Rajasthan's Agricultural Innovation Landscape: An overview of Start-ups and Trends

Abstract

This mini review article provides an overview of the agricultural innovation landscape in Rajasthan, India, with a focus on start-ups and trends. The article highlights the involvement of students from different fields and limited participation of agriculture graduates into emerging Agri based start-ups. Purpose of this article is to give a glimpse so comparative participation for students from different background into Agri based numerous start-ups,and the role of incubators and accelerators in supporting start-ups. It also discusses various government initiatives aimed at boosting the start-up ecosystem in India. The article concludes by discussing the different domains that are leveraging technology for the democratization of sectoral innovation across India. The agriculture sector is crucial to the Indian economy, providing employment opportunities and ensuring national food security. The government has launched various initiatives to promote entrepreneurship in agriculture, including access to high-quality seeds, fertilizers, and market linkages. However, the scalability of these startups in the long term is uncertain due to the absence of agriculture graduates opting for startups. Rajasthan has emerged as a hub for tech-driven entrepreneurs, with the government launching its flagship initiative, istart Rajasthan, to boost the startup ecosystem.

Keywords: Entrepreneurship, Economic development, Government schemes/initiatives, Agriculture, Start-ups

Introduction

Economic development is the process of creating wealth for the community's benefit (Mishra, 2022). It involves distributing scarce resources in a way that has a positive effect on the quality of business activity, employment, income distribution patterns, and fiscal solvency. Entrepreneurs play a variety of roles, such as capital formation, increased per capita income, job creation, balanced regional development, improved living standards, economic independence, backward and forward linkages, inspiring others to become entrepreneurs, creating knowledge

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spillovers, increasing the number of enterprises, providing diversity in firms, organising society's productive resources, and developing new production techniques (Kumar et. al., 2019).

The entrepreneur is the one who organizes and uses capital, labor, and technology, and is responsible for both the establishment of new businesses and the revitalization of existing businesses. Entrepreneurship is not something that happens by accident, but is influenced by a variety of circumstances. Positive and negative impacts relate to variables that prevent entrepreneurship, while positive influences refer to aspects that facilitate it Castario et. al., 2015).

- Assisting factors include: technical expertise, entrepreneurial training, market relationships, family businesses, financial accessibility, successful role models, local manpower, government and institutional backing, and many others.

- Barriers include: a lack of technical skills, a lack of market expertise, a lack of business understanding, legal and bureaucratic limits, patent inhibitions, political instability, and a refusal to collaborate by banks and other institutions, among other things.

Entrepreneurship & Economic Development of India

The economic history of today's industrialized countries, such as the United States, Germany, and Japan, demonstrates that the economy is a result of entrepreneurship. Because of the critical role of entrepreneurs in the growth of western nations, people in developing countries are more aware of the importance of entrepreneurship for economic development (Dhaliwal, 2016). Entrepreneurs determine a country's industrialization and economic growth rate (Schumpeter, Joseph A. Capitalism, Socialism and Democracy. 1942.). A country may be endowed with abundant natural resources, but economic progress is impossible in the absence of effective entrepreneurs. This is why emerging nations like India stayed undeveloped for so long (Shubhanwita, 2019). It is the entrepreneur who contributes to a country's balanced growth by making the best use of its resources. The importance of entrepreneurship in economic growth varies across the economy, based on the country's natural resources, industrial environment, and governmental system's responsiveness to the entrepreneurial function. There are certain aspects that affect the entrepreneurship develop are as follow:

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- Due to a lack of cash and competent labor in underdeveloped/developing countries, the environment is less favorable to creative entrepreneurs.
- Due to a lack of capital and the issue of an imperfect market, entrepreneurs are forced to start their businesses on a modest scale. In such areas, initiator entrepreneurs are also preferred. Hence, the enormous introduction of technologies in industrialised countries leads to quick economic development in underdeveloped/developing regions.
- Further India aims at a decentralized industrial structure to reduce regional imbalances in levels of economic development.

As a result, small-scale entrepreneurship in such an industrial structure has played a crucial part in India's achievement of balanced regional growth, wealth generation, and so on after independence. India has become one of the world's most dynamic economies in recent decades (Chari & Banalieva, 2015). While the first forty years following India's independence in 1947 were marked by a slow yearly growth rate of (about 3%), economic reforms implemented in 1991 resulted in GDP expanding at a pace of roughly 6.8% during the previous quarter century (Chari & Banalieva, 2015).In contrast, although the pre-reform institutional environment largely undervalued and discouraged entrepreneurial and inventive activity (Bardhan, 1994; Sivaraman, 1991), the post-reform period has seen a much broader embrace of the significance of innovation and entrepreneurship. Furthermore, several Indian companies and entrepreneurs have emerged as world leaders in information technology (IT), auto, steel, generic medication manufacture, and medical services (Chari & Banalieva, 2015).

