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ENHANCING COMPETENCY OF EXTENSION PERSONNEL FOR MENTORING AGRIPRENEURS

Edited By

Darsana S, S Helen, Mridula N
Shahaji Phand, & Sushrirekha Das

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MESSAGE

National Institute of Agricultural Extension Management (MANAGE), Hyderabad is an autonomous organization under the Ministry of Agriculture & Farmers Welfare, Government of India. The policies of liberalization and globalization of the economy and the level of agricultural technology becoming more sophisticated and complex, calls for major initiatives towards reorientation and modernization of the agricultural extension system. Effective ways of managing the extension system needed to be evolved and extension organizations enabled to transform the existing set up through professional guidance and training of critical manpower. MANAGE is the response to this imperative need. Agricultural extension to be effective, demands sound technological knowledge to the extension functionaries and therefore MANAGE has focused on training program on technological aspect in collaboration with ICAR institutions and state agriculture/veterinary universities, having expertise and facilities to organize technical training program for extension functionaries of state department.

To foster agricultural entrepreneurship, we must equip the extension personnel with the necessary competencies to effectively mentor agripreneurs. This endeavor demands a multifaceted approach, blending theoretical knowledge with practical skills, and fostering a culture of continuous learning and adaptation. To enhance the competency of our extension personnel for mentoring agripreneurs, several key strategies can be employed, Training and Capacity Building, Experiential Learning, Networking and Collaboration, Continuous Professional Development, Tailored Mentoring Approaches, Monitoring and Evaluation. By investing in the competency development of our extension personnel, we can empower them to become effective mentors and catalysts for agricultural innovation and entrepreneurship. Together, let us work towards creating a vibrant ecosystem where agripreneurs thrive and contribute to the sustainable development of our agricultural sector.

This book covers an array of subjects, Enhancing Competency of Extension Personnel for Mentoring Agripreneurs. I would like to extend my appreciation to Kerala Agricultural University, Thrissur & EAAS Centre, MANAGE, Hyderabad for the tremendous effort in compiling this ebook. I also thank the authors, editors, and designers who have contributed to this ebook creation.

Dr. P. Chandra Shekara
(Director General, MANAGE)

FORWARD

It is with great pleasure that we present an book on "Enhancing Competency of Extension personnel for mentoring agripreneurs". The Directorate of Extension of the Kerala Agricultural University is committed to equip extension personnel with necessary skills and knowledge to effectively support and guide agripreneurs in their journey towards sustainable development and success.

Agripreneurs with their innovative ideas and entrepreneurial spirit are driving the transformation of the agricultural sector. It is our prime responsibility to ensure that extension personnel are well prepared to mentor and empower emerging agripreneurs, thereby enabling them to thrive in their new ventures.

This book has been meticulously designed to address the specific needs and challenges faced by extension personnel in their mentoring role. It covers a wide range of topics ranging from analysing agribusiness scenarios, qualities and competencies of an agripreneur, agribusiness opportunities, formulation of agricultural business plans, export opportunities in agribusiness sector, experiences of successful entrepreneurs, initiatives available for aspiring entrepreneurs from financial institutions and development agencies. It is very important to encourage continuous learning and improvement of the knowledge and skills of extension personnel and in turn agripreneurs.

I encourage you to make the best use of the content written by identified experts for improving the knowledge and skills of extension personnel. By enhancing the competency of extension personnel, we can foster a culture of entrepreneurship and innovations in agricultural sector, ultimately aiming for the sustainable growth and development. I appreciate the dedication and commitment of all the experts and extension personnel in promoting agripreneurship. I thank MANAGE for the financial support and guidance in making this endeavour possible.

Director of Extension
Kerala Agricultural University

PREFACE

In the quest to modernize the agricultural sector and combat poverty while ensuring food and nutritional security for a mushrooming global population, pivotal tasks lie ahead. This necessitates the promotion of the private sector, the elevation of professionalism in agricultural businesses, and the diversification of production chains. Agribusiness, encompassing farming and related commercial activities, becomes the cornerstone of this transformative journey. It involves a comprehensive approach, orchestrating all steps to guarantee quality production, processing, and distribution, ultimately connecting products with the consumer.

The Agribusiness approach strives for a market-oriented paradigm, shifting the focus from mere production to enhancing farm management and cultivating market-oriented business farming practices. Initiating a new business venture is inherently unpredictable. For farmers engaged in agribusiness, it is imperative to embrace sustainable technology and managerial competencies. Agricultural field officers, extension professionals, and researchers are at the forefront of this transformative endeavor, charged with meeting these evolving needs. In this context, the evolving role of extension professionals must be enriched with agribusiness mentoring skills to champion the growth of enterprises and entrepreneurs.

This book is conceived with the purpose of keeping extension professionals abreast of emerging trends, fostering technical and managerial expertise in agribusiness, and empowering them to effectively mentor the next generation of agripreneurs. It serves as a compass, guiding professionals through the intricate landscape of agribusiness and equipping them with the tools and knowledge needed to navigate the challenges and opportunities that lie ahead

Editors

Darsana S
S Helen
Mridula N
Shahaji Phand
Sushirekha Das

Contents

List of contributors

***Amrutha A.P.**, MBA scholar, College of Cooperation Banking and Management, Kerala Agricultural University, Vellanikkara, Thrissur-680651*

***Anoop R.L.**, Assistant Professor, Department of Agricultural Extension, College of Agriculture, Kerala Agricultural University, Padnnakkad, Kasargode- 671314*

***Aswini Vashisht**, Business Development Manager, Agricultural and Processed Food Products Export Development Authority, Kochi- 682025*

***Athira A.P.**, MBA scholar, College of Cooperation Banking and Management, Kerala Agricultural University, Vellanikkara, Thrissur-680651*

***Arya P.S.**, Senior Research Fellow, ICAR-NAHEP-CAAST, Kerala Agricultural University, Vellanikkara, Thrissur-680656*

***Ayisha Mangat**, Research Scholar, Department of Farm Machinery and Power Engineering, Kellappaji College of Agricultural Engineering and Technology, Kerala Agricultural University, Tavanur, Malappuram-679573*

***Berin Pathrose**, Associate Professor, Department of Agricultural Entomology, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur-680656*

***Binoo P. Bonny**, Professor & Head, Department of Agricultural Extension, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur-680656*

***Darsana S.**, Assistant Professor, Central Training Institute, Kerala Agricultural University Mannuthy, Thrissur-680651*

***Devan Chandrasekkharan**, Managing Director, Fuselage Innovations Pvt Ltd, Kalamassery, Ernakulam-683503*

***Fathima Misla**, Research Scholar, Department of Agricultural Extension, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur-680656*

