

BUILDING ENTREPRENEURSHIP THROUGH AGRICULTURAL UNIVERSITIES AND RESEARCH INSTITUTES



Over the years, extension professionals have employed non-profit approaches for entrepreneurship development with non-IPR technologies for transforming farmers into agripreneurs. However, the true benefits of agricultural research will be realised only when the focus is shifted to creating technology-based start-ups with people having the essential entrepreneurial attributes. Extension professionals need to understand and master the process of technology commercialisation and entrepreneurship development in a systematic way, to support research in this endeavour, argues, Dr Sethuraman Sivakumar.

INTRODUCTION

Since their inception in the 1960s, Agricultural Universities have developed significant technologies, which have gone on to enhance livelihood security of farmers and other stakeholders. Currently, India has 60 Agricultural Universities, four central and four deemed-to-be universities, and 98 ICAR research Institutes. The Agricultural Universities and research institutes are traditionally engaged in (i) creating competent and professionally qualified agricultural manpower; (ii) developing location-specific agricultural technologies; and (iii) applying viable agricultural technologies to promote farmers welfare. In recent years, there has been a significant structural change in agriculture, with increasing focus on enhancing the entrepreneurial advantage of this traditional profession. In line with this trend, there is growing interest among universities in pursuing commercial applications of the research products they have developed, including new venture creation.



WHY AGRICULTURAL ENTREPRENEURSHIP?

An Instrument of Poverty Reduction

Agricultural entrepreneurship through value addition has been promoted as an instrument for securing food security and reducing poverty. A World Bank study (Ravallion and Datt 1996) has estimated that a one per cent rise in agricultural value added per hectare results in a 0.4 per cent and 1.9 per cent reduction in poverty in the short- and long-run, respectively.

Rising Share of High Value Agriculture

High value products, such as fruits and vegetable crops, on average generate Rs. 3.30 lakh worth of output per hectare compared with Rs. 37.5 thousand in the case of cereals, and Rs. 29 thousand and Rs. 48.7 thousand in the cases of pulses and oilseeds, respectively (NITI Aayog 2015). These variations in value productivity indicate a very large scope for raising the value of agricultural output through a shift from cereals, pulses and oilseeds into commercial cultivation of fruits and vegetables.

Shift in Household Dietary Consumption Patterns

The nature of eating and composition of foods consumed has changed drastically over the years. India's gross national income (per capita), increased by about 2.3 times in the last decade (2000-10), leaving surplus money in the hands of Indian consumers. A National Sample Survey Organisation's study (NSSO 2014) indicates that cereal consumption has declined – by 16.3% in rural and 12.4% in urban areas – during the 1993-2012 periods. Pooled data indicate that per capita consumption rose by 21 per cent in the case of fruits, 14 per cent in the case of vegetables, 11 per cent in the case of milk, and 23 per cent in the case of meat, eggs and fish during the same period.

Box 1: What is Agricultural Entrepreneurship?

Entrepreneurship is the process of creating something new with value by devoting time and effort, assuming the accompanying financial, psychic and social risks and uncertainties and receiving the resulting rewards of monetary and personal satisfaction (Hisrich *et al.* 2005). Agricultural entrepreneurship deals with the entrepreneurial activities performed within and across agricultural value chains. The purposes of agricultural entrepreneurship are: (i) stabilising market prices of agricultural commodities; (ii) generating assured income from farm produce; (iii) creating opportunities to get additional income by utilising farm produce; (iv) utilising the additional revenue or surplus money to develop a viable business; and (v) generating adequate income to sustain farmers' livelihoods.

Changes in Demographic Composition of the Indian Population

Age-related factors play a crucial role in agricultural commercialisation because food consumption by an individual changes over his/her lifetime. A recent survey indicates that India has the world's highest number of 10-24-year-olds, at 242 million, making it the largest youth population in the world (Swissnex India 2015). Considering the creativity, innovativeness and enthusiasm of youth, a National Policy for Skill Development and Entrepreneurship (2015) has been formulated, and several programmes were initiated to motivate them to create new ventures (Ministry of Skill Development and Entrepreneurship, Government of India 2015).