Start-up Ecosystem in India

A start-up, according to the Government of India, is a firm with an annual turnover of less than INR 250 million (USD 3.52 million) in the previous fiscal year (Bureau, 2021). This entity should be involved in the creation, implementation, or commercialization of new goods, processes, or services based on technology or intellectual property.According to NASSCOM, India is the 3rd largest base for start-ups in the world at present (Sarkar, 2021) with over 59000 plus start-ups and 79 unicorns present in India by 2020, that have created around 1,70,000 jobs in 2021 in the country (Grant Thornton, 2022). The importance of entrepreneurs in the Indian economy arises on account of the following reasons (Singh & Singh, 2018):

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- Entrepreneurs can help reduce unemployment
- Entrepreneurial initiatives can contribute to higher gross national product and per capita income
- Entrepreneurs can contribute toward capital formation
- Entrepreneurial activities can significantly influence the standard of living
- Entrepreneurs endeavor to promote balanced regional development
- Entrepreneurial activities would lead to wealth creation and distribution
- Entrepreneurial initiatives can help in skill development
- Entrepreneurs can improve India's global competitiveness
- Entrepreneurs can increase the country's share in global export trade
- Entrepreneurs ensure the overall development of an economy

Entrepreneurs' activity can have an impact on all sectors of the Indian economy. They have the potential to alleviate societal negativity and despair (Verma, 2013). Their actions incite excitement among those who engage in similar activity. The whole economy desires a new level of growth, and the Indian entrepreneurial class can make significant contributions to the country's overall development.

Fig. 1: Indian start-up ecosystem map

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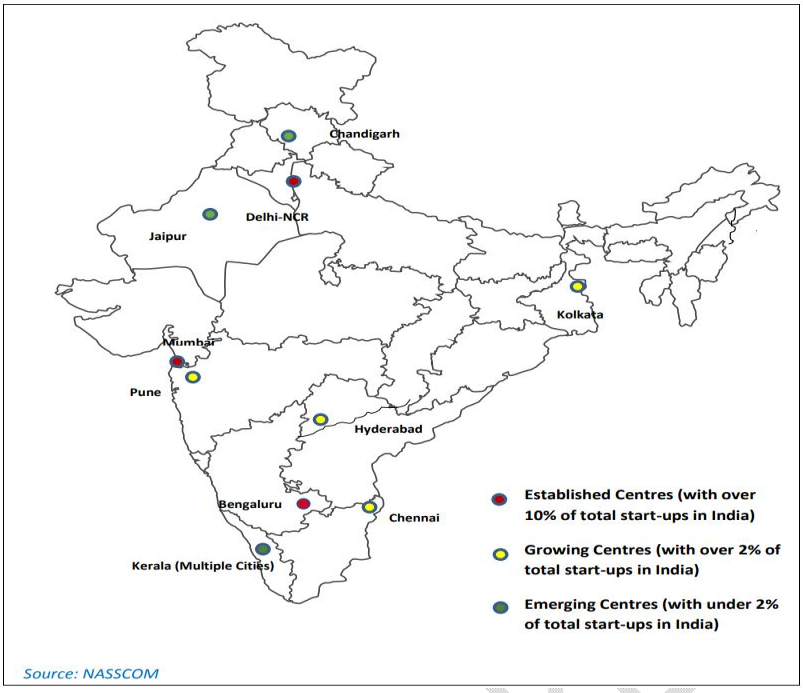

Figure 1 depicts the total growth of the nation's entrepreneurial hubs. Different start-ups are concentrated in cities with under 2 percent (Jaipur, Chandigarh, Kerala), over 2 percent (Pune, Kolkata, Chennai, Hyderabad), and above 10 percent start-up population (Delhi, Mumbai, Bengaluru).

The use of technology has increased the effectiveness of assessing start-ups and finding investment opportunities. This has helped create innovative businesses in India that address specific regional issues while also having relevance in other areas. Unlike traditional companies that targeted only urban markets, these new businesses were developed using indigenous technology, resulting in unique solutions that cater to the needs of the Indian population.To serve the huge market, technology is a playing key role in every domain and focuses on a very specific area that can make things easy to develop and use. Domains like Agri-tech, Ed-tech, Fin-tech, Direct-to-Consumer, and Software as a Service. Blow table is explaining the domains and their area of focus.