***Girija D.**, ICAR Emeritus Professor (Agricultural Microbiology) Kerala Agricultural University, Vellanikkara, Thrissur-680651*

***Hema M.**, Assistant Professor, Department of Agricultural Economics, College of Agriculture, Kerala Agricultural University, Padnnakkad, Kasargode- 671314*

***Jayasree Krishnankutty**, Professor, Department of Agricultural extension, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur-680656*

***Martin P. Chacko**, Assistant Director (Food), Ministry of Micro, Small and Medium Enterprises, Govt. of India, Thrissur-680001*

***Mridula N**., Assistant Professor, Central Training Institute, Kerala Agricultural University, Mannuthy, Thrissur-680651*

***Smijisha A.S**., Assistant Professor, Krishi Vigyan Kendra, Kerala Agricultural University, Palakkad-679306*

***Sreelakshmi S**., Research Assistant, Central Training Institute, Kerala Agricultural University, Mannuthy, Thrissur-680651*

***Sudheer K.P**. Professor & Head, KAU Agri-Business Incubator, Department of Agricultural Engineering, Kerala Agricultural University, Vellanikkara, Thrissur-680656*

***Suma Nair**, Assistant Professor, Agricultural Research Station, Kerala Agricultural University, Mannuthy, Thrissur-680651*

***Suresh Appukuttan**, Assistant Professor, Amrita School of Business, Amritapuri Campus, Kollam-690525*

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Agribusiness scenario and ecosystem analysis

Binoo P. Bonny and Arya P. S.

**Author contact: binoo.pb@kau.in*

India is in a phase of great demographic transition and holds the unique distinction of having the youngest population in the world. The working age group of 15 to 59 years old comprises over 62 per cent of the population and accounts for over 34 per cent of India's Gross National Productivity (GNI). In a world of ageing population, the median age in India in 2022 has been 28 years, compared to 37 years in China, the US, and 45 years in Western Europe. This demographic scenario of the working-age population outnumbering the non-working-age population holds the potential to lead the country into an era of unparalleled development opportunities. It is estimated that the demographic opportunities will provide a five-decade-long leap for the country, if leveraged with suitable policies and programmes. More significantly, a large majority of around 200 million of these young people live in rural areas and are dependent on agriculture directly or indirectly for their livelihoods. Therefore, harnessing the advantage of the demographic dividend to drive India's economic growth and development depend on having agriculture as one of the prime focuses. However, the agriculture sector in the country has been facing multitude of challenges in the form of inadequate resources, the predominance of small and marginal holdings (86.2%), disguised unemployment, stagnant productivity, and dangers associated with climate variability. This has led to many secondary issues including alienation of youth from agriculture and greater urban migration. In order to address these and support the youth in the sector, the Government of India has enacted many policy interventions that tried to facilitate the development of productive workforce that promote innovative thinking, industrial skills and entrepreneurship in rural environments. This has ushered in the scope for integration of entrepreneurship development, one of the most powerful economic tools into the realms of Indian agriculture. This unfolds the pathways of transition of Indian agriculture from a way of life to agripreneurship and agribusiness. It aims to empower the youth of the country to achieve their full potential and through them enable India to find its rightful place in the global community.

Indian Entrepreneurial Ecosystem

India is also the youngest startup nation in the world with 72 per cent of the founders in the age group below 35 years of age. This has given tremendous boost to Indian start up culture and India's transformation from a cheap labour market to an innovation hub. The private corporate companies especially which are unrelated to agriculture are showing more interest to invest in agriculture as Angel investors. Tech startups and e-commerce have led the growth of this new start up era with revenue generation recorded at 12-14 per cent in the 2019-20 fiscal year. Historically entrepreneurs have altered the direction of many national economies, industries, and markets through new products, matrix organizations, and disruptive technologies. However, the famous innovation pyramid as explained by Nirmalya Kumar places Indian innovations in the invisible side of the pyramid which comprised mostly of process and management inventions. He evaluated India's contribution to path breaking disruptive technologies that fall in the visible innovation spectrum to be of minimum impact despite India's impressive growth record of 10 per cent in Science and Technology sector compared to the global average of 4 percent.

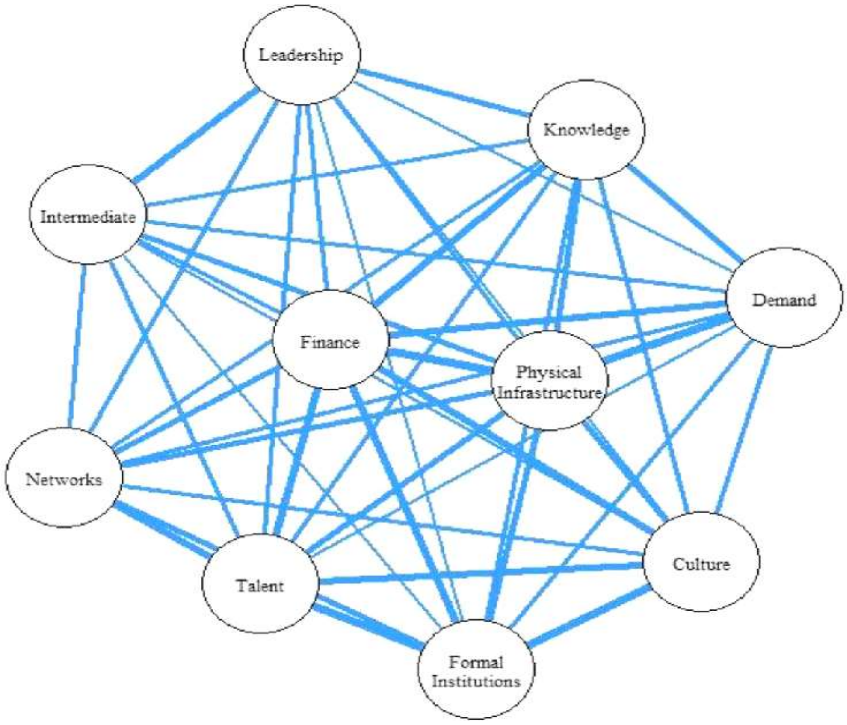

Fig.1. Web of entrepreneurial ecosystem elements (Source: Leendertse *et al.,* 2021)

