Characteristics and Determinants of New Start-ups in Gujarat, India

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Research Article

Abstract

Purpose: *This study examines the relationship of socio-economic characteristics of start-ups with their size in Gujarat, India. It also assesses the determinants affecting the annual sale of start-ups.*

Methods: *It includes primary information based on a survey of 120 founders of start-ups. Linear and semi-log linear regression models have been applied to assess the determinants of start-ups. Probit regression models have been considered to assess the factors affecting the annual sale of the start-ups.*

Results: *Stage of start-up, the participation of founders in conferences, educational qualification, and new products launched by start-ups, professional connections of founders, source of funding, and support from incubator/accelerator/supporting organizations are found crucial determinants of start-up size in Gujarat. The annual sales of the start-ups are positively associated with stage of start-up, support from a mentor, team members, founder's academic qualification, and collaboration with national or international organizations, unskilled workers.*

Implications: *Technology transfer and commercialization, development of new products, government regulations, the requirement of costumers, free rights for entrepreneurs, appropriate financial support for new entrepreneurs, transparency and clarity in government policies, the establishment of high-tech start-ups, and development of digital infrastructure, increase in R&D spending in research academia, and association of research institutions with entrepreneurs would be conducive to create an appropriate start-ups ecosystem and to reduce regional development disparities across Indian states. Subsequently, it would be helpful to increase sustainable development in India.*

Originality: *This study has used primary information of 120 founders of start-ups to assess the determinants, and the factors affecting annual sales of start-ups using the regression model in, Gujrat, India. Thus, it has an empirical contribution to the body of knowledge.*

Limitations: *This study could not provide rational justifications on most factors that show an insignificant impact on start-ups due to the small sample size. Further research, therefore, may be considered to identify the association of start-up size with the variables using a large sample size in India.*

Keywords: Annual sale, Entrepreneurship ecosystem, India, Start-up, Start-ups size, Gujarat, Technology, innovation.

1. Background

Most studies have observed that the entrepreneurship ecosystem is effective to create new start-ups and vice-versa in developing and developed countries (Sabbarwal, 1994; Naudé et al., 2008; Naudé, 2013; Ghosh and Bhowmick, 2014; Röhl, 2016; Sopjani, 2019). Further, several studies have argued that start-ups ecosystem plays a critical role to increase the economic growth and development of a country through creating jobs and new market, the discovery of goods and services, infrastructure development, etc. (Mazanai and Fatoki, 2012; Ghani et al., 2013; Krishna and Subrahmanya, 2015; OECD, 2016; Okrah et al., 2018). The economic performance of a country depends upon the growth of new start-ups which create employment for the skilled and unskilled workforce (Gibcus et al., 2006; Braunerhjelm, 2010; Calá et al., 2015; Sopjani, 2019). Thus, it is a significant driver to increase the economic growth of a nation (Sopjani, 2019). Start-up is a platform in which available resources (i.e. human, physical, financial, environment, technological, academic institution, etc.) are useful to develop goods and services in a country.

Start-up based on advance technology is effective to solve the existing problems of the society. Start-ups is defined as a business venture which has created through innovative idea and knowledge to solve the problems of society (Sopjani, 2019). Start-ups have an appropriate and innovative capacity to create new markets for new goods and services that are introduced by the business community (OECD, 2016). It is also helpful to develop a viable business model to meet the market needs (Sopjani, 2019). Also, a new business model is helpful to improve efficiency, productivity, and effectiveness of a system, price reductions of goods, production of various products, and innovation (Braunerhjelm, 2010; Calá et al., 2015; Singh et al., 2020a). Start-ups develop a link between knowledge and commercialization of technology (Braunerhjelm, 2010; Okrah et al., 2018; Singh et al., 2019a).

There are many economies such as the USA, United Kingdom, and Israel, which have achieved greater benefits from the start-up ecosystem (Röhl, 2016; Singh and Ashraf, 2019). In the USA, the establishment of high-tech start-ups has provided significant benefits to increasing economic growth after the 1970s (Krishna and Subrahmanya, 2015; Singh et al., 2019a). In most developed economies, technological change has created high possibilities for the nurturing of high-tech start-ups during 1970-1980 (Krishna and Subrahmanya, 2015). So, most economies have implemented various policies to create more start-ups to increase economic growth and social development (Mazanai and Fatoki, 2012). Furthermore, these countries have centralized their science & technology (S&T) and intellectual property rights (IPRs) policies to create more start-ups through innovation and technological advancement (Singh et al., 2017b; Singh and Ashraf, 2019; Singh et at., 2019b).

1.1 Definition of Start-ups

As per the literature review, the scientific research community, existing researchers, development organizations, policymakers, development thinkers, government representatives, research organizations have provided different definitions of start-ups. However, there is no

scientific, rational, uniform, and universally acceptable definition of start-ups. Start-up is an early stage newly established company or venture that is in the phase of development and need market (Čalopa et al., 2014). In India, the start-up is an intellectual property-based technology product/platform/e-commerce that meet customer's requirement through a digital platform (NASSCOM, 2016). Start-ups are high-growth enterprises that have an average annual growth in employees or have a 20% more turnover during the last three years (OECD, 2016). A brief overview of some important definitions of start-ups is presented in Table 1.

Table 1: Definition of Start-ups

Performance-based Definitions of Start-ups	
High-growth enterprises	Enterprises that have increased their number of employees (or turnover) by more than 20% during the last three years and had ten or more employee at the beginning of the observation period
Gazelles	High-growth enterprises less than five-year-old
High-impact entrepreneurs	The individual who launch and deal companies with above-average impact in term of job creation and the development of entrepreneurial role models
Definition Based on the Nature of the Business or Innovation Intensity	
Start-ups	Enterprises that are less than three years old that use technologies or innovation-intensive business practices or that have a significant growth potential in term of turnover or jobs
	Enterprises that have been operating for less than two years
	A company working to solve a problem where the solution is not obvious and success is not guaranteed
	A human institution designed to deliver a new product or service under conditions of extreme uncertainty
Mixed Definitions	
Start-ups	Innovative or technological firms targeting the global market with the potential to grow 20% during the first three years and achieve a turnover in excess of USD 1 million
	Companies, not more than five years old, with a turnover of less than INR 250 million (Indian rupees, about USD 3.7 million) in the last five years, that are working towards innovation, development and the commercialization of new products, processes or services driven by technology or intellectual property
	Entrepreneurial venture designed to search for a repeatable and scalable business model. Usually highly innovative and typically based on ideas, technologies, or business models that did not exist before.

Source: OECD (2016); published research papers

In Europe, any company may be considered as a start-up, if the company have the following criteria: it is not more than 10 years old, it has developed highly innovative technologies or created high innovative business models, and it is useful to increase revenues and employment (Röhl, 2016). In India, the Department of Industrial Policy & Promotion (DIPP), Ministry of Commerce and Industry has defined a start-up as an entity which has the following standards: It must not be more than 7 years (except any entity in biotechnology start-ups), the annual turnover of the entity must not be exceeding INR25 Crore in a preceding financial year, and the focus of the entity must be on innovation, development or improvement of products or process or services, or it must have high potential to create employment and wealth.[1]

[1] http://start-upindia.gov.in/.

1.2. Reliable Research Gap and Research Objectives

Most studies have provided the theoretical and empirical background of start-ups ecosystem and it's affecting factors in different economies. Few studies have presented an overview of various factors that affect start-up's size (Colombo et al., 2004; Colombo and Grilli, 2005; Ghosh and Bhowmick, 2014; Klaesson and Karlsson, 2014; Coad et al., 2014; Akben-Selcuk, 2016). A group of researchers has estimated the impact of financial sources on start-ups size and its growth (Čalopa et al., 2014). Isaksson and Quoreshi (2015) have used external finance of start-ups and it's affecting factors in Sweden. However, limited studies have provided clear implications of socio-economic factors on start-up size in developing countries (Ghani et al., 2013; Motoyama and Watkins, 2014; Ashraf and Singh, 2019). Also, earlier studies could not develop a scientific technique or model to assess the impact of socioeconomic progress on start-ups size in these economies. Furthermore, there is little evidence on the relationship of economic growth with start-ups size in the existing studies which have used correlation and regression analysis techniques (Bjornali and Ellingsen, 2014). Limited studies have provided a better understanding of various factors that have a significant impact on start-up size in most developed countries (Gottschalk et al., 2009). Further, it is also essential to include factors such as founder-specific, firm-specific and industry-specific variables to assess their association with new start-ups in empirical models (Gottschalk et al., 2009).