Table 1: Leveraging technology for the democratization of sectoral innovation across India

Domain	Focus Area
Agri-tech	Offering farmers sustainable methods

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	through agri-technologies, which aim to boost productivity and operational profitability, leads to a better return on investment.
Ed-tech	Using advanced technologies like augmented reality (AR), internet, teleconferencing, and artificial intelligence can enhance access to high-quality education and vocational training, resulting in bridging the knowledge gap and shaping inclusive and equitable communities in the future.
Fin-tech	The use of digital platforms and technology for services such as insurance, loans, investments, stock market trading, and healthcare can enable smaller scale payments and facilitate financial inclusion for marginalized segments of society.
D2C (direct to consumer)	By utilizing digital platforms to offer direct access to customers, companies can eliminate the need for intermediaries and expand their brand reach. This approach also allows for location-independent access to products and strengthens the efficiency of the retailer-manufacturer relationship.
SAAS (software as a service)	Generating value by offering more homegrown deep-tech solutions that can have a significant impact on various sectors, including healthcare, logistics, e-commerce, and real estate. This can have far-reaching implications for the national economy and

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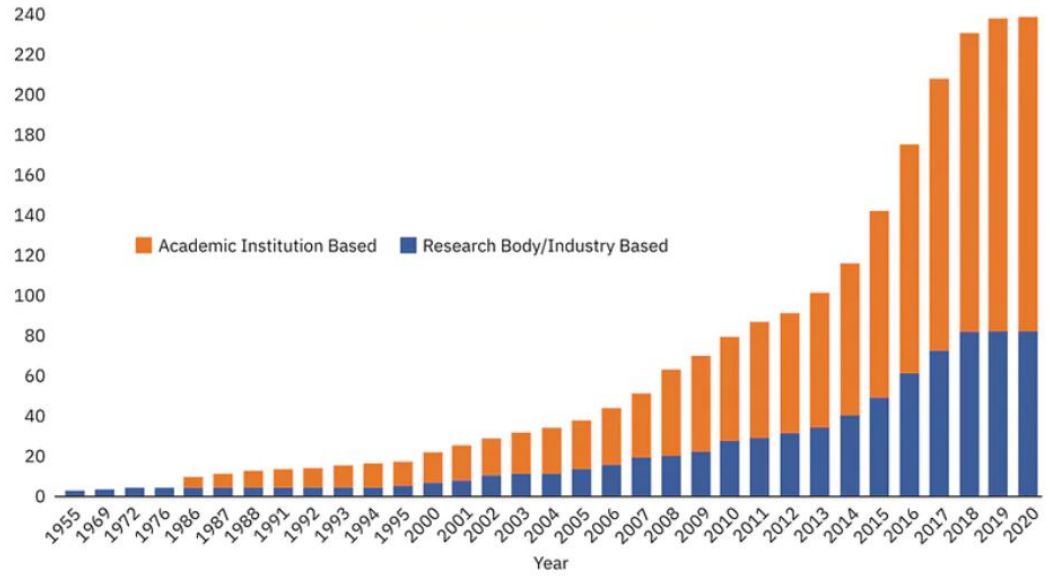
	enable the development of enterprise-grade software-as-a-service (SaaS) solutions that cater to both Indian and global markets.

Source: compiled with secondary data

The role of incubators and accelerators

The presence of angel networks, venture capitalists, accelerators, and incubators is increasingly expanding across various regions, providing extensive support for numerous startups, including prototype development, brand building, and guidance through fundraising and launch. This growth in the number of incubators and accelerators is the result of collaborative efforts from academia, the government, and the private sector. India currently has over 250 incubators and accelerators, with about 60% located in non-metro cities, which are emerging as new centers for entrepreneurial development in the country. The trend of incubator growth is on a steady upward trajectory, as depicted in Figure 2, which shows growth trends from 1955 to 2020.

Fig. 2: Growth of incubators in India



Source: Shifting Orbits: Decoding the Trajectory of the Indian Start-up Ecosystem, Universities Press (India) Private Limited

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Just a few years ago, there were only a small number of incubators and accelerators in India, which were mainly concentrated in prestigious academic institutions like the IIMs and IITs. However, due to increased efforts from both central and state governments, as well as private institutions, there are now thriving incubation programs all over the country, such as Amity Innovation Incubator in Noida, BITS Pilani, and ISB Mohali. Now, over 96% of the top 50 technology institutes in India have campus-based incubator centers, and in 2021 alone, more than 35 academic incubators were established(Grant Thornton, 2022).

The way incubators have emerged and their engagement in boosting start-ups is not the same for everyone; different environments, such as corporate, private academic, and public, have experienced differences as shown in figure 3.