An entrepreneurial ecosystem consists of a set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organisations (such as banks, venture capitalists, business angels and firms), institutions (such as universities, public

sector agencies and financial bodies), and entrepreneurial processes which formally and informally come together to connect, mediate, and regulate the performance within the local environment. Domains within the entrepreneurial system are identified by Isenberg's model of an entrepreneurship ecosystem (Fig.1). These domains are defined in terms of a supportive culture, policies and leadership that facilitate entrepreneurship, the availability of suitable finance, quality of human capital, venture-friendly product markets and a variety of institutional supports. Thus, it defines a system of interdependent actors and their relations that directly or indirectly support entrepreneurship development. The dynamics of interactions between the components play a significant role in giving rise to new entrepreneurs. India tried to instil the entrepreneurial spirit among young minds through innovation promoting agencies and programmes in Indian science such as the Biotechnology Industry Research Assistance Council (BIRAC), a Section 8 ‘Not-for-Profit Company’ of the Government of India, set up as DBT’s interface agency, to serve as a single window for emerging biotech companies. Also, E-Yuva Centers (EYCs) which serve as dedicated innovation hubs housed within the University/ Research centers mandated to promote a culture of applied research and need-oriented entrepreneurial innovation among young entrepreneurs, students and researchers. The scheme provides funding support (through fellowship and research grant), technical and business mentoring, exposure to bio-incubation models, orientation to entrepreneurial culture etc. to students at undergraduates, post-graduates and post-doctoral levels. These also offer pre-incubation support and mentor students for innovative translational research and have improved India’s global ranking in the Innovation Index to the current 40th position (WIPRO, 2023).

These have helped India to move to third position on the global list of venture capital investments and have recorded an impressive story in the growth of its startups. It currently has more tech-driven start-ups than Israel and China. Only the United Kingdom and the United States stand ahead of it. The number of new start-ups is rising every year, mostly fueled by the entry of young students from premium institutes. In 2020, there were around 2,100 startups in the country and it grew to 9000 altogether in 2021 and has the fastest growing base of startups worldwide. The results of a survey by the consulting firm Redseer Strategy Consultants in 2023, indicated the maturity gained by India's startup environment over the past ten years. It revealed that the time taken for a new-age IT company to reach the $100 million revenue milestone has dramatically

dropped from an average of 18 years in 2000 to five years. The gaining support for entrepreneurship in academia is evident from the registration of over 9000 start-ups in India between 2014 and 2020. Most of these startups worked on artificial intelligence (25%), medical sector (14%), banking sector (10%) etc, and the least number of startups were recorded from the agriculture sector (2%). However, there has been a consensus that to achieve balanced economic development and to develop the rural sector, agripreneurship should gain the impetus. It is expected to take the leverage of the rich rural resources and tap the potential in rural sectors.

Agripreneurial Ecosystem

Agripreneurship models are similar to conventional entrepreneurship models in processes and elements, but they differ in motivation and purposes. Agrienterprises have been predominantly driven by social / moral / food security motives in addition to profit, whereas traditional enterprises are exclusively profit driven. It has empowered many youths to seek opportunities in agriculture sector where many find intractable problems. It is reported that the agritech sector has emerged into the centre-stage of innovation after the Covid-19 crisis and has led India's journey towards an overall transformation. There has been a leap in agritech companies and agrienterprises in the Post COVID India. The reason the sector has so many opportunities can be attributed to the number of broken links in the supply chain which have led to losses of over $13 billion in postharvest stages. In harnessing the benefits of these areas government has launched programmes such as ACABC clinics, Mega food parks, Agribusiness Incubators (ABI), Rashtriya Krishi Vikas Yojana - Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR) and Attracting and Retaining Youth in Agriculture (ARYA). Entrepreneurship growth in agriculture has witnessed tremendous growth with the emergence of Agri Business Incubators (ABI) as an institutional innovation. It has improved the livelihood opportunities of the sector by creating more employment and income opportunities by enhancing the infrastructure and related entrepreneurial environment. ABIs functioned as centres for the development of entrepreneurship by acting as a bridge between industries, financial institutions, and research and development organisations, facilitating the better commercialization of technologies (Pandey et al., 2014). In India, ABIs originated as a result of the Agri-Business Incubation Programme in 2003, a joint venture between the Department of Science and Technology (DST) of the Government of India, and the CGIAR International Crops Research Institute for Semi-Arid Tropics (ICRISAT). Ever

since its inception, ABIs have primarily served as catalysts for the growth of entrepreneurship in agriculture. It supported the establishment of start-ups and small and medium-sized businesses that could employ people, make use of appropriate technology, and boost economies (Ogutu and Kihonge, 2016). Under the National Agricultural Innovation Project (NAIP), the Indian Council of Agricultural Research (ICAR) developed 22 ABIs under agriculture research institutes and State Agricultural Universities (SAU) between 2008–09 and 2013–14 in accordance with these goals. The goal of these ABIs was to hasten the transition from agriculture to agribusiness.

The trend is reflected in the growth of India's agriculture tech startups with funding of $248 million in the first half of 2019, over a three-fold increase in investment compared to the previous year. Interestingly the agritech startups may be the only startups that can be considered to be truly a 'Make in India' model with more than 25 Indian agritech companies having a global presence. More than half of the estimated 450 agritech startups in India offer supply chain solutions like better access to inputs for farmers or market linkage with the ecosystem tilted towards B2B models. According to the report on Agritech in India –Emerging trends (2019), every ninth agristart up in the world originated in India and also more than 50 per cent of agritech startups offered supply chain solutions. This is testified by the presence of global startups like Ninjacart (India's largest agri market platform) and Farmlink (Data science tech-company for Precision farming) from India. These trends have brought government support to these through supportive policies and programmes such as startup India, Atal Innovation Mission, New Gen Innovation and entrepreneurship development centers. These along with the well-recognized accelerators, incubators and identified academic mentors have been working in tandem with technology labs to provide the best technical support and reduce the gestation period.

Agripreneurial Ecosystem of Kerala show vibrancy with the presence of seven ABIs, mostly allotted to exclusive crops and products. ABIs in the state consisted of ABI units in Central Plantation Crop Research Institute (CPCRI), Kasaragod; Central Tuber Crop Research Institute (CTCRI), Thiruvananthapuram; Central Institute of Fisheries Technology (CIFT), Kochi; Coconut Development Board (CDB) Kochi; Kerala Agricultural University (KAU), Tavanur, KAU-RABI, Vellanikkara and Indian Institute Spices Research (IISR), Kozhikode. KAU-RABI is supported under Rashtriya Krishi Vikas Yojna, Remunerative Approaches for Agriculture and Allied sector Rejuvenation (RKVY-RAFTAAR), an important scheme of the Government of India,

Ministry of Agriculture and Farmers' Welfare (MoA & FW). It promotes agripreneurship and agribusiness by providing financial support and nurturing the incubation ecosystem. supports agribusiness incubation by tapping innovations and technologies for venture creation in agriculture. The major components of the scheme include seed stage funding of R-ABI incubates, agripreneurship orientation, idea / pre-seed stage funding of agripreneurs.

