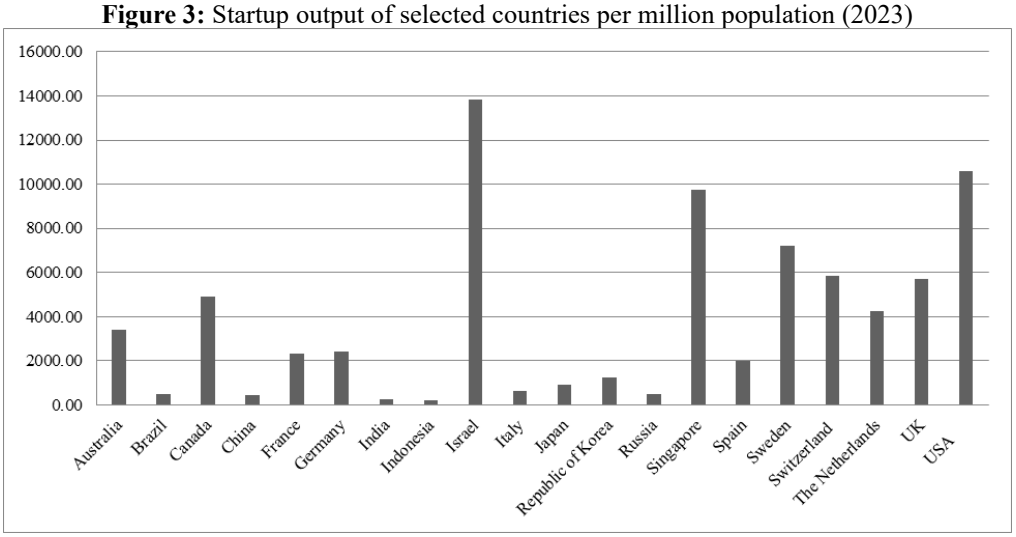
Figure 2: Population by country (2023)



Source: [12]

Figure 2 presents the population (in millions) of selected countries in 2023. China and India are the two most populous countries among these, followed by the USA, Indonesia, Brazil and Russia. Singapore, Switzerland, Israel and Sweden are the least populous among the selected 20 countries. These countries, which are the top performers in terms of startup output, vary in population size. Of the four top startup output performers, three (the USA, China, and India) also have the largest population among all these countries. However, highly populous countries like Indonesia, Brazil, and Russia lag behind less populous countries such as the UK, Canada, France, Germany, and Israel in terms of startup output. Therefore, a direct relationship between startup performance and population size cannot be ascertained by simple analysis or by just looking at Figures 1 and 2. Figure 3, which shows the startup output per million people in each country, also confirms this point.

Figure 3: Startup output of selected countries per million population (2023)

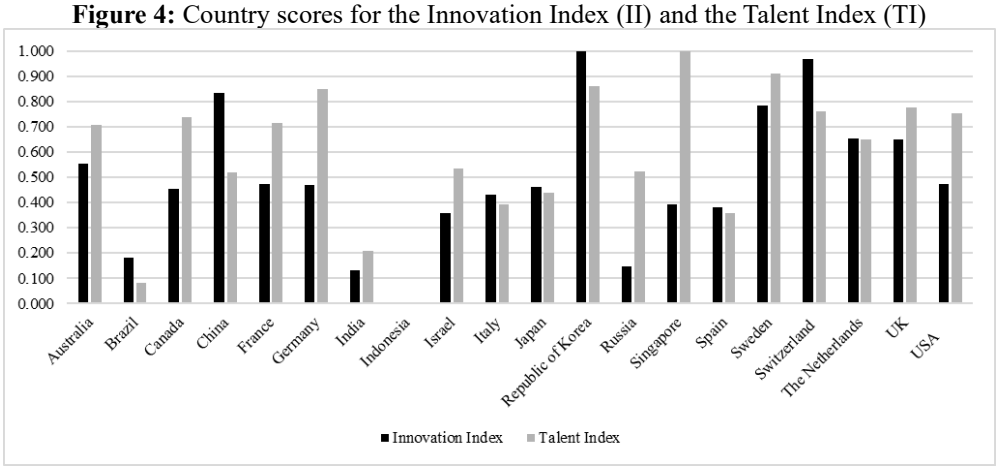


Source: Computed

The highly populous countries India and China have lower startup outputs per million people because their populations are much larger than their startup outputs. In contrast, the USA, the third most populous among the selected countries, has the second-highest startup output per million people. Israel, which has a very small population (only 9.5 million), is the leading country in terms of startup output per million people. Singapore, which has the smallest population among all selected countries, has the third-largest (not the first) startup output per million people. Therefore, after examining Figures 1, 2, and 3, it is clear that population size alone cannot determine a country's startup output performance. Thus, to find out the relation between Startup performance and population size correlation test is applied and results are shown in table 1.