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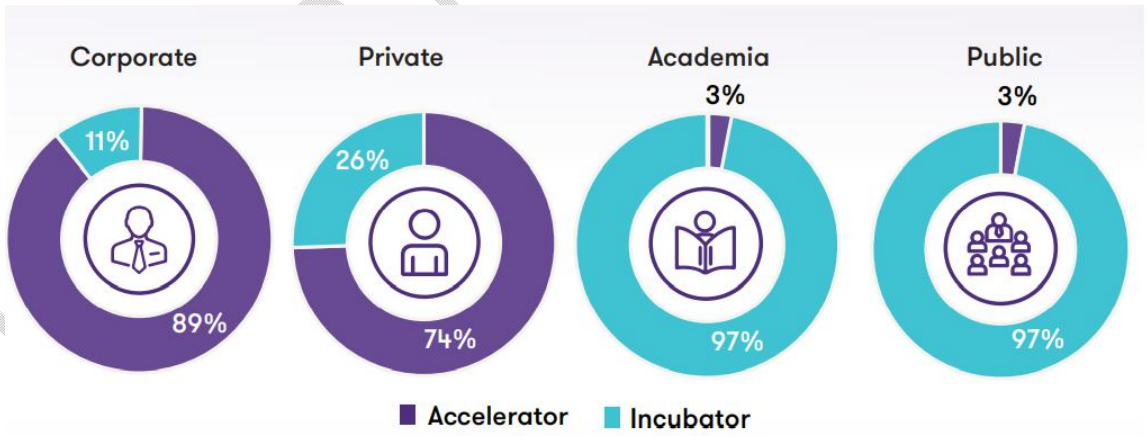
Fig. 3: Split of accelerators and incubators run by various stakeholders in the ecosystem



Source: NASSCOM

Government Initiatives for Start-up Development

Over the past decade, the Indian government has implemented well-designed policies to support the establishment of successful startups. These policies mainly focus on funding support and incentives, industry-academic partnerships, as well as simplification and handholding. As a result, the Indian tech startup industry has become an attractive target for visionary companies such as Google and Microsoft, who recently launched India-focused mentorship and boot camp programs for startups developing both B2C and B2B tech products. Additionally, the liberalization of the economy gave rise to the first generation of entrepreneurs who established well-known brands like TCS, Infosys, Bharti, Kotak, ICICI, among others, and created a new scale of job opportunities for India's educated youth. Recognizing the potential of businesses in creating jobs, successive governments have provided policy support to entrepreneurs. New policies, such as making loans more accessible to micro or small businesses, have transformed the face of entrepreneurship in India.Indian government has launched various schemes that could benefit potential entrepreneurs by different names but with one aim are;

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Table 2: Various initiatives by GOI to boost start-up ecosystem

Government Scheme/Initiatives	Focus Area
Aatmanirbhar Bharat App Innovation Challenge	Development of 'Made in India' applications
SAMRIDH Scheme (Start-up Accelerators of MeitY for pRoduct Innovation, Development, and growtH)	Provide funding support to start-ups along with helping them bring skill sets together
Start-up India Seed Fund	INR 1,000 crores — to help start-ups and support ideas from aspiring entrepreneurs
Start-up India Initiative	Increase wealth and employability
Start-up Leadership Program	To empower outstanding founders and innovators

ASPIRE (A Scheme for Promotion of Innovation, Rural Industries and Entrepreneurship)	Increasing employment, reducing poverty, and encouraging innovation in rural India
Pradhan Mantri Mudra Yojana (PMMY) Micro Units Development Refinance Agency (MUDRA)	Enhance credit facilities
Chunauti (Challenge Hunt Under NGIS for Advanced Uninhibited Technology Intervention)	Start-ups to develop solutions for problems amid a pandemic
Qualcomm Semiconductor Mentorship Program (QSMP)	Start-ups that are working in the Indian semiconductor space
India Water Pitch-Pilot-Scale Start-up Challenge	Water sector start-ups funding
Ministry of Skill Development and Entrepreneurship	Promoting entrepreneurship
ATAL Innovation Mission	Promotional platform involving academicians and draw upon national and international experiences to foster a culture of innovation, research, and development
eBiz Portal (G2B)	To transform and develop a conducive business environment
Dairy Processing and Infrastructure Development Fund (DIDF)	Funding through NABARD with 8000 crores
Support for International Patent Protection in Electronics & Information Technology (SIP-EIT)	Financial support to MSMEs and Technology Start-ups for international patent filing
Multiplier Grants Scheme (MGS)	R&D that is supported by industry and can be commercialized
Credit Guarantee Fund Trust for Micro and Small Entreprises (CGTMSE)	Credit support with zero collateral