The motto of RKVY RAFTAAR has been the promotion of entrepreneurship development through the lab to land principle by circulating new technology. It also takes up seed stage funding of R-ABI incubatees (upto Rs. 25 lakh grant based on competitive business plan pitching) and Idea / Pre-Seed Stage Funding of Rupees five lakhs for product/ protocol development. Under the programme KAU has launched two agripreneurship orientation initiatives viz. RAISE- Realising and Augmenting Innovations for Startup Enterprises, and PACE- Promotion of Agriculture through Commercialization and Entrepreneurship since 2019. Business ideas are promoted through these programmes under major fields of Agri Inputs, Food Processing, Agricultural Supply Chain, Precision Farming, Agri- Social Enterprises, Agri Clinics & Farm Health services, Farm Mechanisation, IoT, ICT and AI in Agriculture, Organic Farming, Agricultural Biotechnology, Natural Resource Management and Waste to Wealth, Secondary Agriculture etc.

Ecosystem Analysis- Components and Interdependencies

Ecosystem analysis entails the rating of efficient functioning and sustainability of the entire agriculture value chain ccomponents and their interdependencies. The components used in the analysis include key stakeholder perspectives involved with agricultural production, processing, distribution and consumption. How the agricultural input suppliers for seeds, fertilizers, and other resources facilitate efficiency in production is analyzed. Also, the role of research and development organizations in the promotion of innovations and technology adoption, which benefit farmers and the entire value chain is evaluated. Transportation and logistics to ensure the smooth movement of agricultural products from farms to processors, retailers, and consumers also formed the part of the ecosystem analysis. Food processors depend on a stable and reliable supply of raw materials from farmers. Financial institutions support farmers and agribusinesses with credit and financing for investment and expansion. Consumers' demand and preferences that shape the type and quantity of agricultural products produced and sold form part of market analytics. Regulatory authorities and

policymakers create an enabling environment for the agriculture sector and establish rules that affect all stakeholders. Subsidies and support, price controls, trade policies, food safety and quality standards, environmental regulations, land tenure and property rights, research and development funding, insurance and risk management programs, development initiatives, biosecurity measures, labour and immigration policies are all part of agripreneurial ecosystem analysis metrices.

In India, ag-tech startups and agri-business are currently in their nascency, with only 1.5 per cent penetration. However, it is estimated to represent a US $24 billion opportunity over the coming years. Agri- business mostly covers **c**ommercial activities involved in the cultivation of crops, raising livestock, and the production of agricultural products, marketing, and distribution. The sunrise sectors that can bring investment into the sector are listed here as follows.

(i) Food processing industry: The food processing industry has received an FDI of Rs 50,000 crore during the period 2011-21 in India. The pro-farmer and pro-industry policies of the Indian government are credited for the growth and India is leading the food processing industry to unprecedented heights with its investor-friendly policies.

(ii) Clean energy: Develop cutting-edge solutions to innovate further solar panels, wind turbines, and energy storage systems. Ambitious target of having 30 per cent of its vehicles powered by electricity by 2030; the highest-ever funding in 2022, with a year-on-year increase of 17 per cent.

(iii) Technology in Agriculture: Technology in modernizing agriculture, precision farming, robotics and automation in agriculture, IoT, drones, sensors, biotechnology and genetically modified crops have received wide attention. The Focus is on the government plans to make indigenous drone manufacturing and adoption a US$ 20 billion industry by 2030.

Conclusion

Technological advancements and policy interventions have improved the livelihood options of small holder farms in developing countries. But the generation of income and job opportunities in the sector could not match the growth rates in other sectors creating disguised unemployment, urban migration and distress among the farming community. In addressing these small farm inadequacies, several facilitation and aggregation models in the form of Agri Business Incubators (ABI), agri-startups and community-based business formats have evolved. All these hold the promise of a new impending agricultural revolution led by young agri- entrepreneurs in the country.

Thus, it is almost certain that the most fundamental challenges the world faces over the coming years will need to be resolved by those working in the agriculture sector. This includes the challenges of feeding a population of nine billion to providing employment to almost half of them along with realising the great Indian dream of a five trillion economy. These altogether warrant a different approach – an approach that puts nature and the protection of its ecosystems back at the heart of the whole process so as to ensure food security and health. It will also require re-discovering how to work with nature which calls for the very best of human ingenuity and resourcefulness. As learning environments, agricultural universities have a fundamental role in helping humanity learn the wisdom of creating a world of compassion and tolerance. In this pursuit, it is imperative both for academic and humanitarian reasons, that problems of human living are put at the heart of entrepreneurship development. That is why it is so important that young people view agriculture, horticulture and all related activities as promising livelihood choice for them.

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Qualities and competencies of an agripreneur

Jayasree Krishnankutty* and Darsana S.

Author contact:* *jayasree.krishna@kau.in*

In 2021, 43.96 per cent of the Indian workforce was employed in agriculture, while the other half was almost evenly distributed among the two other sectors, industry and services. While the share of Indians working in agriculture is declining, it is still the main sector of employment. According to the Economic Survey 2021-22, the average monthly income per agricultural household in the country stood at Rs 10,218 in 2019.The Country has organized and initiated a development programme since 2016 in view of doubling the farmers income. Policies have been entrusted to orient the farmers into agribusiness and agripreneurship. Capacity building of farmers from a single skill of crop production to multiple skills of farm management, enterprise diversification, market identification and farmer aggregations are most needed in the changing era of agriculture.

Agripreneur is defined as an entrepreneur whose main business is agriculture or agriculture-related activities. Agripreneurship is defined as generally sustainable, community-oriented, directly-marketed agriculture. An agripreneur is a determined person, -male, female, young, old worker, retiree, businessperson, who produces for the market. An agripreneur is a determined and creative leader, always looking for opportunities to improve and expand his/her business. An agripreneur likes to take calculated risks and assumes responsibility for both profits and losses. There is a difference between farm business management and entrepreneurship. Farm business management is about better planning, implementation, control and managing risk. Entrepreneurship is about looking forward – identifying opportunities, creating a vision of how the business will grow, innovating and taking risks. A farmer who thinks of the farm as a business that has the potential to grow and develop is an entrepreneur.