India has several problems such as a low number of high-tech industries, low R&D expenditure in research institutions, low technology transfer from research institutions to industrial field and markets, the low skill of the entrepreneurial team, a weak association of entrepreneurs with research institutions, insignificant support for start-up from financial organizations, ineffective government mechanism, high complications in taxation and government policies, low demand of high-value-added products in the domestic market, the low economic capacity of consumers to buy high-value-added products, and others which are creating obstacles to sustain the economic progress of new start-ups. In India, it has observed that most start-ups could not nurture efficiently after a time period, thus start-ups cannot achieve success significantly in the long-run. In India, the existing researchers could not formulate an advanced econometric model to increase the understanding of the start-up ecosystem and its relationship with socio-economic characteristics (Singh et al., 2019b). Most studies have concise their investigation to assess the determinants of start-up size in India (Audretsch and Tamvada, 2008; Ghosh and Bhowmick, 2014). Also, limited studies could estimate the factors which affect the annual sales of start-ups. Due to the aforesaid research gap, the present study is an attempt to answer the following research questions:

- Are socioeconomic activities of the founders have a link with start-up size in Gujarat?
- Which indicator will be most useful to increase the growth of start-up in Gujarat?
- What are the barriers to increase start-up size in Gujarat?
- What must be a suitable measurement to examine the growth of start-ups?
- What is the role of various players to create an appropriate start-up ecosystem?

With relevance to the aforementioned research questions, the present study is aimed to achieve the following objectives:

- To investigate the association of various factors with start-up size in Gujarat.
- To assess the crucial determinants of start-up size in Gujarat.
- To examine the factors affecting annual sales g of the start-ups in Gujarat.

1.3. Current Background of Start-ups in India

India is found as a start-up hub and it is expected that new start-ups would grow by 8-10% in the near future (NASSCOM, 2016). At present, India has around 6253 start-ups, 108 incubators, and 86 investors in different states (SIDBI Start-upMitra, 2017).[2] It also seems that the number of technology start-ups has increased continuously in India after 2011 (NASSCOM, 2016). Also, India would be a destination of 10500 new start-ups and it would be helpful to create jobs for 210,000 peoples in the near future (NASSCOM, 2016). The number of incubators and accelerators are also increased after 2016 (NASSCOM, 2016).

Table 2: State-wise Industry's Specific Target of Start-up Policies

States	Name of the Policy	Time-Period	Focus of Start-up Policies on Industries
Gujarat	Electronics & IT/ITeS Start-up Policy (2016-21)	2016-2021	Agro and food processing, dairy, petrochemicals, textiles, auto, oil and gas, and IT
Karnataka	Start-up Policy 2015-2020	2015-2020	ICT, animation and gaming, agri-biotechnology, health, BFSI, and ESDM
Kerala	Technology Start-up Policy 2014	2014-2020	Handlooms, rubber, bamboo, coir, sericulture, cashew, mining, tourism, and spice
Rajasthan	Start-up Policy 2015	2015-2020	Tourism, textile, marble and steel; water availability, agriculture, and food processing
Uttar Pradesh	Information Technology & Start-UP Policy 2016	2016-2020	Information technology, agro-processing, mineral-based industries, and food processing
West Bengal	Start-up Policy 2016-21	2016-2021	Tea, petrochemicals, mineral resources, auto components, biotechnology, and fisheries
Odisha	Start-up Policy 2016	2016-2021	Plastic, petrochemicals, healthcare, automobiles, and textiles
Telangana	Innovation Policy 2016	2016-2021	Health tech, sustainability, and fintech
Maharashtra	Innovation and Start-up Policy-2017	2017-2022	Agriculture, energy, water management; health and drug discovery
Andhra Pradesh	Innovation and Start-up Policy (2014-2020)	2014-2020	Pharma, oil & gas, and urban management

Source: Based on existing literature and policy documents of respective states published by the respective state government in India.

In India, the prime purpose of the start-ups is to create an entrepreneurship ecosystem through increasing a better association among the stakeholders, incubators/ accelerators, angel investors, venture capitalists, financial supporters, mentors, and technology corporations. In January 2016, the Government of India (GoI) has introduced the 'Start-up India' policy to create an

[2] https://www.sidbistartupmitra.in/.

effective entrepreneurship ecosystem in India. The entrepreneurship ecosystem would be useful to create more jobs for skilled and unskilled laborers in India. Subsequently, most Indian states have taken different initiatives to increase the growth of the manufacturing sector under the Start-up policy.

Gujarat is the first state of India, which has implemented a Start-up policy in January 2015. Few states have decided on their growth agenda in various sectors based on the availability of resources and the requirement of people. Most states have adopted start-up policies to increase the growth of certain industries (Refer to Table 2). It is seen that all states are focusing only on those sectors which have the potential to create jobs and produce optimal outputs. The agriculture sector is found as a prime sector by Gujarat, Karnataka, Rajasthan, U.P., and Maharashtra.

Table 3: State-wise Strategies and Facilitating Environment of Start-up Policies

States	Crucial Strategies for Start-ups	Facilitating Environment for Start-ups
Gujarat	To pursue threefold strategy: innovators, institutions and government committee	Mentor services, financial service for the innovator, and free access to institutional support systems
Karnataka	To promote new business ventures; incubation infrastructure through Public-Private Partnership (PPP) Model	Financial support to new age incubation network branches
Kerala	To accelerate the growth of student entrepreneurs; innovation and technology start-up policy	To establish a leadership academy and Boot camps for youngsters to gain leadership
Rajasthan	To provide support to student entrepreneurs	Free access to university/ libraries/ government laboratories/ Centre of excellence/ PSUs
Uttar Pradesh	To promote IT infrastructure development, human capital/skill development, the incentive for industries	Rural Incubation cum training Centers to new entrepreneurs
West Bengal	To fostering greater social acceptance and recognition of promising start-ups	Digital platform for information, networking, project evaluation, and guidance
Odisha	To maintain partnerships, conducive ecosystem, investment among various stakeholders	Fiscal and non-fiscal benefits, streamline rules, regulations, and legislation
Telangana	Physical infrastructure & program management; human capital	Encourage participation of start-ups in international and national
Maharashtra	Public-Private Partnership (PPP) Model	Extensive events through sponsorship
Andhra Pradesh	Public-Private Partnership (PPP) Model	Appropriate implementation/ operational guidelines with simplified application Performa

Source: Based on existing literature and policy documents of the respective states of India.

The state-wise strategies and facilitating environment to increase the number of start-ups is presented in Table 3. It clearly indicates that Indian states are applying different strategies to increase the growth and size of start-ups. The states are also providing facilities based on regional requirements of people and giving importance to create extensive jobs in India.

2. Literature Review: Determinants of Start-up's Growth and Size

The scientific research community has provided several determinants that affect the growth and size of start-ups, and factors which are effective to create new start-ups in different economies. The size of the start-up varies due to the existence of high diversity in dimensions of socio-economic activities, geographical location, and government policies in different countries (Klaesson and Karlsson, 2014; Okrah et al., 2018). Sopjani (2019) have argued that social conditions are crucial for the development of new business and start-ups in a country. Singh et al. (2020b) have claimed that the ability of an entrepreneur to produce new goods for customers has a positive impact on the effectiveness of new start-ups. Few factors which may be useful to increase or decrease the start-up's size and growth are presented in Table 4. Financial accessibility is found as a prime and crucial factor for the long-term sustainability of start-ups (Mason and Brown, 2014; Isaksson and Quoreshi, 2015). The development of a new firm or start-up depends upon the resources and abilities of an individual person, the attraction of people towards entrepreneurship, culture, and education level of people (Calá et al., 2015).

Infrastructure, availability of finance, and government regulatory also create a conducive environment to nurture the growth of start-ups (OECD, 2016). Geographical location also may be a crucial determinant to increase firms and start-up size (Audretsch and Tamvada, 2008). Furthermore, business family, caste, and religion are also found crucial factors to create an entrepreneurial ecosystem and new start-ups (Sabbarwal, 1994). The entrepreneurial family background of an individual is also found as a decisive determinant to create a new start-up. Earlier job profile of a person also provides an incentive for him to start a new start-up (Sabbarwal, 1994). Additionally, few studies have claimed that start-up growth is positively associated with profits, growth, and size of the industry (Braunerhjelm, 2010). Incubator organizations are also useful to increase the attention of the people to start a new business or start-up (Mason and Brown, 2014). In developing economies, few studies have assessed the determinants of entrepreneurship or start-ups, and their association with socioeconomic and government policy-related variables. The above-mentioned literature has delivered a conceptual framework to measure the impact of various socio-economic activities on the start-up's growth across economies.

The current section presents a brief overview of earlier studies that have assessed the impact of certain factors on the start-up's growth, size, and rate in different economies. Scherr et al. (1993) have assessed the relationship of the ratio of business start-ups debt to total capital with other explanatory variables using Tobit and Probit empirical models. Sabbarwal (1994) has recognized the start-up factors in northern India using the information of 66 entrepreneurs. It inferred that caste, family size and business, previous experience of entrepreneurs (i.e. infrastructure facilities, economic conditions, state regulations, technology, electricity, water connections, etc.),

social network, and availability of finance are found crucial factors to increase the growth of the start-up. Mata and Machaso (1996) have specified that the industry's attributes have a significant contribution to boost the start-up size in Portugal.