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Software Technology Park (STP) Scheme	Export-oriented scheme for the development and export of computer software
The Venture Capital Assistance Scheme (VCA)	Term loans to farmer entrepreneurs
Loan for Rooftop Solar PV Power Projects	To build reliance on non-conventional sources of power
NewGen Innovation and Entrepreneurship Development Centre (NewGen IEDC)	Encourage entrepreneurship through guidance, mentorship, and support.
Single Point Registration Scheme	To facilitate the registration for MSEs
Modified Special Incentive Package Scheme (M-SIPS)	Subsidy for economic and non-economic zones
Stand Up India Scheme	Financing SC/ST and/or Women Entrepreneurs
High Risk - High Reward Research	To support and invite new proposals and ideas that have the potential to usher in a paradigm-shifting
IREDA-NCEF Refinance Scheme (Indian Renewable Energy Development Agency) (National Clean Energy Fund)	Revival of the operations of existing biomass power and other small hydropower projects
Dairy Entrepreneurship Development Scheme	To generate self-employment opportunities in the dairy sector.
Drone Shakti	Diverse applications for drones, including drones-as-a-service (DaaS)
Zero Defect Zero Effect (ZED) Certification Scheme	To create proper awareness about ZED manufacturing among the MSMEs
Sub-Mission on Agricultural Mechanization (SMAM)	To increase the reach of farm mechanisation, especially to the small and marginal farmers
Credit Linked Capital Subsidy for	To upgrade/modernize their equipment or

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Technology Upgradation (CLCSS)	techniques
Design Clinic Scheme for Design Expertise	Aims to infuse design expertise in MSEs

Source: compiled with secondary data

Start-up Ecosystem and Agriculture in India

The agriculture sector holds a crucial position in the Indian economy and is often considered as the backbone of the entire system. The performance of agriculture and its allied sector holds a significant importance for the economic transformation of developing countries such as India. This sector not only provides employment opportunities to the rural population but also plays a crucial role in ensuring national food security. With about 70% of the rural households depending primarily on agriculture for their livelihood and 82% of farmers being small and marginal, the agriculture sector is the largest source of livelihood in India(Anonymous, 2020). Additionally, it serves as a source of raw materials for industries, as well as food and feed for the entire population and livestock, respectively.

The agriculture sector is a significant source of revenue for both central and state governments. Even today, agriculture plays a crucial role in a country's economic development. While the sector's contribution to the national income has decreased over time, it still holds a dominant position in the country's GDP. Indian agriculture is also important in earning valuable foreign exchange for the country at the international level. However, due to higher growth in secondary and tertiary sectors, the sector's contribution to national income is declining, reflecting the development process and the structural transformation taking place in the economy.

The agriculture sector needs transformative changes to shift farmers' perceptions towards farming and encourage them to view their farms as businesses. To promote entrepreneurship in agriculture, innovation can be encouraged to enhance crop productivity and generate more profits, while creating new employment opportunities for rural youth.While pledging massive public investment in farming and associated industries in the last few years, the central government urged private enterprises to participate. The agriculture industry has a lot of scope for private investment, which may help it to grow. Over the last two decades, there have been a large number of entrepreneurial operations in which farmers have been helped to increase their yields by technology interventions and product assistance. All of these services include access to

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high-quality seeds, fertilizers, a more efficient irrigation system, as well as agricultural tools, equipment, and market linkage.

As per a study by NASSCOM, India has more than 450 startups operating in the agriculture sector, and they have raised around US$ 248 million till June 2019. Entrepreneurship in agriculture can assist in overcoming the challenges associated with dissemination of information, farm management, availability of capital, mechanization of farms, and the agriculture supply chain. The US, China, and Israel have demonstrated successful examples of transforming agriculture practices through technology. They have used a combination of technologies such as hybrid seeds, precision farming, big data analytics, artificial intelligence (AI), geo-tagging, satellite monitoring, mobile apps, and farm management software to enhance productivity and farm incomes at every stage of the agriculture process

Furthermore, there are various innovations that can be employed to enhance the farming system such as informing farmers of appropriate sowing and harvesting times in accordance with market demands, using technology to detect adulteration of fresh produce, implementing automated farming techniques, and developing warning systems for unpredictable weather patterns and pest infestation. Additionally, entrepreneurial ventures in food processing and packaging can greatly benefit farmers by shielding them from the volatility of commodity markets and enabling them to generate additional income through exports. Overall, entrepreneurship in agriculture has the potential to transform the entire food chain, ultimately benefiting small land-holding farmers and marginalized communities over the long run.