Successful entrepreneurs

Successful entrepreneurs have the initiative, drive and ability to identify and take advantage of opportunities. They are creative leaders who are always looking for opportunities to improve and expand their businesses. Also determined to implement their vision and ideas and to achieve their goals. Successful entrepreneurs have a thrive

on change and cope well with uncertainty. They know how to identify and evaluate risks and are willing to take calculated risks, while accepting responsibility for both profits and losses. Entrepreneurs need the skill to organise people, strategies and technologies to fit for the changing environments. They are creative problem-solvers, understand the decision-making process and enjoy making decisions. Their ability to establish strong partnerships and other relationships and work well with other people is highly appreciable. Entrepreneurs are innovators who are always looking for better and more profitable ways to do things, which is particularly important in the face of strong competition and a changing agricultural market environment. Honesty and trustworthy behaviour are bonded with their character. They are eager to learn and keep themselves informed about the latest developments and trends in the agricultural environment

The 10 qualities of a highly successful entrepreneur

A Positive Mental Attitude
Enjoy Being Around People
Excellent Communication Skills
A Strong Desire to Achieve
Resourcefulness
Objective
Committed
Dependable
Proactive and Not Reactive
Possess Technical Skills and Knowledge

Competencies

Entrepreneurial competency is a set of skills and behaviours needed to create, develop, manage, and grow a business venture. It also includes the ability to handle the risks that come with running a business. Without a doubt, business owners and startup founders must possess most of the entrepreneur competencies to succeed. As per We (2017) Competency is described as a cluster of related abilities, responsibilities, knowledge and skills that allow a person (or organization) to function in a job or circumstance efficiently. Modern farmers have to acquire entrepreneurial competencies for remodeling farming enterprises. K.V. Thomas and Saran Murali (2023) had identified Agreeableness (AG), Technological Competency (TC), Competitive Spirit (CS), Innovativeness (IN), Self-Confidence (SC), Social Responsibility (SR), Conscientiousness (CO) and Leadership (LS) as competencies of agriprneurs.

Identifying a business opportunity

Opportunity is a chance to take advantage of a situation. Business opportunity relates to the ability to take advantage of the occurrence in the market for business gain. What is a strong business opportunity for agripreneurs?

- The product meets a need

- The opportunity has to work in your location
- Having access to the resources
- Providing the product at the right price
- Timing is a key element when evaluating business opportunities

Testing the viability of a business idea

Once a business idea has been identified, viability testing must be conducted, encompassing technical, financial, marketing, and social aspects of the enterprise. Technical viability assesses the technological strength of the idea, examining its problem orientation and scientific rationale. Market viability assessment helps identify the demand for the product or services. Additionally, a detailed plan of expenditure and project budgeting outlines the resources required for the business. Viability assessment should also include a thorough examination of competitors and marketing channels. This comprehensive evaluation ensures that the business idea is not only technically sound but also financially sustainable and well-aligned with market demands.

Identifying a business gap

A business gap can usually be found in an area in which consumers are not yet buying a particular product, or in which there is a customer demand that has not been met. Business gaps range from the need for new products to changing a current product, or offering it in an alternative way, e.g. importing bulked soybean or providing organic coffee to the international market. Identifying a business gap involves the following:

- Study trends in the market that the farmer or producer intends to enter into.
- Listen to customers and try to determine what their expectations and concerns are and what they like or dislike about the farmer's competitors.
- Establish what customers require in terms of product cost, quality and service delivery
- Identify customer needs that are not currently being addressed
- Determine if there is room for the farmer's product in the market by identifying competitors' strengths and weaknesses, in order to identify gaps in their services that the entrepreneur may offer

Value proposition

A statement that identifies and briefly describes the unique value that a product would bring to your customers that your competitors' products do not offer. In other words, the value proposition summarises the reasons for a customer buying a particular product

- Offers a clear explanation or your product
- Gives an indication of the way in which your product differs from alternatives on the market;
- Outlines the reasons why customers would prefer your product over your competitors' products.

Having a vision

A vision is a brief description of what a business or an organisation wants to become and achieve in future. Having a vision has several benefits for the agrientrepreneur

- Gives a better understanding of the environment in which the business will be operating in future and what the business needs to be successful in that environment
- Gives a clear focus on the things that really matter to the business, so that time and resources are not wasted on unnecessary tasks
- Provides a common goal that can be used in building teams and encouraging teamwork;
- Simplifies decision-making, in that every decision can be tested against the vision
- Provides a tool for measuring business progress
- Makes it possible for the business to integrate all its change efforts into a single process, in order to process the demands of the changing business environment (e.g. technological changes, financial changes, changes in government legislation and regulations and changes in markets and competition.

Competitor analysis

Businesses operate in a highly competitive environment. It is crucial to be familiar with what their competitors are doing. Competitor analysis is a tool that is used to evaluate the strengths and weaknesses of the competitors of a business in a particular market. Once you know your clients' competitors' products, strategies, strengths and weaknesses the information can be included in the value proposition

Steps in conducting a competitor analysis
Step 1: Conduct market research
Step 2: Collect information on competitors
Step 3: Analyse the collected competitor information
Step 4: Determine your position in the market

Distinguish between customers in the consumer market and customers in the industrial market.

The consumer market refers to the markets for products that are bought by individual customer for their own or family use. The industrial market involves the sales of goods and products between businesses. In the agricultural sector, customers in the industrial market include supermarkets, hotels and restaurants, feed markets and export markets.

Key skills for running an agri business
Critical thinking skills
System-analysis skills
Operations analysis skills
Decision-making skills
Problem-solving skills
Coordinating skills
Communication skills

Making a business plan

A business plan is a document that outlines the financial and operational goals of a business for the near future and shows how these goals will be achieved. In other words, a business plan is a written description of the future of a business. A business plan also describes:

Value proposition, means of delivery to key customers, the resources and partners needed to deliver the product; and basic income and costs.

Skills required for business planning by the agri-preneur

- Setting goals that align with the value proposition of the business
- Identifying a value proposition that fits with customer needs
- Collecting, organising, analysing and interpreting information and situations
- Diagnosing problems and identifying relevant causes of the problems
- Evaluating and comparing courses of action to address problems
- Predicting and forecasting
- Estimating the time and effort required to complete tasks
- Implementing and monitoring actions and tasks

Negotiating skills

- Active listening skills
- Clarify issues by asking relevant questions
- Identify the key issues involved in the negotiation
- Identify areas of common ground between negotiating parties
- Develop a line of logical, reasoned argument
- Put their points clearly and understandably using verbal communication skills
- Identify and structure the problem, identify possible solutions or courses of action and decide on the most suitable option using problem solving skills

- Plan alternative outcomes if a satisfactory decision cannot be reached
- Use decision-making skills
- Use presented facts to make decisions with reasoning skills
- Use persuasion skills

The market opportunity identification for spotting the market gap

Market demand and buying conditions for existing products with reference to collective marketing within a group have to identified. Market options for new products need to encourage diversification, with an emphasis on higher value goods and market options for value added products has to be identified by extension professional so that service providers can assist farmers in shifting from raw to processed goods.