Growth in Export Opportunities for High-Value Agricultural Commodities

In the last few decades, India has mastered its export competitiveness in agricultural commodities, especially in high value products, making it the world's 14th largest agricultural, fishery, and forestry produce exporter. A report prepared by a not-for-profit organisation, the Centre for Environment and Agriculture (Centegro) indicates that Indian agricultural commodities exports are likely to grow to Rs 6507 billion by 2022 from the present ₹ 2342.7 billion (The Economic Times, 23 August 2017).

Emerging Agri-Food Retail Chains

Retail industry in India is expected to grow to ₹23400 billion by 2020 from the current level of ₹21613 billion, registering a Compound Annual Growth Rate (CAGR) of over 10% (Euromonitor International, February 2017). Grocery and food account for more than 50 percent of fast moving consumer goods (FMCG) sales, and together form the biggest retail channel in India.

Increase in the Foreign Direct Investment Inflow for Agri-Businesses

The FDI in agriculture is held in three sectors – food processing, agricultural services, and agricultural machinery. The food processing industry is one of the largest industries in India and ranks fifth in

terms of production, consumption, and exports and contributes 14 percent of the Gross Domestic product of India. Food processing is a hallmark sector attracting FDI at an increasing level. FDI in the food processing sector rose from Rs. 3357 crore in 2014-15, to 4732.28crore in 2016-17 (Press Information Bureau, July 2017).

ENTREPRENEURSHIP DEVELOPMENT IN UNIVERSITIES AND RESEARCH INSTITUTES

Traditionally, Universities and research Institutes are engaged in three primary functions of teaching, research and extension, which are now incorporating entrepreneurship development as their fourth function. The entrepreneurial development activities of universities and research institutes are channelized in three ways. The interrelationships among these core functions are displayed in Fig. 1. An overview of the entrepreneurship development process is displayed in Fig. 2.

- (i) **Technology management** involves planning and executing stakeholder-oriented technology development strategies and programmes;
- (ii) **Intellectual Property (IP) management** deals with protecting the intellectual property rights (IPR) of the viable technologies; and
- (iii) **Commercialisation management** translates the products of research/technologies, including IP protected technologies, into commercial products and services.

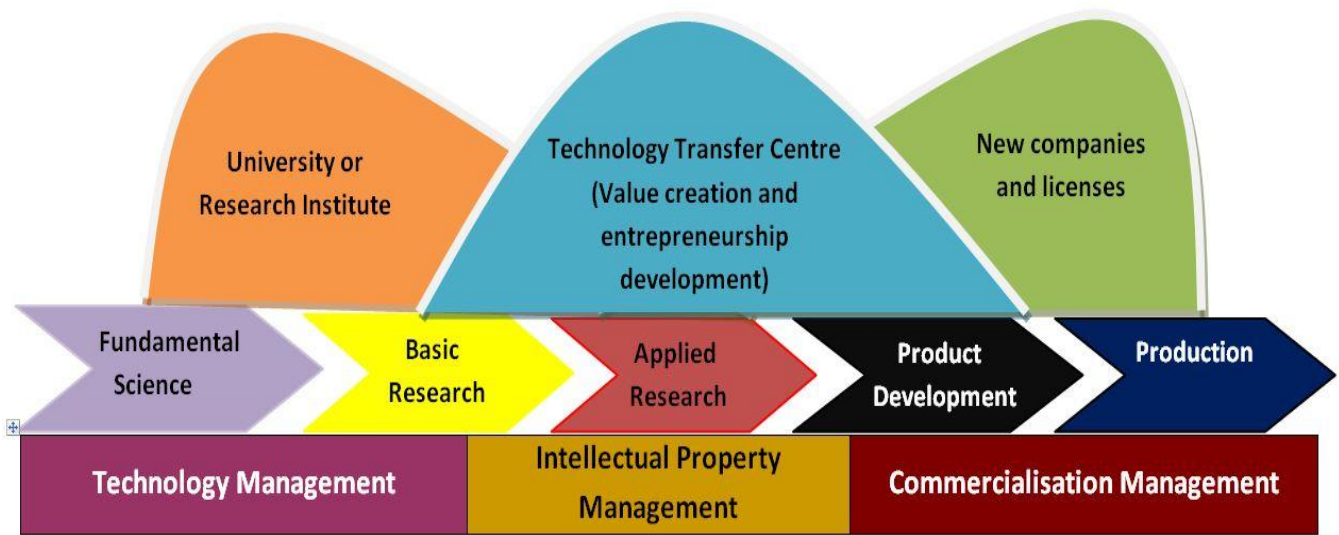


Fig. 1. Technology management and commercialisation process (Adapted from Park, 2015)