The start-up genome report for 2021 states that India has now become the third-largest start-up ecosystem globally, following the US and China. India's rapid growth in unicorns can be attributed to both strategic and conditional factors. Agritech, the adoption of technology in agriculture, is becoming increasingly prevalent in India, and it can address several issues throughout the traditional agriculture value chain. The agritech industry has the potential to reach a market size of $24 billion by 2025. Agri-based start-ups have enormous potential to grow in various agriculture sectors, such as market linkage, precision agriculture and farm management, quality management and traceability, supply chain technology, and output market linkages and financial services.

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Agri-based start-ups are growing and doing well in functioning and attracting investors. And to boost, this start-up culture government is also playing a vital role and this leads to an increase in farms' income. Different government initiatives are helping the common man to start his or her own venture. But a very important stratum of young manpower is lacking somewhere to get benefit out of it and those are Agri graduates having basic as well as technical knowledge in this field. Every year thousands of students complete their degrees and try to get jobs in the government or private sector but their participation in building their own venture is very less compared to the students who are from other educational backgrounds and still try to build their business in the agriculture sector.

Participation of Agri graduates in Agri-tech start-ups is comparatively very low. The below figure is illustrating the top 25 Agri-tech start-ups founders' educational qualification.

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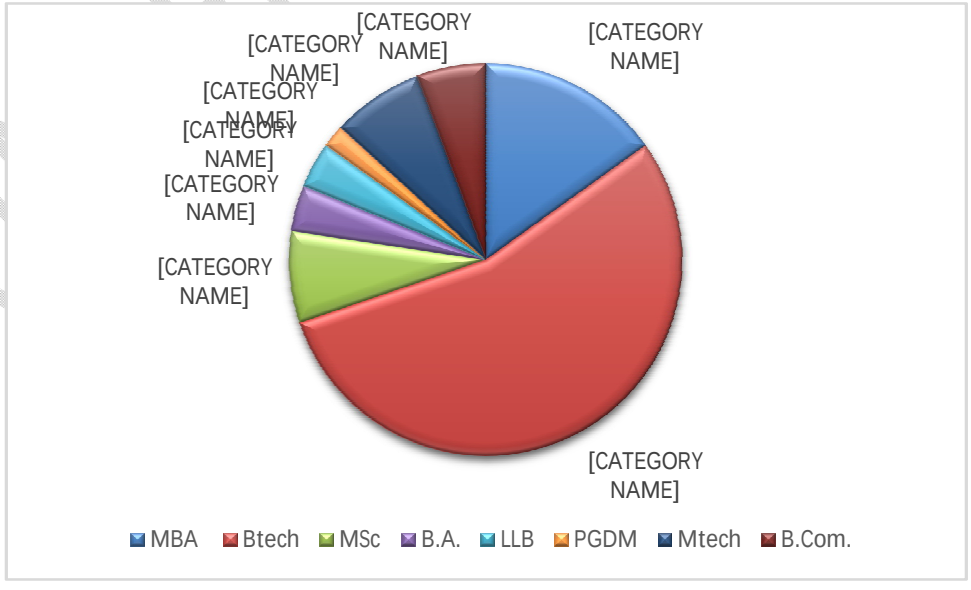
Fig. 4: Contribution of various programs to driving India's Agri start-ups



Source: LinkedIn (2022)

Start-up Ecosystem in Rajasthan

Rajasthan is well-known for its tourism, mining, arts, and crafts industries. However, in recent years, the state has also emerged as a hub for tech-driven entrepreneurs. In the first half of 2019, Rajasthan was the most funded Tier 2 state in India in terms of start-up investments, with cities such as Jaipur, Jodhpur, and Udaipur emerging as major start-up hotspots. There are 1110 registered start-ups in the state, covering 50 different categories. The Rajasthan government launched its start-up policy in 2015, and in late 2017, it launched its flagship initiative, istart Rajasthan, to further boost the start-up ecosystem. The Rajasthan Start-up & Innovation Policy 2019 aims to create a culture of entrepreneurship by providing support such as incubator facilities, student entrepreneur support, and funding to potential entrepreneurs. The government intends to attract entrepreneurs, innovators, and established start-ups to grow and scale up in Rajasthan. The state's co-working spaces and incubators, such as Malaviya National Institute of Technology (MNIT) Jaipur, Banasthali Vidyapith, IIM Udaipur, Startup Oasis, BITS Pilani, Catalyst Atal Incubation Centre (AIC), Sri Karan Narendra Agri-Business Incubator (SABI), and National Institute of Agricultural Marketing (NIAM), have helped facilitate the growth of start-ups in Rajasthan.