Model canvas for a business plan

Customers	The buyers of the product, such as traders or consumers. For most products, there is more than one type of customer. A supermarket may buy the highest grade output, but the lower grades will have to be sold in a local wholesale market and the lowest quality used to feed animals
Value propositions	A statement that clearly and concisely describes the unique value of a firm or group's products. It states the firm/group's core objectives, which set it apart from the competition. The value proposition focuses on a specific product that the farmers plan to produce Products may include things like maize or milk.
Channels	Indications of the way in which the group plans to deliver the product to the buyer, e.g. by having members deliver to a village collection center ready for pick-up.
Customer relationships	These indicate how the group plans to identify buyers and create and maintain relationships with them, through basic agreements, alliances and or contracts
Income	The money the group earns from selling the product
Key resources	The inputs and resources that the group uses to produce the product and they include land, equipment, seed, fertiliser and labour, as well as the group's internal organisation
Key activities	The activities that the group plans to do to produce the product, e.g. planting, crop management, harvesting and drying.
Business services and partners	The services and partners that the group uses to produce and market its product, such as input suppliers, the agricultural extension service and a microfinance institution
Costs	The costs that the group incurs in order to produce and market the product

Conclusion

The exploration of qualities and competencies essential for successful agripreneurs reveals a dynamic interplay between personal attributes and professional skills. The journey toward becoming a thriving agripreneur demands a unique blend of passion, resilience, and a deep understanding of the agricultural landscape. By cultivating a mindset that embraces innovation, adaptability, and a commitment to sustainable practices, agripreneurs can navigate the challenges of the industry and capitalize on emerging opportunities. Moreover, the development of effective communication, leadership, and business acumen proves pivotal in establishing and maintaining fruitful partnerships within the agricultural community. As this chapter highlights, the successful agripreneur is not only a proficient cultivator but also a visionary leader capable of integrating diverse skills to create a resilient and profitable agricultural enterprise. Ultimately, by embodying these qualities and competencies, agripreneurs are poised to contribute significantly to the sustainable growth of the agricultural sector while securing their own success in a dynamic and challenging industry.

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3

Role of agribusiness incubators in fostering innovation and entrepreneurship in the food processing industry

Sudheer K. P.

Author contact: kp.sudheer@kau.in

Agribusiness incubators (ABIs) play a pivotal role in promoting and fostering entrepreneurship in the food processing sector by acting as vital hubs for developing innovative technologies and commercializing research outcomes. These incubators serve as a bridge between research institutions, industries, and financial institutions, facilitating the transformation of agribusiness ideas into viable products or services. This chapter explores the multifaceted functions of agribusiness incubators in driving economic development, enhancing livelihoods in the agricultural sector, and contributing to the growth of the food processing industry.

Entrepreneurship Development Hubs

Agribusiness incubators function as entrepreneurship development hubs, providing a platform for collaborative efforts between entrepreneurs, research institutions, and industries. They serve as interfaces that facilitate the translation of cutting-edge research into practical applications. The Kerala Agricultural University's network of ABIs exemplifies this role, bringing together entrepreneurs to collectively explore opportunities and strengthen the agrarian economy. Agribusiness incubators not only provide access to technology but also offer training and support in utilizing these advancements effectively. Entrepreneurs acquire the necessary skills to operate and maintain modern machinery, ensuring sustained productivity and maximizing the return on their technological investments.

Commercialization of Technologies

One of the primary functions of agribusiness incubators is to support the commercialization of technologies. By focusing on innovations that require support for proliferation, ABIs act as growth drivers in the low-end spectrum of the incubation ecosystem. These initiatives, backed by public policy reforms and improved infrastructural capabilities, have the potential to revive the agriculture sector through scaling up and commercializing innovative products. Agribusiness incubators assist

entrepreneurs in scaling up their production capacity by introducing technologies that enable larger-scale operations. Increased production volume often leads to economies of scale, allowing entrepreneurs to spread fixed costs across a higher output and, consequently, improving profit margins.

Technological Innovations in Food Processing

Agribusiness incubators contribute significantly to the food processing sector by developing and implementing innovative technologies. Examples include 3D food printing, vacuum frying technology for banana chips, hot extrusion technology for ready-to-eat foods, retort pouch packaging technology, microencapsulation technology, and vacuum impregnation technology for the production of dry fruits. Additionally, ABIs play a role in designing gender-friendly small-scale processing tools, promoting inclusivity and addressing diverse needs within the industry.

Impact of ABIs on Specific Sectors

The Kerala Agricultural University's ABI has played a crucial role in promoting entrepreneurship development in specific sectors such as jackfruit processing, banana processing, and rice processing. By providing entrepreneur support and developing tailored solutions for these industries, the ABI contributes to job creation, income generation, and overall economic growth in the region.

The Convergence of Innovation and Technology

The chapter also emphasizes the transformative impact of innovation and technology on the food processing industry. Emerging technologies such as artificial intelligence, blockchain, and 3D printing have the potential to revolutionize traditional processes, providing entrepreneurs with opportunities to challenge established norms and create disruptive business models. Entrepreneurs who embrace new technologies and machinery gain a competitive advantage in the market by offering innovative and high-quality products. This competitive edge allows them to capture a larger market share and increases their potential for sustainable income growth.

Agribusiness incubator and income generation

Agribusiness incubators play a pivotal role in enhancing the income of entrepreneurs in the food sector by facilitating the adoption of new technologies and improved machinery. They provide entrepreneurs in the food sector with access to cutting-edge technologies that enhance efficiency in various stages of food processing. The adoption of technologies such as automation, artificial intelligence, and data

analytics optimizes production processes, reducing labour costs and increasing overall productivity. Agribusiness incubators contribute to the development and implementation of innovative machinery and equipment designed to streamline food processing operations. Entrepreneurs benefit from improved processing techniques, leading to higher-quality products and reduced production times, ultimately contributing to increased profitability. The implementation of new technologies and improved machinery enhances the quality and consistency of food products, meeting higher market standards and consumer expectations. Entrepreneurs gain better access to premium markets and can command higher prices for their products, contributing to increased revenue and income.