Table 4: Major Determinants of Start-up in Few Selected Economies

Author(s)	Countries	Crucial Determinants of Start-ups
Audretsch and Tamvada (2008)	India	Ownership structure, initial knowledge endowments, technical know-how, geographical location, age and education of founder, and financial development
Ghosh and Bhowmick (2014)	India	Founder members in a start-up and long-term vision of founders
Görg et al. (2000)	Ireland	Sub-optimal scale, industry size, turbulence, industry growth, the performance of firms in industries, and market condition
Colombo and Grilli (2005)	Italy	Salaried persons and founders, firm's initial capital, private equity; educational qualification and working experience of founders; firm's association with technological incubators, and real interest rate
Akben-Selcuk (2016)	Turkey	Return on assets, gross margin, leverage, liquidity, firm size, exports, R&D expenditure, and international sale
Klaesson and Karlsson (2014)	Sweden	Accessibility to market potential, degree of competition, labor productivity and costs, capital costs, availability of finance, inputs costs, specialization of locality, and diversity in socio-economic activities and government policies
Bjornali and Ellingsen (2014)	Based on Reviewed	Finance performance, social identity, alliance portfolio, and internationalization; individual factor (i.e. skills and competence), firm-specific factor (i.e. financial and human resources), and external factor (i.e. industry-wide or nation-wide, national policies)
Gottschalk et al. (2009)	Germany	Number of founders, human capital, entry strategies, number of employees, new technologies or innovative products, involvement in R&D activities, public fund, and labor cost
Naudé (2013)	Based on Reviewed	Cost of R&D activities and other socio-economic indicators of start-ups founders
Suzuki and Okamuro (2017)	Japan	Technological capabilities, public support, geographical location, firm's size and age, academic qualification and earlier work experience of founders, the excellency of parent university in research, and sector-specific start-ups
Song et al. (2008)	USA	Competition intensity, internationalization, low-cost strategy, market growth and scope, start-up's experience, financial resource, R&D investment and alliance, firm's age and size, size of the founding team, university association, and product innovation
Mazanai and Fatoki (2012)	South Africa	Business age, size, and ownership; access to finance; position, age, education, and gender of respondents; government subsidy
Naudé et al. (2008)	South Africa	Population density, formal bank credit, market-size, education, profit level, number of banks, unemployment, regional economic growth, and economic size
Scherr et al. (1993)	USA	Owner's age, gender and education, family business experience and professional experience of the owner, human capital, founder of firms, personal characteristics, and operating attributes
Colombo et al. (2004)	Italy	Founder's human capital, experience, and managerial skills, infrastructure, and industry's characteristics
Andersson (2013)	Sweden	The education level of employees, market size, and share of services
Coad et al. (2014)	United Kingdom	Business and selling experience of the owner; age, education profile, the gender of the owner; and indicators of industries
Fritsch and Wyrwich (2017)	Germany	Self-employment rate, employment share in the manufacturing sector, employment growth, population density, market potential, and R&D employees
Okrah et al. (2018)	13 selected developed countries	Financing, government support, taxes, basic education, research & development, market dynamics and openness, GDP per capita and employment

Görg et al. (2000) have used a quantile empirical model to assess the determinants of start-ups in Ireland. It implies that the start-up size is impacted due to the earlier performance of firms in industries. Almus et al. (2004) have explored the association of innovation with start-ups in Germany. It concludes that the growth of firms is obstructed due to variations in legal form, human capital, and business knowledge. It also shows a confirmation that innovative start-ups have a higher growth opportunity as compared to non-innovative start-ups. Colombo et al. (2004) have examined the determinants of the start-up size of new technology-based firms using empirical models in Italy. It specifies that the human capital of entrepreneurs; experience and managerial skills of founders, infrastructure, and industry's characteristics are found important factors to boost start-up size. Colombo and Grilli (2005) have explored the impact of external finance on start-ups size in Italy. It found that private equity finance and human capital are observed most vital factors to boost tech-based start-ups. Gibcus et al. (2006) have identified the factors which affect start-ups growth in the Netherlands.

Song et al. (2008) have examined the success and sustainability of new technology venture (NTV) affecting factors in the USA using the Meta-analysis technique. It observed that supply chain integration, market scope, firm's age and size, financial resource, marketing and industry experience, and patent protection are found vital activities to increase the success of NTV. Audretsch and Tamvada (2008) have examined the role of geographical location to start a new start-up and its distribution in India using comprehensive database analysis. It observes that the characteristics of firms and industries do not have a significant contribution to start-ups in India. Naudé et al. (2008) have explored the regional determinants of the start-up rate in South Africa. It observes that formal bank finance, education, profits, and market-size are the important drivers to increase start-ups rate. Gottschalk et al. (2009) have identified the determinants of start-up size in Germany using an empirical model. It implies that the R&D expenditure of a firm is found as a crucial factor to increase the start-up size. Also, formal education, primary motivation, specific human capital, and age of founders are the significant variables to boost start-ups size.

Mazanai and Fatoki (2012) have assessed the perception of start-up SMEs owner and working staff towards the services which are provided by business development serviced in South Africa. It argued that business age; size; business ownership; access to finance; age, education qualification, and gender of respondents; and government subsidy are found critical factors to create an appropriate start-up ecosystem. Andersson (2013) have explored the association of start-ups activities with business cycles in Sweden. It detects that supply and demand-side characteristics in the market are useful to increase the activities of start-ups. Ghani et al. (2013) have estimated the determinants of entrepreneurship in manufacturing and service sectors in India. It found that physical infrastructure, education level of the workforce, labor laws, and banking accessibility are vital indicators to improve the entrepreneurship ecosystem.

Čalopa et al. (2014) have inspected the impact of funding sources on start-up companies in Croatia. It found that the growth of start-ups companies depends upon traditional and informal financial sources. Ghosh and Bhowmick (2014) have recognized the indicators of the social self-identity of start-ups in India. It found that a firm's success or failure is significantly connected

with the harmonization of decision making and the long-term vision of the founding team of a start-up. Klaesson and Karlsson (2014) have assessed the determinants of new start-ups in different industries in Sweden. It found a positive relationship of new start-ups size with market potential, labor market conditions, and regional specialization. Bjornali and Ellingsen (2014) have recognized the growth of clean-tech start-up affecting factors based on existing literature. It provided a further research direction to appraise the relationship of socio-economic factors with the firm's activities.

Coad et al. (2014) have explored the determinants of start-up size in the United Kingdom. It shows that business experience; age, education, and bank activities are the noteworthy variables to increase the start-up size. Isaksson and Quoreshi (2015) have measured the impact of various factors on external financing of business start-ups in Sweden. It found that ethnicity, gender, education, experience, age, region, and firm size are useful factors for new start-ups. Krishna and Subrahmanya (2015) have evaluated the long-term sustainability of high-tech start-ups in India using descriptive analysis. It concluded that high-tech start-ups have a strong ability to survive in the long-term.

OECD (2016) has noticed that new start-ups are significantly associated with an innovative idea that needs more financial capital as compared to physical infrastructure. Akben-Selcuk (2016) has examined the impact of explanatory variables on the financial performance of firms in Turkey using an empirical model. It reported that firm size is positively, and R&D expenditure is negatively associated with the financial performance of firms. Fritsch and Wyrwich (2017) have investigated the impact of the number of start-ups on employment growth in Germany. Suzuki and Okamuro (2017) have measured the determinants of academic start-ups and their expansion at the international level in Japan using an empirical model. It specified that technological capabilities, public support, the business environment in a specific region, the association of start-ups with the universities are the important indicators to increase the publicity of start-ups at world-wide.

Arafat and Saleem (2017) have evaluated the impact of socio-economic factors on the creation of start-ups in India using a robust regression model. It observed that age, household income, education level, and fear of failure are found as crucial indicators to start a new venture or start-ups. Lombardi et al. (2017) have explored the importance of financial instruments in innovative start-ups in Italy using an exploratory analysis. Okrah et al. (2018) have identified the factors which have a significant impact on the success of a startup in 13 developed countries. It found that the confidence of entrepreneurs depends upon turnover, market openness, and dynamics, and government policies. Kim et al. (2018) have determined the success factors of start-ups in Korea. It found that idea commercialization has a significant impact on the success of start-ups. Ashraf and Singh (2019) have identified the association of entrepreneurship ecosystems with per capita GDP in selected economies using linear and non-linear regression models. It reported that per capita GDP is positively related to the entrepreneurship ecosystem. Sopjani (2019) has investigated the entrepreneurship ecosystem as focusing on start-ups and infrastructure in Kosovo. It also found a significant association of the entrepreneurship ecosystem with start-ups.