Start-up ecosystem of Rajasthan covers 50 industries that are leveraged due to liberal start-up policies. Figure 4 shows the industries covered under the start-up ecosystem are as follows (IT Services, Education, Healthcare & Lifesciences, Food & Beverages, Agriculture, Travel & Tourism, Professional & Commercial Services, Renewable Energy, Green Technology, Finance Technology, Social Impact, Human Resource, Media & Entertainment, AI, Marketing, Transportation & Storage, IoT, Enterprise Software, Retail, Advertising, Fashion, Textiles & Apparel, Construction, Technology Hardware, Art & Photography, AR/VR, Automotive, House-Hold service, Social Network, Real Estate, Design, Event, Robotics, Security Solutions, Architecture/Interior, Pets & Animals, Analytics, Specialty Retailers, Sports, Aeronautics, Safety, Chemicals, Telecommunication & Networking, Nano Technology, Animation, Dating/Matrimonial, Non-Renewable Energy).

Fig. 5: Different start-ups' contributions to Rajasthan's ecosystem

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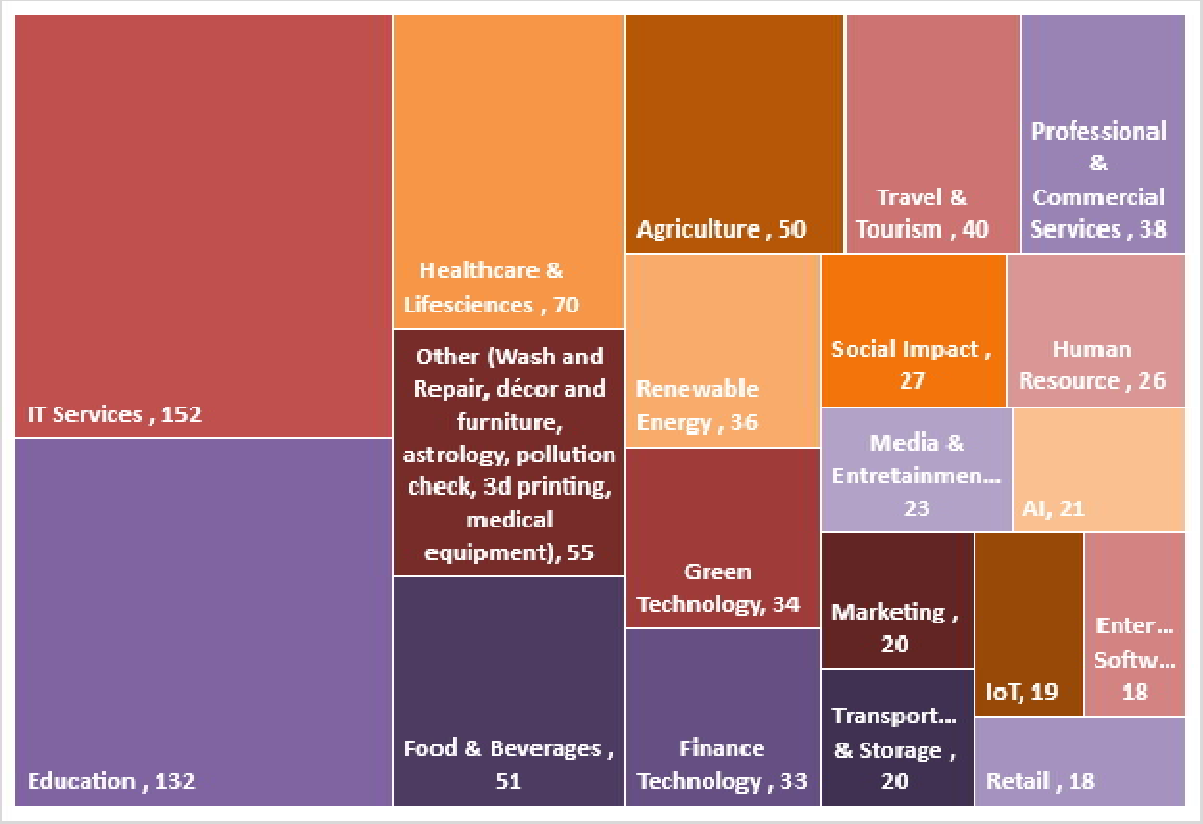

Source: https://istart.rajasthan.gov.in/

There is a huge business opportunity for start-ups with the Rajasthan Government's various departments. To support start-ups, it will give work orders up to Rs 15 lakh without tendering process, to the registered start-ups. Notably, in 2020, promising start-ups in the state raised over Rs 200 Cr funding. Some of them were DealShare (147 Cr), Fleece (25 Cr), Freshokartz (10 Cr), Kirana King (7 Cr); Med Cords (7 Cr), Krimanshi Feeds (5 Cr), Fabriclore (4 Cr). The major investors in these start-ups were Alpha Wave Incubation, Falcon Edge Capital, Z3 Partners, Matrix Partners India, Omidyar Network India, Bridgestone India, Rajasthan Venture Capital Fund (RVCF), and more (Anonymous, 2021).