Technology Management

Technology management refers to the planning and execution of stakeholder-oriented technology development strategies for generating high impact technological products and services. Strategies are formed by critically analysing the external drivers of technology and the existing infrastructure available in the organisation. Technology management is done by the Directorate of Research and Planning in Agricultural Universities, and the Planning, Monitoring and Evaluation (PME) Unit in ICAR Institutes.

Intellectual Property Management

IP management at the universities and research institutes is undertaken by an IPR Cell (Agricultural Universities) or Intellectual Property and Technology Management Unit (ICAR Institutes). In ICAR Institutes, the Intellectual Property and Technology Management Unit manages Intellectual Property and Technology Commercialisation at the institute level with guidance from the Intellectual Property and Technology Management Committee. The Zonal Technology Management Unit (ZTMU) at the

regional level and the Intellectual Property and Technology Management Unit (IPTM) at ICAR HQ are the coordinating agencies at higher levels.

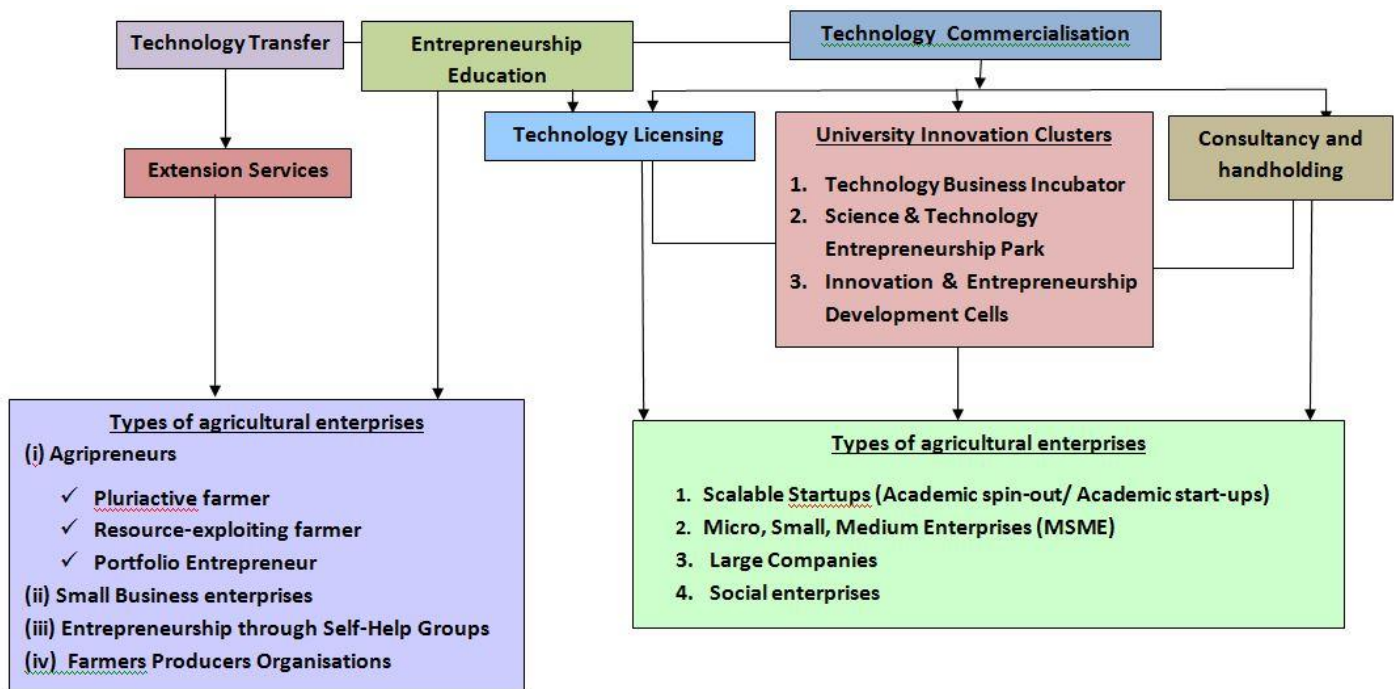


Fig 2. Entrepreneurship Development in Universities and Research Institutes

IP management has three components:

➤ **Technology or invention disclosure**

The inventor explains the details of the technology to a commercialisation committee in a confidential meeting. All the members provide an undertaking of non-disclosure of the technology details. During the meeting, the inventor(s) provide details of name of the invention, technical details, the inventors, source of funding for creating the invention, advantages of the technology over prior art, potential drawbacks, its scope of use, publication records related to the invention, proposed price, market potential and prospective buyers. After a critical discussion, the committee decides on whether to proceed for IPR protection. The technology non-disclosure clause is binding for protecting IPR of the technologies.

➤ **Intellectual Property Rights Protection**

Intellectual Property Protection involves identification of potential technologies for IP protection through critical assessment of their market viability, selecting a suitable IPR protection method, preparing and filing an IPR application, and managing the entire process until the IPR is granted. The purpose of IP protection is to safeguard the intellectual property rights of the technologies developed at the universities and research institutes from possible misuse by other parties. There are four common types of IPR: patents, copyrights, trademarks and Geographical Indications (Box 2).

➤ **Intellectual Property Portfolio Management**

IP Portfolio management is the processes and tools that enable acquisition, analysis, and organization of IP information, available both inside and outside the universities and research institutes. The IP Portfolio managers analyse the current IP scenario of specific technological products and develop future IP management strategies. The IP Portfolio is a key function which

determines the choice of technologies for protecting IP, guides decision-making on mode and extent of commercialization of technologies, and type of entrepreneurs created by the universities and research institutes.

Box 2: Common forms of Intellectual Property Rights

- 1. Copyrights** protect original works of authorship, such as original literary, dramatic, musical or artistic work, cinematograph films, sound recordings, and computer programmes (treated as literary work). With copyright protection, the holder has exclusive rights to modify, distribute, perform, create, display, and copy the work. In general, the protection is valid for 60 years for most types.
- 2. Patent** is a document, issued, upon application, by a government office, which describes an invention and creates a legal situation in which the patented invention can normally only be exploited - manufactured, used, sold, imported, with the authorization of the owner of the patent. "Invention" means a solution to a specific problem in the field of technology. An invention may relate to a product or a process. The protection conferred by the patent is valid for 20 years.
- 3. Trademark** is a word, phrase, symbol, or design that distinguishes the source of products (trademarks) or services (service marks) of one business from its competitors. In order to qualify for patent protection, the mark must be distinctive. The registration for trademark is valid for 10 years and renewable for every 10 years. In addition to trademarks, the Certification marks (granted to anyone who can certify that the products involved meet certain established standards like ISO and ASTM), and Collective marks (owned by associations and the members allowed to use it to identify themselves with a level of quality and other requirements and standards set by the association) can also be protected.
- 4. Geographical Indications (GI)** identify a good as "originating in a place" where a given quality, reputation, or other characteristic of the good is essentially attributable to its geographical origin. For example, Darjeeling tea and Mysore Silks are unique products protected by GI.

Source: Nishith Desai and Associates (July 2015)

The specific functions of IP Portfolio management (Burdon 2007) include technology scan, IP surveillance, licensing/business development IP support, patent development/patentability, patent landscape and managing infringement claims.

Commercialisation Management

The commercialisation management of technologies is the process of turning IP assets into value for both stakeholders and the university and research institute. Commercialisation management has two components: Technology Transfer, and Technology Commercialisation.

➤ Technology Transfer

Technology transfer is a generic term which indicates the formal and informal movement of know-how, skills, technical knowledge, procedures, methods, expertise or technology from one organizational setting to another (Roessner 2000). It includes both 'for profit' and 'non-profit' forms and is used as a mechanism to apply the technological products to derive impacts which enhance the welfare of the stakeholders. While the 'for profit' forms represent technology commercialisation, the 'non-profit' forms are implemented through 'extension outreach' programmes. The differences between 'for profit' and 'non-profit' forms of technology transfer are displayed in Table 1.