3. Research Methodology

Brief Description of Study Area: Gujarat is one of the prime leading industrialized states, contributing more than a 7.5% share in India's GDP. It has 18% share in India's fixed capital (CMIE, 2016).[3] It occupies around 10% of India's factories. The manufacturing sector of Gujarat contributes around 28% share in its gross domestic product (CMIE, 2016). In India, most states have adopted policies to increase the number of start-ups and start-up size during 2015-2016. As Gujarat is a first state which has adopted a start-ups policy and it is an industrial hub in India. Also, the Government of Gujarat has taken several initiatives to increase start-ups growth. Therefore, the study area of the present research is Gujarat, which includes only new start-ups.

Selection of Sample Size and Respondents: This study is used as a primary survey, for this, it collects the required information from 250 founders of a new start-up. The primary detail and address of the start-up's founders are taken from various incubators centers which is located in Gujarat. Structural questionnaires are sent to the respondents through mail to acquire the data on start-ups related activities. The questionnaires include quantitative and qualitative information with regards to the structure and opinion of founders on various aspects of start-ups. The survey of the start-up's founders was conducted from May 2017 to June 2017. Only 120 founders of new start-ups have provided responses, while 52 respondents have produced complete information that is used for descriptive and empirical analysis in this research. MS excel office is used for cleaning the data, and SPSS statistical software is used for coding and to produce descriptive results (i.e. mean, standard deviation, percentage, variation, and correlations coefficient). Proposed regression models are run through STATA statistical software.

3.1 Theoretical Framework on Valuation of Growth and Determinants of Start-ups

Several empirical models have applied by existing researchers to assess the relationship of start-ups size or new firms with socio-economic variables across economies (Colombo and Grilli, 2005; Audretsch and Tamvada, 2008; Gottschalk et al., 2009; Klaesson and Karlsson, 2014; Coad et al., 2014; Isaksson and Quoreshi, 2015; Akben-Selcuk, 2016; Fritsch and Wyrwich, 2017; Suzuki and Okamuro, 2017; Arafat and Saleem, 2017). Start-up size is a crucial measurement to recognize the progress or start-up's growth (Coad et al., 2014). Most studies, therefore have used start-up size and its financial performance as a proxy for start-ups growth (Colombo et al., 2004; Colombo and Grilli, 2005; Ghosh and Bhowmick, 2014; Klaesson and Karlsson, 2014; Akben-Selcuk, 2016). Few studies have considered the ratio of business start-up debt with total capital as dependent variables and recognized the start-up's growth affecting factors using regression models (Scherr et al., 1993; Isaksson and Quoreshi, 2015). Few researchers have preferred a quantile regression model to examine the determinants of start-ups size (Mata and Machaso, 1996; Görg et al., 2000; Coad et al., 2014). Naudé et al. (2008) have used a start-up rate as a dependent variable to examine its relationship with socioeconomic factors in South Africa

[3] Centre for Monitoring Indian Economy (CMIE) Private Limited (2016) [online] http://www.cmie.com/.

using Semi-log linear and Tobit regression models. Fritsch and Wyrwich (2017) also used similar models in Germany.

Furthermore, the scientific research community has also introduced linear, non-linear, log-linear, and semi-log-linear regression models to examine the start-ups or firms affecting factors in different economies (Colombo et al., 2004; Song et al., 2008; Audretsch and Tamvada, 2008; Gottschalk et al., 2009; Dada, 2012; Coad et al., 2014; Ghosh and Bhowmick, 2014; Klaesson and Karlsson, 2014; Coad et al., 2014; Fritsch and Wyrwich, 2017; Suzuki and Okamuro, 2017; Arafat and Saleem, 2017). These studies have considered start-ups size (i.e., number of founders and employees) as a dependent variable, while human capital and skills (education level), age of founder; financial requirement, market potential, geographical location, number of consumers, bank and public facilities, subsidy, R&D activities and labor cost as explanatory variables. Suzuki and Okamuro (2017) have used the categorical variable to recognize the relationship of start-ups size with a set of specific explanatory variables in Japan. Also, most studies have assessed the association of various factors with start-ups in different economies using a concrete empirical model (Almus et al., 2004; Colombo and Grilli, 2005; Gibcus et al., 2006; Bjornali and Ellingsen, 2014; Akben-Selcuk, 2016; Ashraf and Singh, 2019).

4. Empirical Analysis

4.1 Formulation of Empirical Models

This study comprises the cross-sectional data of randomly selected new start-ups and its associated variables which are collected from Gujarat (India). It includes start-up size as a dependent variable, while it is regressed with selected explanatory variables using linear and semi-log linear regression models. For this, the proposed models have adopted from previous studies such as Colombo et al. (2004); Colombo and Grilli (2005); Gottschalk et al. (2009); Dada (2012); Coad et al. (2014); Ghosh and Bhowmick (2014); Klaesson and Karlsson (2014); Akben-Selcuk (2016); Fritsch and Wyrwich (2017). For the abovementioned purpose, this study assumes that start-up size (i.e., number of employees in a start-up) is a function of several variables that is specified as:

$$teps = f(ss, psfbcc, ntms, eqsf, nnpls, npcs, npcnios, sdfs, siaso) \quad (1)$$

Here, *teps* is total number of employees in a start-up, *ss* is stage of start-ups (in year), *psfbcc* is participation of founders in business contest and conferences (Yes = 1, No = 0), *ntms* is team members in start-up (in number), *eqsf* is educational qualification of founder (years spent by founder in academic organization), *nnpls* is number of new products launched by start-up (in number), *npcs* is professional connections of start-up with others (in number), *npcnios* is professional collaborations of start-up with national or international organization (in number), *sdfs* is source of debt funding of start-ups (1 = family/friend, 0 = bank), *siaso* is support for start-up from incubator/accelerator/supporting organization (Yes = 1, No = 0). After applying the econometric model, the equation (1) would became as:

$$(teps)_i = \alpha_0 + \alpha_1 (ss)_i + \alpha_2 (psfbcc)_i + \alpha_3 (ntms)_i + \alpha_4 (eqsf)_i + \alpha_5 (nnpls)_i + \alpha_6 (npcs)_i + \alpha_7 (npcnios)_i + \alpha_8 (sdfs)_i + \alpha_9 (siaso)_i + u_i \quad (2)$$

Here, i is the i^{th} start-up; α_0 is the constant coefficient; α_1 to α_9 are the regression coefficients of related explanatory variables and u_i is the error term in equation (2). The explanations of explanatory variables is given in equation (1). For semi-log linear regression model, the equation (2) is use as:

$$log(teps)_i = \beta_0 + \beta_1 (ss)i + \beta_2 (psfbcc)_i + \beta_3 (ntms)_i + \beta_4 (eqsf)_i + \beta_5 (nnpls)_i + \beta_6 (npcs)_i + \beta_7 (npcnios)_i + \beta_8 (sdfs)_i + \beta_9 (siaso)_i + €_i \quad (3)$$

Here, $log(teps)$ is the natural logarithm of the total number of employees in a start-up; β_0 is the constant coefficient; β_1 to β_9 is the regression coefficient of associated explanatory variables and $€_i$ is the error term in equation (3). The descriptions of other variables are given in equation (1). Accordingly, it assessed the annual sale affecting factors of a start-up using the probit regression model (Scherr et al., 1993; Isaksson and Quoreshi, 2015). For this investigation, the model is used as:

$$(ass)_i = £_0 (ss)_i + £_1 (same)_i + £_2 (ntms)_i + £_3 (eqsf)_i + £_4 (nusws)_i + £_5 (npcnios)_i + \delta_i \quad (4)$$

Here, *ass* is the annual sale of start-up (1 = Increased, 0 = Decreased), *ss* is the stage of start-ups (in year), *same* is support for start-up from mentor/advisor/evangelist (Yes = 1, No = 0), *ntms* is team members in start-up (in number), *eqsf* is educational qualification of the founder (years spent by the founder in an academic organization), *nusws* is the number of skilled workers in start-up (in number), and *npcnios* is professional collaborations of a start-up with a national or international organization (in number). $£_0$ is the constant coefficient; $£_1 \ldots £_5$ are the regression coefficients of respective variables; and δ_i is the error term in the equation (4).

4.2 Validity of Data and Selection of Appropriate Model

Normality Test: Jarque and Bera test is applied to check the normality of each variable in the data set (Mata and Machaso, 1996; Kumar et al., 2020). Normality is a situation which shows that the data set does not have a high variation.

Multicollinearity: It measures the presence of an exact and linear relationship between the explanatory variables (Kumar and Sharma, 2013; Kumar and Sharma, 2014; Kumar et al., 2014; Kumar et al., 2015a,b; Kumar et al., 2020). Value of Variance Inflation Factor (*VIF*) is estimated to recognize the presence of multicollinearity between explanatory variables (Kumar et al., 2016; Fritsch and Wyrwich, 2017; Kumar et al., 2017; Sharma and Singh, 2017; Singh et al., 2017b; Singh and Sharma, 2018; Singh, 2018; Singh et al., 2020a; Singh and Singh, 2020).