In 2020, Rajasthan has attracted good funding despite the lockdown effect but still, the state is leaking somewhere for Agri start-ups. Figure 5 shows the number of Agri start-ups in each state. If compared to Maharashtra, Rajasthan is far behind.

Fig. 6: State-wise number of Agri start-ups (2018)

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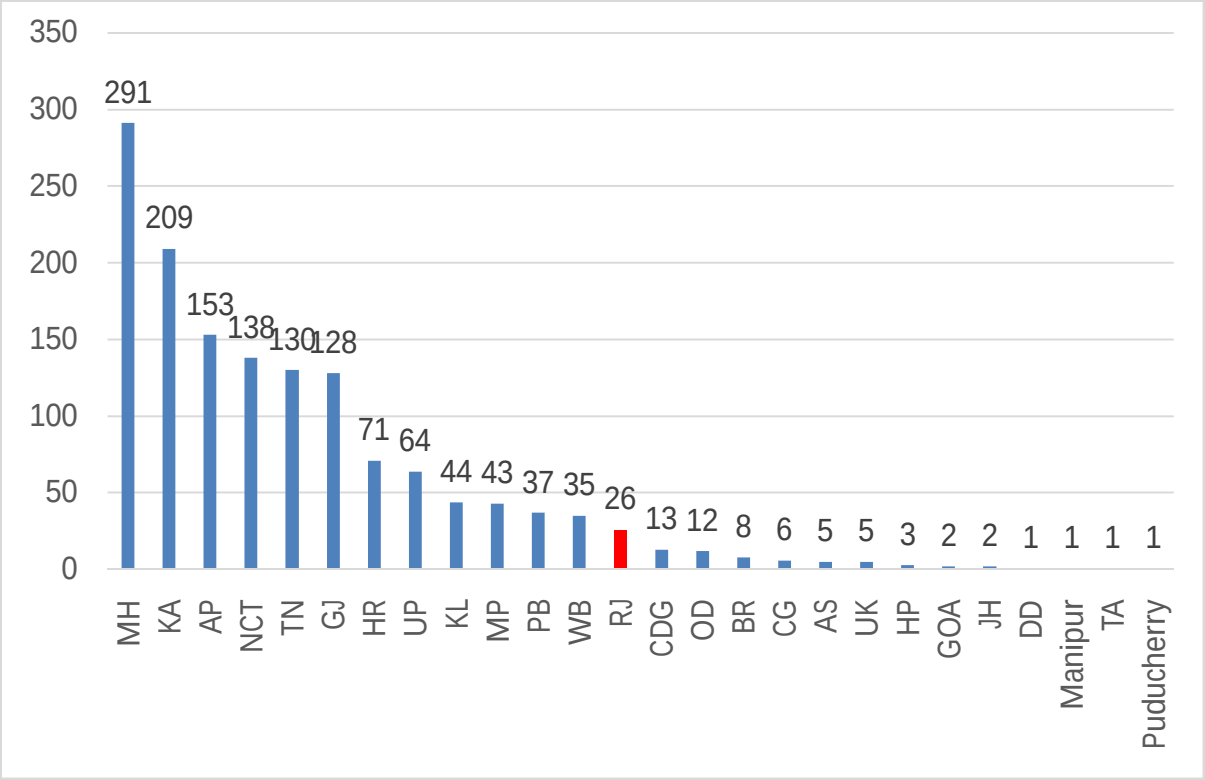

Source: http://nmoop.gov.in/conference/docs/Background_Paper_Agri_Startups.pdf

Conclusion

Significant public institution participation in building startup eco-system has been observed. The government is making continuous efforts to attract and provide facilities to potential individuals throughout the country. The results of these efforts are evident from our global presence where we rank third in terms of size and scalability potential. Similar to other sectors, the agriculture sector has also taken advantage of the emerging eco-system in the country. However, the scalability of these startups in the long term is uncertain due to the absence of the main contributor to this sector. Agriculture graduates are not opting for startups, which raises doubts about the long-term scalability of these startups. The issue is the same in Rajasthan as well.

COMPETING INTERESTS DISCLAIMER:

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We as a author of this paper do not have any known competing financial interest OR non-financial interest OR personal relationships that could have appeared to influence the work reported in this paper.

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