Agribusiness incubators and startup promotion

Agribusiness incubators play a crucial role in promoting and supporting the creation of agri and food startups. These specialized hubs serve as catalysts for innovation, providing a nurturing environment for entrepreneurs to develop, test, and scale their agribusiness ideas. Agribusiness incubators act as platforms that encourage and facilitate the entrepreneurial spirit within the agricultural and food sectors. They provide a conducive environment for individuals with innovative ideas to transform them into viable startup ventures. ABIs offer startups access to essential resources, including state-of-the-art laboratories, research facilities, and shared infrastructure. This access allows entrepreneurs to develop and test their concepts without the burden of high upfront costs, fostering a supportive ecosystem for startup creation.

ABIs role in funding opportunities for food startups

Agribusiness incubators play a crucial role in promoting and supporting funding access opportunities for food startups. These specialized hubs serve as intermediaries, connecting startups with various sources of funding that are essential for their growth and development. Agribusiness incubators provide food startups with access to a network of investors, including venture capitalists, angel investors, and impact investors. By facilitating introductions and networking events, incubators create opportunities for startups to pitch their ideas and secure funding from interested investors. Incubators organize pitch events and demo days where startups can showcase their products and business models to potential investors. These events serve as platforms for startups to attract attention, generate interest, and secure financial support from investors looking for promising opportunities in the food sector. Incubators also assist food startups in identifying and applying for grants and government funding

programs viz RAFTAAR, KSUM, BIRAC, Nidhi-Prayas, etc. By leveraging their networks and knowledge of available opportunities, incubators help startups access non-dilutive funding that supports early-stage development and research.

Agribusiness incubator and sustainability

Agribusiness incubators act as catalysts for the development and implementation of innovative technologies and practices that enhance sustainability in agriculture. They support the creation of eco-friendly farming methods, resource-efficient techniques, and sustainable supply chain solutions to minimize environmental impact. Sustainable farming practices promoted by these incubators focus on minimizing waste, reducing the use of chemical inputs, and promoting soil health and biodiversity. Supporting the development of a variety of agribusinesses within the food sector ensures a more robust and adaptable agricultural ecosystem. By fostering innovation and sustainability, these incubators contribute to building a resilient and environmentally conscious agricultural ecosystem.

Collaborative Ecosystem and Entrepreneurial Spirit

The convergence of innovation and technology has fostered a collaborative ecosystem, where entrepreneurs can leverage shared resources, knowledge, and expertise. Agribusiness incubators often collaborate with research institutions, facilitating the transfer of cutting-edge technologies to startups. This collaboration accelerates the development of innovative solutions and positions startups at the forefront of technological advancements in agriculture and food processing. Crowdfunding, open-source software, co-working spaces, innovation clusters, and startup incubators contribute to a culture of collaboration, enabling entrepreneurs to access funding, mentorship, and networking opportunities. Incubators create networking opportunities for agristartups and food startups by connecting them with industry experts, mentors, and fellow entrepreneurs. Networking enhances knowledge exchange, collaboration, and the potential for partnerships, contributing to the overall growth and success of startups. Agribusiness incubators provide technical guidance and business mentorship to startup founders. Entrepreneurs benefit from the expertise of mentors who can offer insights into agricultural practices, market trends, and business strategies, enhancing the chances of startup success. This collaborative spirit nurtures collective growth and innovation among entrepreneurs in the food processing industry.

Conclusion

In conclusion, agribusiness incubators play a vital role in driving entrepreneurship development, economic growth, and sustainability in the food processing sector. Their multifaceted functions, ranging from supporting technology adoption to promoting startup creation and facilitating funding access, position these incubators as key contributors to the transformation of the agribusiness landscape. As demonstrated by the Kerala Agricultural University's ABI, their impact goes beyond individual enterprises, contributing to job creation, income generation, and the overall advancement of the agricultural and food sectors. The ongoing convergence of innovation and technology further underscores the potential for agribusiness incubators to shape the future of the agri-food industry.

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4

Agribusiness opportunities in farm input production

Fathima Misla P.* and Berin Pathrose

Author contact: fathimamisla@gmail.com*

The agribusiness landscape is not just about meeting the demands of today; it's about representing the future of agriculture. It's about understanding the farmer's aspirations, the needs of the soil, and the dynamics of a world hungry for sustainable, efficient, and high-yielding agricultural practices. Within the expansive realm of agribusiness, manufacturing of farm inputs emerges as a crucial sector brimming with significant opportunities for expansion and profitability.

Private industry is increasingly portrayed as a significant force for prosperity in policy and pursuing development objectives outside of business, such as food security (SDG2 in particular). It is claimed that public and civil society organisations are less successful and efficient than the private sector at attracting investment money and achieving objectives. This has resulted in inclusive business models or methods that assist the underprivileged as suppliers or customers. Through their integration into commercial value chains, inclusive agribusiness helps impoverished farmers enhance their living standards by providing them access to markets, inputs, and services such as training and financing in profitable ways for the industry (van Westen *et al*., 2019).

The various agribusiness opportunities in the production of agri inputs are discussed below.

1. Fertilizer and pesticide dealership

Establishing a fertilizer and pesticide dealership in Kerala requires meticulous planning and adherence to legal requirements. Thorough research into the local market dynamics, understanding customer needs, and complying with regulations are essential steps. Securing the necessary licenses and permits, choosing a strategically located facility, and building solid relationships with reputable suppliers is critical.

Developing a robust marketing strategy, emphasizing customer service, and ensuring staff expertise is crucial for success. Implementing proper inventory management, considering environmental impact, and obtaining insurance coverage contribute to a sustainable and responsible business model. Networking with local farmers, agricultural organizations, and government agencies enhances the dealership's reach and credibility. A fertilizer and pesticide dealership can thrive in Kerala's rural

landscape by staying informed about industry trends and continuously adapting to customer demands.

Licensing requirements:

- Application form A1
- Principal certificate
- Panchayat license
- Building suitability certificate from AO
- Ownership certificate agreement
- Apply through the Kswift portal

2. Bio-input production unit

Establishing a bio-input production unit involves creating a facility that produces biological inputs, such as biofertilizers, biopesticides, and other microbial-based agricultural products. This venture aligns with the growing demand for sustainable and environmentally friendly farming practices. The process begins with thorough research on the bio-input types needed in the local agricultural context.

Obtaining the necessary licenses and complying with regulatory standards is crucial to ensure product quality and safety. Setting up a production facility equipped with the technology required for cultivating and processing beneficial microorganisms is essential. Developing relationships with researchers, biotechnologists, and agricultural experts can aid in staying updated on the latest advancements in bio-input technologies. A focus on quality control, efficient production processes, and eco-friendly packaging are integral aspects. Effective marketing and education campaigns can raise awareness among farmers about the benefits of incorporating bio-inputs into their farming practices. Overall, a bio-input production unit contributes to sustainable agriculture, promoting soil health and reducing the reliance on traditional chemical inputs.