As the theory and previous research studies explain that the innovation and talent are essential factors for startup performance in a country, so present research analysis the level of innovation and talent in the selected countries with the help of Innovation Index (II), Talent Index (TI) and Combined Innovation and Talent Index (CITI) computed by the researcher herself based on the secondary data collected for the indicators mentioned in the section 2 of the research paper. Figure 4 presents the scores of these indices for all selected countries.

Figure 4: Country scores for the Innovation Index (II) and the Talent Index (TI)

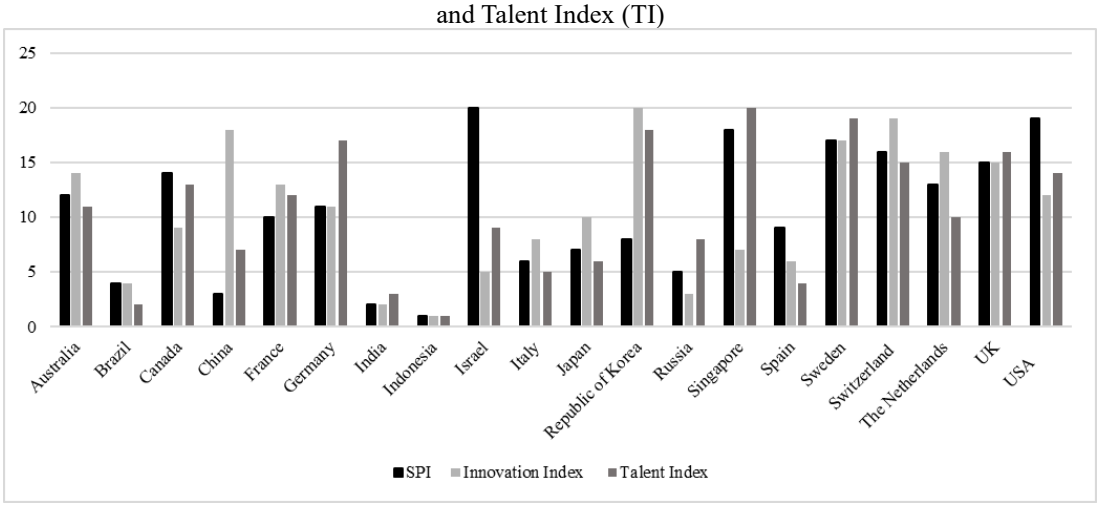


Source: Computed

If we look at the Innovation Index, the Republic of Korea, Switzerland, China, Sweden, the Netherlands and UK are the leading countries among selected countries. Indonesia has the lowest score in the II followed by India, Russia and Brazil. As per the scores of Talent Index, Singapore, Sweden, the Republic of South Korea and Germany are the leading countries followed by the UK, USA and Switzerland. Indonesia has the lowest score in the TI also and Brazil and India follow it. Indicator-wise analysis shows that India is the lowest scorer of total trademark registrations per million population, total geographical indications in force per million population and researchers (full time equivalent) per million population. It is the second lowest scorer of knowledge-intensive employment (percentage of workforce of above the age of 15 years) and the third lowest scorer of total patent grants per million population and scientific and technical articles per billion GDP in dollars (ppp).

To have an idea about whether there is any relation between the levels of innovation and talent in a country and its startup output performance, a bar chart is created for rankings of selected countries by Startup Performance Index, Innovation Index and Talent Index (Figure 5).

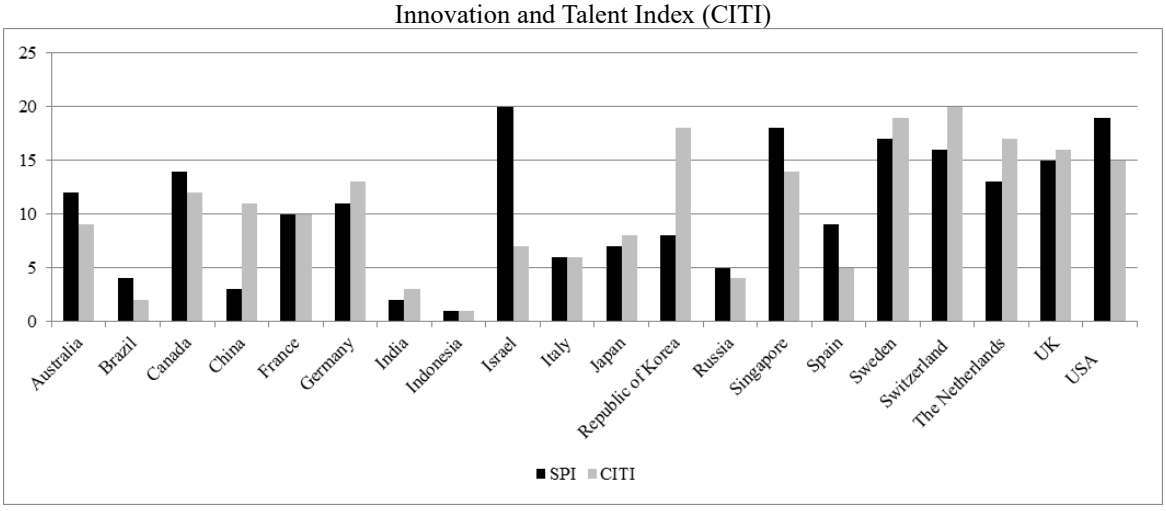
Figure 5: Ranking (in ascending order) of countries by Startup Performance ndex (SPI), Innovation Index (II) and Talent Index (TI)