The entrepreneurship development activities of extension services focus on the farmer's welfare. The technological products and services are provided at a reasonable cost or free, to help the stakeholders including farmers to maximise returns.

The types of entrepreneurs created through extension services are as follows:

a. Agripreneurs: Agripreneurs are primarily the farmers who are engaged in entrepreneurial activities associated with their farm. Agripreneurship development focuses on creating a new breed

of farmers with core business skills in undertaking farm-based businesses for maximising their income.

Table 1. Differences between ‘for profit’ and ‘non-profit’ forms of technology transfer

Aspect	‘For profit’ technology transfer (Commercialisation)	‘Non-profit’ technology transfer (Extension and Outreach Services)
Purpose	To recover costs incurred in developing the technology and realize the value for the innovation	To enhance stakeholder welfare by applying technological products and services
Type of technologies	With or without IP protection	Only technologies which are not IP protected
Target group	Existing and new enterprises, individual entrepreneurs, public and private sector agencies which are interested in using the technologies for generating revenue	Non-profit public and private sector agencies like KVKs, state extension agencies, NGOs and other stakeholder groups
Mechanism of technology transfer	Technology licensing, contract research, direct and online sale of technologies	Extension outreach programmes

b. Small Business Enterprises: Small-scale enterprises focus only on a few commodities or services. They are created by agripreneurs or rural youth to sustain their livelihoods. This business doesn’t require specialised skills and can run with farmers’ own capital. Examples include: agri-clinics and horticultural nurseries.

Box 3: Types of Agripreneurs

According to Alsoset *al.* (2003), there are three types of agripreneurs: Pluriactive farmer, Resource-exploiting, and the Portfolio Entrepreneur.

- 1. Pluriactive Farmer:** They derive a reasonable proportion of income from the off-farm income generating activities. The purpose of engaging in off-farm economic activities is to sustain their farming and/or to expand their farms to provide employment to their family members. This approach is used as a coping mechanism to sustain in adverse climatic conditions and other shocks which affect their livelihoods (Shucksmith *et al.* 1989). In the pluriactive approach, the farm business is owned by the family and is less capital intensive.
- 2. Resource Exploiting Entrepreneur:** They are farmers who utilize the unique resources available in their farm to develop a new farm-based business. For example, livestock farmers can prepare compost from cow dung; or the farm can be used as an agri-tourism venue to generate additional income. The capital requirement for the business activity varies with the nature of the business.
- 3. The Portfolio Entrepreneur:** They are progressive farmers who wish to exploit a novel but risky business idea. They develop teams to implement their ideas and are ready to invest large capital for translating these into a viable business. Though the ideas originate from farm, the new business is registered as a separate entity from the farm. For example, when a group of farmers create a mango pulp processing factory using their own produce at the initial stages, and then go on to procure from others when expanding production.

c. Entrepreneurship through Self-Help Groups (SHGs): An SHG is a village-based financial intermediary usually composed of 10–20 local women or men. The SHGs are formed by NGOs and financed by banks to undertake a specific entrepreneurial activity. SHGs mostly work on traditional agri-businesses and the profits earned are utilised in a collective way.

d. Farmers Producers Organisations (FPOs): The FPO is a collective of producers, especially small and marginal farmers, who have formed an effective alliance to collectively address many challenges of agriculture, such as improved access to investment, technology, inputs and markets. This collective can be registered as a company under the Company’s Act and undertake farm-based business.

➤ Technology Commercialisation

Technology commercialisation is a systematic attempt to translate technological advancements into commercial products or services targeted to satisfy the felt/unfelt needs of consumers. As indicated in Table 1, it is a special form of technology transfer, which occurs when the party transferring technology receives money in exchange for giving up some or all the usage rights to the technology (Speser, 2008). Technology commercialisation involves selling, licensing, or contracting of technology services, intellectual assets, and related-knowledge to potential users, i.e., independent entrepreneurs, companies or other public/private sector organisations.

Technology commercialisation management involves the following activities:

- a. *Technology valuation*: It involves estimating the value of the technologies from both buyers and sellers perspectives for deciding the licensing fee. In the case of non-IP technologies, the technology price is determined through negotiation between the buyer and seller.
- b. *Developing technology commercialisation strategies*: Technology commercialisation strategies are a series of options that a university or research institute can employ to move its technologies from concept to the marketplace. The purpose of devising commercialisation strategies is to realize the value of Intellectual Property developed by the university or research institute and also to recover the costs incurred in developing those technologies. Various technology commercialisation strategies employed by Universities and Research Institutes are – (i) Technology licensing; (ii) Venture creation; and (iii) Consultancy and handholding.