Heteroskedasticity: Cameron & Trivedi decomposition of IM-test and Breusch-Pagan/Cook-Weisberg test is applied to identify the presence of heteroskedasticity in the data set (Kumar and Sharma, 2013; Kumar et al., 2015a,b; Kumar et al., 2016; Fritsch and Wyrwich 2017; Kumar

et al. 2017; Singh et al. 2017a; Sharma and Singh, 2017; Singh and Sharma, 2018; Okrah et al., 2018; Singh 2018; Singh et al., 2019c; Kumar et al., 2020; Singh et al., 2020a; Singh and Singh, 2020).

Ramsay RESET Test: Ramsay RESET test provide evidence that whether a model is linear in original variables or not. Further, it also suggests that whether a functional form of a model is correctly well-defined or not (Singh, 2018; Singh and Issac, 2018; Kumar et al., 2020; Singh and Singh, 2020; Singh et al., 2020a). In this study, it assumes that the proposed model does not have any omitted variables, and the functional relationship of a model is properly specified.

AIC and BIC Test: This study applied linear and semi-log linear regression models to ascertain the determinant of start-up size. Therefore, Akaike Information Criterion and Schwarz Information Criteria/Bayesian Information Criterion /Schwarz-Bayesian Information Criteria statistical techniques are used to choose a reliable model (Brown and Kshirsagar 2015; Kumar et al., 2015a,b Kumar et al. 2017; Singh et al. 2017a; Singh 2018; Singh et al., 2019c; Singh and Singh, 2020; Singh et al., 2020a).

5. Brief Summary of Descriptive Results

The brief overview of selected start-ups is presented in Table 5. It infers that the largest number of start-ups have begun through previous experience of founders in organizations and provoked by social issues. It also concludes that research organizations have a minimal contribution to increasing the number of new start-ups in Gujarat. Therefore, the lowest numbers of start-ups are created through a patented technology. Here, it is also suggested that patented technology could not create new start-ups in Gujarat. Furthermore, it also emphasizes that research organizations must increase their responsibilities to create more start-ups through patented technology in Gujarat. Consequently, it would be useful to create a conducive start-up ecosystem in Gujarat.

Table 5: Source of Idea to Start Business/Start-up

Source of idea	Frequency	Percent
Experience with previous organizations	21	40.4
Provoked by social issue	21	40.4
Research organizations	8	15.2
Derived from a patented technology	2	3.8
Total	52	100.0

Source: Based on field survey

The sector-wise distribution of start-ups in various categories is presented in Table 6. The detailed descriptions of the dependent and independent variables are also presented in Table 7. It shows that most variables (except team members in start-up, numbers of workers/volunteers, skilled workers, technical staff, total employed persons in start-ups; new products launched by start-up, professional connections of start-up, professional collaborations of a start-up with the national or international organization) have low values of standard deviation. Thus, these variables are normal, and these do not have high variation and leverages as well.

Table 6: Sector-wise Category of Start-up

Sector-wise categories of start-up			The present state of the start-up		
Sector	Frequency	Percent	Stage of start-up	Frequency	Percent
Aggregator	5	9.6	<5 years	4	7.7
eCommerce	5	9.6	Growth (1-3 years)	26	50
Edutech	5	9.6	Idea	3	5.8
Fintech	2	3.8	Launch (<1 year)	11	21.2
Healthtech	8	15.4	Prototype	8	15.4
Other	27	51.9	Total	52	100
Total	52	100			

Source: Field survey

The results based on the Karl-Pearson correlation coefficient technique which shows the correlation among the undertaken variables is presented in Table A1 (Appendix A). Estimates show that the size of start-ups has a positive association with the stage of start-ups, the participation of founder in business contest and conferences, educational qualification and professional experience of the founder, ratio of skilled worker with the total worker, the annual sale of start-up, demand, and launching of new products, the professional collaboration of founder with national or international organizations and source of debt funding. On the contrary, the size of start-ups is negatively associated with support for start-up from incubator/accelerator/supporting organizations and mentor/advisor/evangelist. Furthermore, the results infer that annual sale of start-ups is positively associated with stage of start-ups, support from mentor/advisor/evangelist, the participation of founder in business contests and conferences, team members, educational qualification and professional experience of the founder, number of volunteers, number of unskilled workers, number of skilled workers, number of technical and non-technical staff, total employed persons, the ratio of skilled worker with the total worker, demand and launching of new products, and professional collaboration of founders with national or international organizations. The annual sale of start-ups is

negatively correlated with the support of incubator/accelerator/supporting organization and source of debt funding.

Table 7: Description of Dependent and Independent variables

Brief description of variables	Symbol	Min.	Max.	Mean	Std. Dev.
Stage of start-ups (in year)	*ss*	0	5	1.6	1.272
Support for start-up from incubator/accelerator/supporting organization (Yes = 1, No = 0)	*siaso*	0	1	0.6	0.495
Support for start-up from mentor/advisor/evangelist (Yes = 1, No = 0)	*same*	0	1	0.48	0.505
Participation of start-ups founder in business contest(s)/conferences (Yes = 1, No = 0)	*psfbcc*	0	1	0.44	0.502
Team members in start-up (in number)	*ntms*	1	50	9.37	11.086
Educational qualification of start-up founder (years spent by founder in an academic organization) (in years)	*eqsf*	15	25	16.79	1.786
Professional experience of start-up founder (in years)	*pesf*	0	17	1.87	4.136
Number of workers/volunteers in start-up (in number)	*nws*	0	50	8.77	10.898
Number of un-skilled workers in start-up (in number)	*nuswsw*	0	25	1.65	4.405
Number of skilled workers in start-up (in number)	*nuswsw*	0	48	7.19	10.892
Number of Technical staff in start-up (in number)	*ntss*	0	46	6.04	9.347
Number of non-technical staff in start-up (in number)	*nntss*	0	15	3.02	3.787
Total employed persons in start-up (in number)	*teps*	1	148	26.62	30.526
Ratio of skilled worker with total worker in start-up (in number)	*rswtw*	0	0.5	0.2177	0.16185
Annual sale of start-up (1 = Increased, 0 = Decreased)	*ass*	0	1	0.87	0.345
Demand of products (1 = Increased, 0 = Decreased)	*dps*	0	1	0.87	0.345
New products launched by start-up (in number)	*nnpls*	0	125	4.08	17.302
Professional connections with start-up (in number)	*npcs*	0	42828	830.6	5938.212
Professional collaboration(s) with a national or international organization (in number)	*npcnios*	0	100	11	29.744
Source of debt funding for start-up (1 = Family/Friend, 0 = Bank)	*sdfs*	0	1	0.74	0.443

Source: Authors' Estimation

6. Discussion on Empirical Results

Regression results that estimate the impact of various explanatory variables on start-up size using linear and semi-log linear regression models are presented in Table 8. As the semi-log linear regression model produces a lower value of *AIC* and *BIC* as compared to the linear regression model, thus it produces consistent and rational results. *F-value* under *the Ramsay RESET* test is also found statistically insignificant, thus it shows that structure of the semi-log linear model is correctly specified. The Chi^2 values under the *Breusch-Pagan/Cook-Weisberg* test

and *Cameron* & *Trivedi's* Decomposition of *IM-test* are found statistically significant, thus it shows that the data set does not have heteroskedasticity. The mean value of variation inflation factor (*VIF*) is found 1.25 for both the models that specify that there is no multicollinearity in independent variables. R^2-Value is found 0.55, thus it shows that a 55% variation in start-up size can be explained through undertaken variables in the model.

Table 8: Regression Coefficients of Explanatory Variables with start-ups Size

Model's Name	Semi-log Linear Regression Model			Linear Regression Model		
No. of Obs.	52			52		
F-Value	15.98			21.72		
Prob > F	0.0000			0.0000		
R^2-Value	0.5524			0.7576		
Root MSE	0.90009			17.052		
Mean VIF	1.25			1.25		
AIC	137.5554			425.8247		
BIC/SIC	156.4736			444.7429		
Variables	*Reg. Coef.*	*Std. Err.*	*P>|t|*	*Reg. Coef.*	*Std. Err.*	*P>|t|*
ss	0.1198	0.1202	0.325	2.4849	2.9165	0.399
psfbcc	0.5349	0.2427	0.034	7.4112	5.3146	0.171
ntms	0.0618	0.0110	0.000	2.3138	0.4457	0.000
eqsf	0.0017	0.0496	0.972	-1.0066	0.8958	0.268
nnpls	0.0103	0.0032	0.003	0.0830	0.0383	0.036
npcs	0.0001	5.28e-06	0.002	0.0002	0.0001	0.013
npcnios	0.0090	0.0023	0.000	0.0921	0.0557	0.106
sdfs	0.0716	0.4342	0.870	-4.5928	6.3794	0.476
siaso	0.2926	0.3447	0.401	4.7472	5.9266	0.428
Con. Coef.	1.3118	0.7473	0.087	14.8887	11.2042	0.192
Ramsey RESET test [F-Value]	2.02			2.77		
B-P/C-W test [Chi^2-Value]	10.48			12.99		
C&T's IM-test [Chi^2-Value]	55.32			62.39		

Source: Authors' Estimation. Note: - *VIF*: Variance Inflation Factor; *AIC*: Akaike's Information Criterion; BIC/SIC: *Bayesian's or Bayesian's Information Criterion*; B-P/C-W test: Breusch-Pagan/Cook-Weisberg test; C&T's IM-test: Cameron & Trivedi's Decomposition of IM-test.