Source: Computed

Figure 5 demonstrates that there is difference in a country's rankings for SPI, II and TI in almost all countries but difference is not large except for a few countries. Israel has very high ranking in SPI whereas the Republic of Korea and China have a very low SPI ranking compared to other two indices. Germany has very high ranking in TI compared to SPI and II rankings. Singapore has very low ranking in II compared to other indices. This indicates that there could be a correlation between the level of talent and innovation in the country and its startup performance. To have more clarity regarding this a bar chart is created for rankings of selected countries by Startup Performance Index and Combined Innovation and Talent Index (Figure 6).

Figure 6: Ranking (in ascending order) of countries by Startup Performance Index (SPI) and Combined Innovation and Talent Index (CITI)



Source: Computed

Figure 6 demonstrates that there is not much gap between a countries' SPI and CITI scores for almost all countries' except Israel, the Republic of Korea and China. This indicates that there is a correlation between the combined level of talent and innovation in the country and its startup performance. Israel have much higher score of SPI compared to CITI score the reason behind this could be the government supports to new businesses with grants, tax incentives and R&D support programmes which declines the risks and attract foreign investments and secondly the highest concentration of venture capital firms per capita (second only to Silicon Valley in the USA) here ensures access to necessary capital for startups to scale up their operations along with mandatory military technology training to young people and a large pool of skilled educated human capital. On the contrary China and the Republic of Korea have high CIPI score compared to SPI score. In China, the uncertain business environment dur to regulatory crackdown on major tech companies, reduced foreign investment due to geopolitical tensions and migration of highly talented individuals towards stable and well-paying jobs in the state sector instead of starting startups are the reason for low startup performance, whereas in the Republic of Korea dominance of large corporations and intense competition make difficult for new startups to gain significant market share, attract or secure top talent and effectively commercialise research outcomes despite high R&D investments and high patents.

Figure 5 and 6 indicates the possibility of correlation in startup performance in a country and level of innovation and talent in a country. To check this the Pearson's correlation test is applied and results are shown in table 1.

VI. Results Of Hypothesis-Testing And Discussions

Correlation analysis of startup performance with population, innovation and talent

Table 1: Pearson's Correlation Coefficient and Significance Value

Variables	SPI	II	TI	CITI	PI
SPI	1	.176 (.459)	.525* (.017)	.369 (.110)	-.336 (.148)
II	.176 (.459)	1	.666** (.001)	.928** (.000)	-.113 (.634)
TI	.525* (.017)	.666** (.001)	1	.893 (.000)	-.379 (.099)
CITI	.369 (.110)	.928** (.000)	.893 (.000)	1	-.243 (.303)
PI	-.336 (.148)	-.113 (.634)	-.379 (.099)	-.243 (.303)	1

Source: Computed

*Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed)

Note: Value in the parentheses are significance or P-value.

Table 1 shows that SPI is significantly correlated with TI only but it shows positive, low and insignificant correlation with II and CITI and negative, low and insignificant correlation with PI. It indicates that startup performance is significantly correlated with talent but not with the size of population. II and TI are highly correlated with CITI which is obvious because CITI is just the combination of these two indices. II and TI also show a significant positive correlation. PI is not significantly correlated with TI, II or CITI which means larger population cannot ensures high level of talent and innovation in a country and even it sometimes could work as a hindrance for achieving their high levels.

Results of the regression analysis

The correlation analysis explained that SPI shows the significant correlation with TI only, but its relation with PI, II and CITI cannot be denied theoretically and empirically. So, they are also included in regression analysis to check whether they also contribute in startup performance along with the level of talent in a country or not. Since the CITI is formed by using II and TI so they simultaneously cannot be included in the same model, therefore two regression models are applied as explained in the section 3.