(i) Technology Licensing

Technology licensing involves transferring rights of IP-protected technologies, technological knowhow (confidential information), copyrights, and registered or unregistered designs developed by the university or research institute to entrepreneurs. It is basically an agreement whereby an owner of a technological intellectual property (University/Research Institute) allows another party (Entrepreneur) by granting exclusive or non-exclusive rights to use, modify, and/or resell that IP in a particular market for a specific purpose in exchange for suitable compensation. The compensation may take the form of a (1) lump sum license fee; and (2) royalty, based on volume of sales. Such agreements are legally binding commitments by one or both parties to not use or disclose to others the confidential information that they have come to know during the negotiations. The period of licensing varies with the stage of technology development (Box 3) and its market potential.

Among the technology development stages, the technologies at the 'prototyping, formulation and compound' stage are directly licensed to interested entrepreneurs for large scale commercialisation. The stage 3 technologies need scaling up for making them 'market-ready'. Both stage 1 and 2 technologies require extensive research before they can be turned into a suitable commercial form.

Technology licensing and contract research with universities and research institutes may help agricultural enterprises to acquire valuable technology from them for improving existing businesses or to develop a new one.

In addition to technology licensing, universities and research institutions are also undertaking contract research with public sector or private agencies for developing a new technology/assessing the existing technology for its viability and efficiency/upgrading these technologies in stages 1-3 for making them 'market-ready'.

Box 4. Stages of Agricultural Technology

Stage 1 - Early stage: An early-stage technology is an idea which is expected to work and solve an existing problem, or create a new need. For example, a plant extract known to have a pesticidal property, but the components and modalities are unknown.

Stage 2 - Proof of concept: Then this early stage idea could be researched and a new technology developed to the point that it shows signs of having the proposed effect. In this stage, a few components of the plant extract which cause insect mortality would have been identified, but the mechanism by which they act is still unknown.

Stage 3 - Reduction to practice: In this stage, several experiments on the specific idea have been completed and the projected results have been reliably and repeatedly reproduced. The pesticidal properties of specific components of the plant extract have been identified, and a mode of action documented and validated.

Stage 4 - Prototyping, formulation and compound: The technology is now standardised and found reliable and valid and ready for commercialisation. In the previous stage, the components having pesticidal properties are extracted using a specific method and reformulated into a pesticide with target-specific claims.

Source: Markman et al. (2005)

(ii) Venture Creation

The entrepreneurship developed by universities and research institutes are largely technology-based with the aim of translating various technological products and services into sustainable businesses. Various institutional mechanisms for creating enterprises include: University Innovation Clusters containing Technology Business Incubators, Science & Technology Parks, and Innovation and Entrepreneurship Development Centre (IEDC) along with consultancy and handholding services. The types of agricultural enterprises created by university and research institutes are given in Box 5 and Fig. 2.

Mechanisms of venture creation

▪ University Innovation Clusters and its constituents

University Innovation Clusters are macro-interventions aimed to create an innovation network with multiple stakeholders, such as Industry, other Universities, R&D Labs, and others. The focus is on developing an innovation culture for developing novel products, processes, services, and delivery which will in turn enable growth and development (Office of Adviser to the Prime Minister on Public Information Infrastructure and Innovations 2011). Within each cluster, project teams made up of researchers, students, entrepreneurs, policy makers, extension agencies and funding agencies co-design new strategies for addressing a specific unmet need within a population.

The University here acts as the focal point of such a cluster and will be able to leverage the following (Office of Adviser to the Prime Minister on Public Information Infrastructure and Innovations 2011):

- Technology R&D and problem solving strengths of the University;
- The entrepreneurial spirit of the students and faculty;
- Collaboration with local industry, NGOs and others;
- The teaching and training capabilities of the University;
- Infrastructure and capital available locally;
- Government policy initiatives, more efficiently.