Regression coefficients of the stage of start-up, the participation of founder in business contest and conferences, team members, education qualification of founders, new products launched by start-up, professional connections of start-ups, professional collaboration with national or

international organizations, source of debt funding, and support from incubator/accelerator/supporting organizations with start-up size are found positive. Funding sources from friends or family have a greater contribution to start a start-up as compared to funding from the bank. Therefore, estimates show that these are the crucial determinants to increase start-up size. Empirical results are consistent with earlier studies which also found the positive association of aforesaid factors with start-up size in different economies (Gottschalk et al., 2009; Mazanai and Fatoki, 2012; Dada, 2012; Coad et al., 2014; Suzuki and Okamuro, 2017). However, results based on the correlation coefficient technique indicate that start-up size is negatively associated with support for tart-up from incubator/accelerator/supporting organizations and mentor/advisor/evangelist. This result can be defensible that around 81% of start-ups have nurtured through previous experience of founders and provoked by social issues.

Since the annual sale of start-ups is found an important activity for the long-term sustainability of start-ups. Therefore, the annual sale of the start-up is regressed with the stage of start-up, support for start-up from mentor/advisor/evangelist, team members in start-up, educational qualification of the founder, skilled workers, and professional collaboration of founder with national or international organizations using the probit regression model. The empirical results of this model are presented in Table 9.

Table 9: Regression Coefficients of Explanatory Variables with Annual Sales of Start-up based on Probit Regression Model

No. of Observation		52	*Wald Chi*^{2}		10.29	
Log Pseudolikelihood		-10.8884	*Prob> Chi*^{2}		0.1131	
Pseudo R^2		0.4662	-		-	
Variable	*Reg. Coef.*	*Std. Errors*	*z*	*P > |z|*	95% *Confidence Interval*	
ss	0.0676	0.3822	0.18	0.860	-0.6814	0.8167
same	0.0678	0.6547	0.10	0.917	-1.2154	1.3510
ntms	0.0635	0.0710	0.89	0.371	-0.0756	0.2026
eqsf	1.3936	0.4776	2.92	0.004	0.4575	2.3297
nusws	0.4949	0.4463	1.11	0.268	-0.3799	1.3696
npcnios	0.0098	0.0119	0.82	0.410	-0.0136	0.0332
Con. Coef.	-21.7871	7.5799	-2.87	0.004	-36.6435	-6.9308

Source: Authors' Estimation

The results infer that the stage of start-up, support from a mentor, team members, academic qualification of the founder, unskilled worker, and the number of the professional collaboration of founder with national or international organizations have a positive impact on the annual sale of the start-up. As the annual sale of the startup has a positive impact on the size of startups. Thus, policymakers must implement a favorable policy to increase the professional collaborations of the start-up's founders with national and international organizations to boost the growth and size of startups in Gujarat.

7. Major Findings and Policy Suggestions

The prime aim of the study was to investigate the relationship of socio-economic characteristics of start-ups with their size in Gujarat (India) using the correlation coefficient technique. Thereupon, it assesses the determinants of start-up size using linear and semi-log linear regression models. Finally, it examines the annual sale affecting factors of start-ups using a probit regression model. It also provides conclusive suggestions for policymakers to increase the number of start-ups and their size in Indian states. Hence, this study provides empirical evidence on start-ups size and it's affecting factors in the Indian context using primary information of selected founders of start-ups. Descriptive results based on the Karl-Pearson correlation coefficient technique show that start-up size is positively associated with the participation of founder in business contests and conferences; team members; educational qualification and professional experience of the founder; workers/volunteers, un-skilled and skilled workers, technical and non-technical staff, the ratio of skilled worker with the total worker; annual sales, demand of products, professional connections and collaboration of founder with national or international organizations, and funding sources.

The empirical results based on the semi-log linear regression model show a positive relationship of start-up size with the stage of start-ups, the participation of founder in business contests and conferences, team members, educational qualification of the founder, new products launched by start-up, professional connections of the founder with national or international organizations, source of debt funding, and support for start-up from incubator/accelerator/supporting. Thus, there is desirable to focus on the aforesaid factors to increase the start-up size in Gujarat. This study includes the most relevant factors which are found as crucial determinants of start-up size. Funding sources from banks do not show a positive impact on start-ups size in Gujarat. Thus, it suggested that the banking sector should provide financial support to the newly created start-ups.

The results also infer that support for start-up from incubators/accelerators/supporting organizations and mentors/advisors/evangelists have a negative impact on start-up size. Thus, this is a vital concern for the government to find why and how the aforementioned factors have a negative impact on start-up size in Gujarat? Since the present study could not find a rational justification for it due to the small sample size. A further empirical investigation therefore must be considered to recognize the association of start-up size with incubators/accelerators/supporting organizations and mentors/advisors/evangelists in India using a large sample size. It would be helpful to formulate a better and effective start-up policy in India. Also, the annual sale of start-up will be increased as an increase in the stage of start-up, getting support from mentors, team members, and academic qualification of founders, unskilled workers, and professional collaborations of founders with national or international research organizations.

Commercialization and economic valuation of existing technologies, appropriate design and development of products, funding support from the public and private sectors, setting a low price of relative goods in the market, creation of a new market, and managing talent of skilled workers, effective government regulations, and requirements of costumers are found significant

factors to sustain the economic activities of start-ups in Gujarat. Hence, this study is emphasized that there is essential to give free rights to entrepreneurs to start new start-ups in different sectors in India (Sabbarwal, 1994). For this, Government needs to provide appropriate financial support to SMEs to maintain the economic activities of start-ups in the log-term (Colombo et al., 2004; Naudé et al., 2008; Mazanai and Fatoki, 2012). Investors play a crucial role to take a significant initiative to start a new start-up (Start-up Outlook Report, 2017). Thus, there must be better transparency in government policies (e.g., tax reduction, subsidy, environmental-related concern, bank loan facility, etc.) to increase the attention of investors to start a new business or venture in India.

Moreover, it is evident that high-tech start-ups have high possibilities to grow in the long-term (Krishna and Subrahmanya, 2015). Thus, it is essential for India to establish more high-tech start-ups. Indian research academia needs to increase their extensive involvement in R&D activities in emerging research areas to create more innovation which would assist to meet the technological needs of high-tech start-ups (Song et al., 2008; Gottschalk et al., 2009; Naudé, 2013; Akben-Selcuk, 2016; Fritsch and Wyrwich, 2017; Singh et al., 2019a,b). Subsequently, it would be useful to increase India's position in high-tech start-ups at a global level. There is an urgency for GoI to increase R&D funds in research institutions. There is also essential to develop digital infrastructure to boost the start-up ecosystem in India (Start-up Outlook Report, 2017). Sector-specific financial support may be useful to maintain the growth of high-tech start-ups in India.

There is a low contribution of high-tech-based start-ups in India, therefore it must be a crucial target to increase high-tech-based start-ups in India (Singh et al., 2017b; Ashraf and Singh, 2019). In South Africa, Business Development Services (BDS) has provided greater benefits to new start-ups (Mazanai and Fatoki, 2012). In India, BDS cells must be established in research organizations to create new start-ups. High-tech-intensive start-ups require more money; therefore there needs to provide financial support to create more high-tech-based start-ups in India (Krishna and Subrahmanya, 2015; Röhl, 2016). Likewise, India has extensive regional development disparities in start-ups ecosystem across states. Thus, extensive start-up subsidies may be useful to create a new start-up and to reduce disparities across India states (Andersson 2013). Furthermore, it may be useful to reduce regional development disparities in start-ups across Indian states and it would be beneficial to increase sustainable development.

This study is observed that patented technology and support for start-ups from incubators/accelerators/supporting organizations and mentors/advisors/evangelists have an insignificant contribution to create new start-ups in Gujarat. Furthermore, this study could not provide rational justifications on the aforementioned factors due to the small sample size. Further research, therefore must be considered to identify the association of start-up size with these variables in India using a large sample size.

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REFERENCE

Akben-Selcuk, E. (2016). Factors affecting firm competitiveness: Evidence from an emerging market. *International Journal of Financial Studies*, *4 (9)*, 1-10.

Almus, M., Nerlinger, E. A, & Steil, F. (2004). Growth determinants of start-ups in eastern Germany: A comparison between innovative and non-innovative firms. ZEW Discussion Paper No. 99-05. ftp://ftp.zew.de/pub/zew-docs/dp/dp0599.pdf.