Table 2 presents the regression results of model1 where SPI is the dependent variable and PI and CITI are the predictors.

Table 2: Regression results of model 1

Model 1[a]	Unstandardized Coefficients		t Statistics	Significance or P-value	Collinearity Statistics	
					Tolerance	VIF
	B	Std. Error				
PI	-.189	.196	-.964	.348	.888	1.126

CITI	.489[c]	.102	4.809	.000[c]	.888	1.126
R Square[b]= .567		Adjusted R Square =.519		F=11.796 (.001[c])		

Source: Computed

a. Dependent Variable: SPI and Predictors: PI and CITI

b. For regression through the origin (the no-intercept model)

c. significant at the 0.01 level (2-tailed)

Table 2 explains that p-value for f statistic is significant at 1 per cent level of significance so model is fit. Its r square value shows that both the variables explain 56.7 per cent variance and collinearity statistics (tolarence>.10 and VIF <10) shows that no severe multicollinearity problem exist so model is acceptable.

Out of the two independent variables only CITI has significant beta coefficient that shows the combined level of innovation and talent contributes positively in determining startup performance in the country not the size of the population. To explore which factor - the level of talent or the level of innovation contributes more in startup performance regression model 2 is applied having the level of talent and level of innovation in a country as two separate independent variables in the form of TI and II along with population index (PI).

Table 3: Regression results of model 2

Model 1[a]	Unstandardized Coefficients		t Statistics	Significance or P-value	Collinearity Statistics	
	B	Std. Error			Tolerance	VIF
PI	-.098	.184	-.532	.602	.846	1.182
II	-.301	.287	-1.048	.309	.120	8.326
TI	.726[c]	.240	3.027	.008[c]	.127	7.867
R Square[b]= .654		Adjusted R Square =.593		F=10.714 (.000[c])		

Source: Computed

a. Dependent Variable: SPI and Predictors: PI, II and TI

b. For regression through the origin (the no-intercept model)

c. significant at the 0.01 level (2-tailed)

The regression results of model 2 shows that its r square value is greater than the model 1 so it explains the variance in dependent variable better (65.4 percent) compared to model 1 (56.7 per cent). F statistic shows that this model is fit at 1 per cent level of significance. Its variance inflation factor (VIF) for TI and II indicates some level of multicollinearity but since VIF is less than 10 and tolerance is greater than 1 for all predictors so model can be considered for simple analysis. The beta coefficient is significant only for TI so it can be concluded that it is the level of talent in the country which actually determines the startup performance not the population size and even the high level of innovation. If the country has many patents granted, designs registered and research results published but if they are not commercially used or applied the startup performance cannot be improved. China is the example where the level of innovation is very high but level of talent is low and so as its startup output. Whereas Singapore has low level of innovation but high level of talent so it achieved the high level of startup output. Only innovations cannot lead to higher level of startup output if it is not combined with higher level of talent in the country.

Based on the regression results of both models, it can be concluded that population size does not significantly contribute in determining the startup performance but the quality of the population means the level of talent in the country contribute significantly.

VII. Conclusion And Suggestions

Startup performance is not affected by the Population size. Innovations and talent jointly contribute in improving the startup output but not the innovations alone. After looking at some countries like China it could be concluded that though innovations are taking place but not converting into the startup output whereas Singapore is doing well in startup output even though it has low level of innovations.

The survival of startups is very difficult. Empirical studies confirmed that the chances of survival for a new firm are just 10 percent as generally 9 out of 10 startups fails within five years. Only large size of population and large number of patents and other intellectual property rights cannot help. It is the talent of the country which can lead to better startup performance of the country. Talent and innovation jointly explain the 56.7 per cent variance of the startup performance it means some other factors are also important, like government policy which also plays crucial role in determining the level of innovation and talent thus the startup performance in the country.

This research paper suggests that countries with large population like India and China should control the size of the population and improve its quality by promoting talent in the country through policy and financial

support. Countries should invest in upgrading the knowledge, skills and capabilities of the people, give incentives for advanced researches and developing good academic and research environment in higher education institutions and students should be promoted to Science, Technology, Engineering and Management education. Countries should develop the world class institutions for higher education in collaboration with other nations.

Countries with high innovation but low startup performance should encourage universities and other higher education institutions for promoting entrepreneurship, creativity and new business talents among students. Appropriate use of intellectual property rights for the business development should be ensured instead of mere registrations.

Countries should address the issues related to setting up and funding of startups and make doing business more interesting and enjoyable for entrepreneurs rather than a pain giving task. Both the government and entrepreneurs should work together to create the healthy working environment in startups to attract and retain best talent there. The flourishing startups with high talent and innovation can change the market scenario and contribute for high economics progress of a country.

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