Several govt. agencies, including National Science Technology & Entrepreneurship Development Board (NSTEDB) - DST, Biotechnology Industry Research Assistance Council (BIRAC), and NAIF-National Agricultural Innovation Fund of Indian Council of Agricultural Research (ICAR), have created University Innovation Clusters on specific focal areas. Typically, a University Innovation Cluster is comprised of a Technology Business Incubator/Agri-Business Incubator, a Science & Technology Entrepreneurship Park (STEP), and Innovation & Entrepreneurship Development Cells (IEDC), which are linked to its stakeholders.

▪ Technology Business Incubator (TBI)

A Business Incubator is an organization designed to create, accelerate the growth and success of entrepreneurial companies through an array of business support resources and services that could include physical space, capital, coaching, common lab facilities and services, and networking connections. A TBI is a special type of business incubator, where the focus group consists of innovative, mostly technology-oriented, or knowledge-intensive service sector enterprises which

Box 5. Technology Commercialisation - Types of agricultural enterprises created (Blank, 2010)

1. Scalable Startups

- ❖ Baby companies, which are developing innovative products or services based on a marketable idea, but yet to establish a concrete business model;
- ❖ Often registered as a Private Limited Company;
- ❖ Up to seven years from the date of its incorporation/registration;
- ❖ Annual turnover – maximum of Rs. 25 crores.

Types of start-ups

⇒ **Academic spin-out** - A commercial entity that derives a significant portion of its commercial activities from the application or use of a technology and/or know-how developed by, or during, a research program of a university or non-profit, usually public, research organization.

⇒ **Academic start-ups** – Technology-based enterprises created by the persons who have studied at a university or research Institutions. They are built upon technological knowledge derived from academic research.

2. Micro, Small, Medium Enterprises (MSME)

- ❖ A MSME is a permanent and structured business unit that focuses on the delivery of value to its already-known customers.
- ❖ As per Govt. of India guidelines, the MSME is classified based on investment. Micro: up to Rs 5 crore; Small: up to Rs 75 crore; and Medium: up to Rs 250 crore.

3. Large Companies

- ❖ Universities can help large companies to develop new ideas and business opportunities, leading to new business ventures and the improvement of organizational profitability, thus enhancing the competitive position of the existing firm.

4. Social enterprises

- ❖ A social enterprise is an organization that applies commercial strategies to maximize improvements in financial, social and environmental well-being of people, and maximizing social impact alongside profits for external shareholders.
- ❖ Social enterprises are not volunteer organizations in that they operate as an enterprise by selling in a market (profit or non-profit enterprises).

constantly interact with the academic sector to bring innovative technology-based solutions to solve persistent problems of society. The impact of TBIs is assessed by the number of companies that have been founded and developed there, the number of created jobs, commercialised technologies or patents obtained. A few of the technology incubators maintained at Agricultural Universities and ICAR Institutes are listed in Table 2.

Table 2. Technology Business Incubators at Agricultural Universities and research institutes

Name of the TBI	Host Organisation	Contact details
Association for Innovation Development of Entrepreneurship in Agriculture (A-IDEA)	National Academy of Agricultural Research Management (NAARM) (ICAR), Rajendranagar, Hyderabad-500030, Telangana	Tel: +91-40-24581427 Email: coo.aidea@naarm.in
Society for Innovation and Entrepreneurship in Dairying (SINED)	National Dairy Research Institute Campus, Karnal – 132001, Haryana	Tel:+91-184-2259329 Email : tbi@ndri.res.in
Agri Business Incubation Society – TBI	Tamil Nadu Agricultural University (TNAU), Coimbatore- 641003, TN	Tel: +91-422-6611310 Email: business@tnau.ac.in
NIELAN –Technology Business Incubator (TBI)	Indian Institute of Millets Research, Rajendranagar, Hyderabad-500030, Telangana	Tel: +91- 8499895407 Email: nielan-tbi@millets.res.in

- **Science & Technology Entrepreneurship Park (STEP)**

A Science Park is an organization managed by specialized professionals whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions (International Association of Science Parks and Areas of Innovation 2017). The main task of STEPs is to create the scientific research infrastructure available for creating new companies. Further, technology parks are to provide students and university staff with the opportunity to do scientific-research cooperation with enterprises. STEPs are offering services like technology transfer, incubation, business support, and link with academics.