Andersson, M. (2013). Start-up rates, entrepreneurship culture, and business cycle. Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE), Lund University, Paper No. 2013/01. http://wp.circle.lu.se/upload/CIRCLE/workingpapers/201301_Andersson.pdf.

Arafat, M. Y., & Saleem, I. (2017). Examining start-up intention of Indians through cognitive approach: A study using GEM data. *Journal of Global Entrepreneurship Research*, *7 (13)*, 1-11.

Ashraf, S. N., & Singh, A. K. (2019). Does entrepreneurship ecosystem have a long-term relationship with economic growth in selected economies? A statistical investigation, in Misra S., Shukla S. and Batthini G. (Eds.). Proceedings of the 13th Biennial Conference on Entrepreneurship Organized by EDII Ahmedabad, pp. 176-187. New Delhi: Bookwell Publishing House.

Audretsch, D. B, & Tamvada, J. P. (2008). The distribution of farm start-ups size across geographic space. http://econpapers.repec.org/paper/cprceprdp/6846.htm.

Bjornali, E. S., & Ellingsen, A. (2014). Factors affecting the development of clean-tech start-ups: A literature review. *Energy Procedia*, *58 (1)*, 43-50.

Braunerhjelm, P. (2010). Entrepreneurship, innovation and economic growth-past experiences, current knowledge, and policy implications. Working Paper Series from Swedish Entrepreneurship Forum, Sodra Kungstornet, Kungsgatan, Stockholm. http://econpapers.repec.org/paper/hhscesisp/0224.htm.

Brown, M. E., & Kshirsagar, V. (2015). Weather and international price shock on food prices in developing world. *Global Environmental Change*, *35 (5)*, 31-40.

Calá, C. D., Arauzo-Carod, J. M., & Manjón-Antolín, M. (2015). The determinants of entrepreneurship in developing countries. Working Paper No. 01. http://nulan.mdp.edu.ar/2125/1/cala.2015.pdf.

Čalopa, M. K., Horvat, J., & Lalić, M. (2014). Analysis of financing sources for start-up companies. *Management*, *19 (2)*, 19-44.

Coad, A., Frankish, J. S., Nightingale, P., & Roberts, R. G. (2014). Business experience and start-up size: buying more lottery tickets next time around? Small Business Economics, Sussex Research Online, University of Sussex, United Kingdom. http://sro.sussex.ac.uk/47883/.

Colombo, M. G., & Grilli, L. (2005). Start-up size: The role of external financing. *Economic Letters*, *88(2)*, 243-250.

Colombo, M. G., Delmastro, M., & Grilli, L. (2004). Entrepreneurs' human capital and the start-up size of new technology-based firms. International Journal of Industrial Organization, 22(8-9), 1183-1211.

Dada, A. D. (2012). Evaluation of technological capability and innovations in the Nigeria Cassava processing industry. Presented at the 8th Ph.D. School of Innovation and Economic Development of the 2012 Global Network for Economics of Learning, Innovation, and Competence Building Systems (Globelics Academy)

Federal University of Rio de Janeiro, Brazil. http://www.redesist.ie.ufrj.br/ga2012/paper/AbolajiDaudaDada.pdf.

Fritsch, M., & Wyrwich, M. (2017). The effect of entrepreneurship on economic development—an empirical analysis using regional entrepreneurship culture. Journal of Economic Geography, 17(1), 157-189.

Ghani, E., Kerr, W. R., & O'Connell, S. (2013). Spatial determinants of entrepreneurship in India. Regional Studies, 48(6), 1071-1089.

Ghosh, S., & Bhowmick, B. (2014). Uncertainties in entrepreneurship climate: A study on start-ups in India. Procedia-Social and Behavioral Science, 150(1), 46-55.

Gibcus, P., de Jong P. M., & Kemp, R. G. M. (2006). Determinants of growth of start-ups in the Netherlands. SCALES Paper N200517, EIM Business Research, Zoetermeer. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.629.3056&rep=rep1&type=pdf.

Görg, H., Strobl, E., & Ruane, F. (2000). Determinants of firm start-up Size: An application of quantile regression for Ireland. Small Business Economics, 14(3), 211-222.

Gottschalk, S., Müller, K., & Niefert, M. (2009). Founder's human capital, entry strategie,s and start-up size. Discussion Paper No. 09, ZEW Center for European Economic Research. ftp://ftp.zew.de/pub/zew-docs/dp/dp09030.pdf.

Isaksson, A., & Quoreshi, A. M. M. S. (2015). The impact of social factors on external financing of newly founded businesses. CITR Electronic Working Paper Series, Paper No. 2015/1. https://www2.bth.se/mam/forskning.nsf/attachments/WP%202015_1_Quoreshiv1_1_pdf/$file/WP%202015_1_Quoreshiv1_1.pdf.

Kim, B., Kim, H., & Jeon, Y. (2018). Critical success factors of a design startup business. Sustainability, 10(2981), 1-15.

Klaesson, J., & Karlsson, C. (2014). Market potential, start-up siz,e and the survival of new firms. Centre of Excellence for Science and Innovation Studies (CESIS) Electronic Working Paper No. 384, The Royal Institute of Technology, Stockholm, Sweden.

Krishna, H. S., & Subrahmanya, M. H. B. (2015). Transnational entrepreneurship and Indian high-tech start-up survival: An empirical investigation. South Asian Journal of Management, 22(2), 82-98.

Kumar, A., & Sharma, P. (2013). Impact of climate variation on agricultural productivity and food security in rural India. Economics Discussion Papers No. 2013-43, Kiel Institute for the World Economy. http://www.economics-ejournal.org/economics/discussionpapers/2013-43.

Kumar, A., & Sharma, P. (2014). Climate change and sugarcane productivity in India: An econometric analysis. Journal of Social and Development Sciences, 5(2), 111-122.

Kumar, A., Ahmad, M. M., & Sharma, P. (2017). Influence of climatic and non-climatic factors on sustainable food security in India: A statistical investigation. International Journal of Sustainable Agricultural Management and Informatics, 3(1), 1-30.

Kumar, A., Sharma, P. & Ambrammal, S. K. (2015a). Climatic effects on sugarcane productivity in India: A stochastic production function application. International Journal of Economics and Business Research, 10(2), 179-203.

Kumar, A., Sharma, P., & Ambrammal, S. K. (2015b). Effects of climatic factors on productivity on cash crops in India: Evidence from state-wise panel data. Global Journal of Research in Social Sciences, 1(1), 9-18.

Kumar, A., Sharma, P., & Ambrammal, S. K. (2014). Climatic effects on food grain productivity in India: A crop analysis. Journal of Studies in Dynamics and Change, 1(1), 38-48.

Kumar, A., Sharma, P., & Joshi, S. (2016). Assessing the impacts of climate change on land productivity in Indian crop agriculture: An evidence from panel data analysis. Journal of Agricultural Sciences and Technology, 18(10), 1-13.

Kumar, A., Singh, B. J., & Sharma, P. (2020). Assessing the climate change impact on rice and wheat production in Uttar Pradesh and Haryana states of India. Climate Change, 6(21), 74-93.

Lombardi, R., Trequattrini, R., & Russo, G. (2017). Innovative start-ups and equity crow funding. Int J Risk Assessment and Management, 19(½), 68-81.

Mason, C., & Brown, R. (2014). Entrepreneurial ecosystems and growt- oriented entrepreneurship. https://www.oecd.org/cfe/leed/Entrepreneurial-ecosystems.pdf.

Mata, J., & Machaso, J. A. F. (1996). Firm start-up size: A conditional qaintile approach. European Economic Review, 40(6), 1305-1323.

Mazanai, M., & Fatoki, O. (2012). Perceptions of start-up small and medium-sized enterprises (SMEs) on the importance of business development services providers (BDS) on improving access to finance in South Africa. Journal of Social Sciences, 30(1), 31-41.

Motoyama, Y, & Watkins, K. K. (2014). Examining the connections within the start-u'ps ecosystem: A case study of St. Louis. Kauffman Foundation Research Series on City, Metro, and Regional Entrepreneurship, Kansas City, Missouri, USA.

NASSCOM (2016). Indian start-up ecosystem maturing. NASSCOM, Noida, Uttar Pradesh, India.

Naudé, W. (2013). Entrepreneurship and economic development: Theory, evidenc,e and policy. IZA Discussion Paper No. 7507, Bonn, Germany.

Naudé, W., Gries, T., Wood, E, & Meintjies, A. (2008). Regional determinants of entrepreneurial start-ups in a developing country. Entrepreneurship & Regional Development, 20(2), 111-124.

OECD (2016). Start-ups Latin America 2016: Building an innovative future. Development Centre Studies, OECD Publishing, Paris.