- **The Innovation and Entrepreneurship Development Centre (IEDC)**

IEDCs are promoted in educational institutions to develop institutional mechanisms to create an entrepreneurial culture in Science & Technology academic institutions and to foster techno-entrepreneurship. The IEDC programme is focused directly on entrepreneurship development in academic institutions by maintaining close relations with existing businesses and R&D practice.

(iii) Consultancy and handholding

Apart from licensing technologies to enterprises, Universities and Research Institutes also offer consultancy and handholding services for commencing commercial production of technologies. Consultancy services are offered on individual and institutional basis to help entrepreneurs solve specific problems. Handholding is the provision of careful support or guidance to budding entrepreneurs for establishing agricultural technology-based ventures. It involves technology transfer or licensing, extending farm advisory services, linking with funding agencies, establishing the industry, product planning and development, business mentoring, linking with marketing agencies and others.

ENTREPRENEURSHIP EDUCATION

Entrepreneurship education in agriculture is offered by most of the Agricultural Universities, Private Universities and Institutes, and a few ICAR Institutes. This education and capacity development on entrepreneurial skills is: (i) a regular course in UG, PG and PhD level; (ii) a specialised course at Masters level; and (iii) continuous education programmes in technology commercialisation and entrepreneurship development.

Regular courses: Considering the importance of agricultural entrepreneurship, Entrepreneurship Development course is introduced in all agricultural and animal husbandry disciplines. The purpose of these courses is to sensitize UG students on the importance and techniques of entrepreneurship and equip them with critical skills in creating and managing enterprises.

In general, there are two components in teaching entrepreneurship. First aspect is to develop a fundamental understanding of entrepreneurship and business management by providing concepts, principles, structures and processes associated with entrepreneurship. The second aspect focuses more on creating entrepreneurship and managing the business where students are equipped to apply their fundamental understanding along with critical skills to create and manage enterprises. For example, teaching agricultural marketing develops a fundamental understanding of the concept, principles, channels, and structures associated with marketing of agricultural produce. However, the actual practice of marketing requires critical skills in understanding consumers, devising marketing strategies and managing market intelligence through proven strategies and methods/techniques. The current curriculum of entrepreneurship at the undergraduate level focuses more on creating a fundamental understanding of entrepreneurship and business management, but lacks in their application. Though post-graduate curriculum in extension covers both aspects in a general way,

there is a need to enrich it with state-of-the-art approaches and tools with adequate hands-on experience for creating and managing successful agri-businesses.

Specialised course: A specialised MBA in Rural and Agri-business Management is offered in many universities to develop adequate business manpower to meet emerging demands. These specialised courses are well-designed so as to make the students competent in creating and managing agri-businesses. Apart from Agricultural Universities, the Deemed Universities under ICAR system are also offering MBA courses in agriculture.

Continuous education: The continuous education programmes on entrepreneurship are offered to equip professionals on critical skills in business planning, technology management, marketing, etc. The Indian Institute of Management (IIM) at Ahmedabad and Lucknow; Institute of Rural Management (IRMA), Anand; National Academy of Agricultural Research Management (NAARM) and National Institute of Agricultural Extension Management (MANAGE), Hyderabad; Indian Institute of Plantation Management, Bengaluru; CCS National Institute of Agricultural Marketing (NIAM), Jaipur, along with many public sector and private universities and colleges are offering specialised short term courses in business management.

END NOTE

Universities and Research Institutes have expanded their traditional roles of knowledge generation by teaching agricultural technology development and thereby producing quality human resources that can accommodate the fourth function of entrepreneurship development. Though entrepreneurship development is an essential component of both technology transfer and commercialisation, their objectives, reach, and impact are technically different. Over the years, extension professionals have employed non-profit approaches for entrepreneurship development with non-IPR technologies for transforming farmers into agripreneurs. Though this strategy has paid rich dividends, the true benefits of agricultural research will be realised only when the focus is shifted to creating technology-based start-ups with people having the essential entrepreneurial attributes. As creating technology-based entrepreneurship is a very complex process, it is essential for extension professionals to understand and master the process of technology commercialisation and entrepreneurship development in a systematic way prior to developing sustainable entrepreneurships.

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