Okrah, J., Nepp, A., & Agbozo, E. (2018). Exploring the factors of startup success and growth. The Business and Management Review, 9(3), 229-237.

Röhl, K. H. (2016). Entrepreneurial culture and start-ups could a cultural shift in favour of entrepreneurship lead to more innovative start-ups? IW Policy Paper, 2/2016, Institut der deutschen Wirtschaft Köln, Postfach, Köln.

Sabbarwal, S. (1994). Determinants of entrepreneurial start-ups: A study of industrial units in India. The Journal of Entrepreneurship, 3(1), 79-80.

Scherr, F. C., Sugrue, T. F., & Ward, J. B. (1993). Financing the small firm start-up: determinants of debt use. The Journal of Entrepreneurial Finance, 3(1), 17-36.

Sharma, P., & Singh, A. K. (2017). Association of state-wise food security index with climatic factors in India: Evidence from state-wise panel data. Journal of Global Agriculture and Ecology, 6(3), 196-205.

Singh, A. K. (2018). An empirical analysis to assess the GDP projection of Gujarat state of India. JNNCE Journal of Engineering & Management, 1(1), 1-10.

Singh, A. K., & Ashraf, S. N. (2019). Viability of Bayh-Dole act of USA in context of India: Critical evidence from review of literature. JNNCE Journal of Engineering & Management, 3(1), 7-22.

Singh, A. K., & Issac, J. (2018). Impact of climatic and non-climatic factors on sustainable livelihood security in Gujarat state of India: A statistical exploration. Agriculture and Food Sciences Research, 5(1), 30-46.

Singh, A. K., & Sharma, P. (2018). Measuring the productivity of food-grain crops in different climate change scenarios in India: An evidence from time series investigation. Climate Change, 4(16), 661-673.

Singh, A. K., & Singh, B. J. (2020). Assessing the infectious diseases of students in different weather seasons in DIT University Dehradun, Uttarakhand (India). Asian Journal of Multidimensional Research, 9(3), 34-48.

Singh, A. K., Ashraf, S. N., & Arya, A. (2019a). Estimating factors affecting technical efficiency in Indian manufacturing sector. Eurasian Journal of Business and Economics, 12(24), 65-86.

Singh, A. K., Arya, A., & Jyoti, B. (2019b). A conceptual review on economic, business, intellectual property right,s and science & technolog- related activities in Asian economies. JNNCE Journal of Engineering & Management, 3(2), 1-22.

Singh, A. K, Issac, J., & Narayanan, K. G. S. (2019c). Measurement of environmental sustainability and its association with socio-economic indicators in selected Asian economies: An empirical investigation. International Journal of Environment and Sustainable Development, 18(1), 57-100.

Singh, A. K., Narayanan, K. G. S, & Sharma, P. (2017a). Effect of climatic factors on cash crop farming in India: An application of Cobb-Douglas production function model. International Journal of Agricultural Resources, Governanc,e and Ecology, 13(2), 175-210.

Singh, A. K., Acharya, S. R., & Chavda, P. (2017b). Implications of intellectual property rights and socio-economic factors on growth of manufacturing sector in selected cross economies: An empirical assessment',Iin Sasi Misra, Sunil Shukla and Ganapathi Batthini (Eds.). Proceedings of the Twelfth Biennial Conference on Entrepreneurship Organized by EDII Ahmedabad, pp. 262-279. New Delhi: Bookwell Publishing House.

Singh, A. K., Singh B. J., & Negi V. (2020a). Does sustainable development have causal relationship with environmental development? An evidence from country-wise panel data analysis. International Journal of Technology Management and Sustainable Development, 19(2), 1-39.

Singh, A. K., Singh, B. J., & Ashraf, S. N. (2020b). Effect of intellectual property awareness and science & technological development on manufacturing sector in selected economies. Journal of Advocacy, Researc,h and Education, 7(1), 16-35.

Song, M., Podoynitsyna, K., van der Bij H., & Halman, J. I. M. (2008). Success factors in new ventures: A meta-analysis. The Journal of Product Innovation Management, 25(1), 7-27.

Sopjani, X. (2019). Challenges and opportunities for startup innovation and entrepreneurship as tools towards a knowledge-based economy: The case of Kosovo. Thesis, Rochester Institute of Technology. https://scholarworks.rit.edu/cgi/viewcontent.cgi?article=11380&context=theses.

Start-up Outlook Report 2017 (2017). Start-ups in India are in a technology bubble-start-ups outlook report 2017. https://theindianeconomist.com/start-ups-outlook-report/.

Suzuki, S., & Okamuro, H. (2017). Determinants of academic start-ups' orientation toward international business expansion. Administrative Science, 7(1), 2-20.

Appendix A: Association of Explanatory Variables

Table A1: Results Based on Karl-Pearson Correlation Coefficients among the Variables

Variables	*ss*	*siaso*	*same*	*psfbcc*	*ntms*	*eqsf*	*pesf*	*nws*	*nusws*
ss	1								
siaso	-0.326**	1							
same	-0.089	0.714**	1						
psfbcc	0.193	0.181	0.228	1					
ntms	0.297*	-0.255*	-0.169	0.242*	1				
eqsf	0.402**	-0.121	0.137	0.128	0.177	1			
pesf	-0.053	0.09	0.147	0.056	-0.006	0.000	1		
nws	0.258*	-0.058	0.021	0.313*	0.557**	-0.005	-0.038	1	
nusws	0.146	-0.326**	-0.215	0.035	0.169	0.160	0.017	-0.088	1
nsws	0.232*	-0.138	-0.021	0.253*	0.798**	0.162	0.042	0.670**	0.245*
ntss	0.326**	-0.225	-0.17	0.251*	0.901**	0.161	-0.009	0.670**	0.206
nntss	0.047	0.026	0.152	0.058	0.409**	0.124	0.075	0.267*	0.000
teps	0.301*	-0.184	-0.067	0.293*	0.835**	0.145	0.012	0.822**	0.263*
rswtw	-0.103	0.262*	0.273*	0.268*	0.115	0.096	0.056	0.127	-0.004
ass	0.187	-0.210	0.041	0.011	0.162	0.335**	0.029	0.190	0.124
dps	0.187	-0.210	0.041	0.011	0.162	0.335**	0.029	0.190	0.124
nnpls	0.073	-0.202	-0.157	-0.09	-0.045	0.031	-0.070	0.052	0.102
npcnios	0.006	-0.008	-0.061	0.004	0.010	0.138	-0.079	0.111	0.000
sdfs	0.233	0.050	-0.069	0.066	0.211	0.093	0.015	0.148	0.104

Source: Author's Estimation. Note: *Correlation coefficient is significant at the 0.05 level; **Correlation coefficient is significant at the 0.01 level.

Table A1: Conti…

Variables	*nsws*	*ntss*	*nntss*	*teps*	*rswtw*	*ass*	*dps*	*nnpls*	*npcnios*	*sdfs*
nsws	1									
ntss	0.895**	1								
nntss	0.346**	0.181	1							
teps	0.948**	0.917**	0.397**	1						
rswtw	0.462**	0.195	0.165	0.288*	1					
ass	0.143	0.148	0.184	0.204	0.042	1				
dps	0.143	0.148	0.184	0.204	0.042	1.000**	1			
nnpls	-0.032	-0.039	-0.005	0.010	-0.079	0.068	0.068	1		
npcnios	0.076	0.026	0.032	0.079	0.138	0.135	0.135	0.011	1	
sdfs	0.162	0.251*	-0.003	0.202	0.064	-0.239*	-0.239*	-0.22	0.187	1

Source: Author's Estimation. Note: *Correlation coefficient is significant at the 0.05 level; **Correlation coefficient is significant at the 0.01 level.

Note: *ss* - Stage of start-ups (in year), *siaso* - Support from incubator/accelerator/supporting organization (Yes = 1, No = 0), same - Support from mentor/advisor/evangelist (Yes = 1, No = 0), *psfbcc* - Participation of start-up founder in business contest and conferences (Yes = 1, No = 0), *ntms* - Team members in start-up (in number), *eqsf* - Educational qualification of start-up founder (years spent by founder in academic organization), *pesf* - Professional experience of start-up founder (in years), *nws* – Number of workers/volunteers in start-up (in number), *nusws* - Number of unskilled workers in start-up (in number), *nusws* – Number of skilled workers in start-up (in number), *ntss* – Number of Technical staff in start-up (in number), *nntss* – Number of non-technical staff in start-up (in number), *teps* - Total employed persons in start-ups (in numbers), *rswtw* - Ratio of skilled worker with total worker in start-up, *ass* - Annual sale of start-up (1 = Increased, 0 = Decreased), *dps* - Demand of products (1 = Increased, 0 = Decreased), *nnpls* - New products launched by start-up (in number), *npcs* - Professional connections with start-up (in number), *npcnios* - Professional collaboration(s) with national or international organization (in number), *sdfs* - Source of debt funding for start-up (1 = Family/Friend, 0 = Bank).