3. Consultancy services

Consultancy services in agriculture involve offering specialized advice and guidance to various stakeholders in the agricultural sector. Agricultural consultants provide expertise in crop cultivation, livestock management, agribusiness, sustainability, and technology adoption. Their role encompasses conducting assessments, devising strategic plans, integrating modern technologies, and ensuring regulatory compliance. Additionally, consultants may offer market research insights, deliver training sessions, and facilitate capacity building to empower farmers and

agricultural professionals. Sustainability consulting, risk management, and financial planning are integral to their services, contributing to rural businesses' overall success and resilience. With a focus on staying alongside industry trends and building a network within the farming community, consultancy services are crucial in guiding individuals, businesses, and organizations towards efficient, sustainable, and profitable agricultural practices.

4. Farm Labour Contractors

Providing a reliable and skilled workforce is paramount in agriculture, and various entities serve as vital labour suppliers to meet this demand. Farm Labour Contractors (FLCs) play a pivotal role by recruiting, hiring, and often transporting seasonal or temporary workers to farms, ensuring compliance with labour regulations. Temporary staffing agencies specializing in agricultural labour offer farmers access to a screened pool of workers for diverse tasks. Community-based organizations and online platforms connect farmers with available labour, while informal labour pools or gatherings may spontaneously form in some areas. Upholding legal and ethical standards is crucial for farmers and labour suppliers to foster fair and sustainable working conditions in the agricultural sector.

5. Online platforms for input supply

In the agricultural sector, online platforms for input supply have become increasingly prevalent, offering a streamlined and convenient way for farmers to access essential resources for their farming operations. These platforms are digital marketplaces where farmers can browse, compare, and purchase various agricultural inputs. Inputs include seeds, fertilizers, pesticides, equipment, and other supplies necessary for crop cultivation.

Online platforms often provide detailed product information, user reviews, and pricing transparency, empowering farmers to make informed decisions. Additionally, these platforms may offer delivery services, saving farmers time and effort in procuring inputs. Some online platforms may also incorporate data-driven insights and precision agriculture technologies, helping farmers optimize their input usage for improved productivity and sustainability. The digitalization of input supply in agriculture contributes to efficiency, accessibility, and connectivity within the farming community, fostering agricultural advancements in the modern era.

6. Drone service provider

In an entrepreneurial endeavour that blends technology with agriculture, envision an individual purchasing a drone to establish a service dedicated to aiding farmers in crop spraying. This innovation, recognizing the efficiency and precision offered by drone technology, embarks on a mission to provide a valuable solution to agricultural challenges. Armed with a reliable drone equipped with spraying capabilities, offering a service encompassing the targeted application of pesticides, fertilizers, and other crop protection products. This initiative addresses the need for efficient and precise farming practices and contributes to sustainable agriculture by minimizing the environmental impact of traditional spraying methods.

The entrepreneur's journey involves mastering the technical aspects of drone operation and spraying systems and navigating regulatory frameworks and safety protocols related to drone usage in agriculture. As the business gains momentum, the service provider should establish partnerships with local farmers, offering them a convenient and technology-driven alternative to conventional crop spraying methods. The entrepreneur's commitment to promoting precision agriculture and optimizing resource use resonates with farmers seeking ways to enhance crop yields while minimizing input costs.

The drone service provider may integrate additional features into the business model, such as data analytics, to provide farmers with insights into crop health and growth patterns. Drone services enhance the value proposition for farmers and align with the broader trend of digital transformation in agriculture.

As the venture evolves, the entrepreneur catalyzes positive change in the agricultural community, contributing to increased efficiency, reduced environmental impact, and improved yields. The success of this business rests not only on technical proficiency but also on building trust with the farming community, understanding their unique needs, and adapting to the dynamic nature of modern agriculture. In this narrative, the individual's journey embodies the intersection of technology and agriculture, showcasing the potential for innovation to drive positive change in traditional industries.

7. Online platforms for expert advice

Building an inventive online platform to tackle agricultural challenges experienced by farmers globally, delivering expert guidance on soil conditions, pests, and diseases. The vision is to empower farmers with precise and timely insights, enhancing their decision-making processes and optimizing crop health. The platform lets farmers directly upload images of their crops, soil, or any concerning signs. Then, the platform's algorithms analyze these inputs, offering instant diagnoses of potential issues and providing actionable recommendations for treatment and prevention. It incorporates advanced agronomic tools to assess soil conditions comprehensively. Through partnerships with soil testing laboratories, the platform offers farmers an efficient and accessible means to gauge soil health. Real-time data, including nutrient levels, pH, and organic matter, can be made available through a secure online interface. The platform continues beyond diagnosis but extends its capabilities to provide tailored advice on soil amendments, nutrient management, and sustainable agricultural practices.

Monetization strategies may include subscription models, where farmers can access premium features for a fee, and partnerships with agricultural input suppliers for targeted advertisements. Additional features like integration with precision agriculture technologies, weather monitoring, and collaborative forums for farmers to share insights could be explored as the venture grows.

8. Social media influencer

In social media, strategic posts can highlight innovative farming practices, success stories, and the journey from soil to market. Engaging blogs can serve as a digital diary, chronicling the challenges and triumphs of agricultural entrepreneurship while providing valuable insights to aspiring farmers. Videos on YouTube or other platforms offer a dynamic medium to showcase modern farming techniques, equipment reviews, and interviews with seasoned agricultural entrepreneurs. Leveraging social media, blogs, and videos in this entrepreneurial pursuit creates a comprehensive narrative that promotes the farm business and contributes to a broader dialogue on sustainable farming practices, market trends, and the vital role of agriculture in our global economy. As the digital landscape continues to evolve, embracing these platforms becomes not just a means of promoting agribusiness but a crucial element in fostering community, knowledge exchange, and the growth of a thriving agricultural entrepreneurial ecosystem.

Conclusion

As the agricultural landscape continues to evolve, the demand for innovative and sustainable solutions in producing essential inputs such as fertilizers, seeds, and crop protection products is rising. Entrepreneurs venturing into this sector have the potential to not only contribute significantly to the agricultural value chain but also address the evolving needs of farmers. By harnessing technological advancements, promoting eco-friendly practices, and embracing strategic partnerships, agribusinesses in farm input production can play a pivotal role in enhancing agricultural productivity and sustainability.

The significance of agripreneurship as a connection between youth, agriculture, and rural employment cannot be emphasized enough. With decreasing job opportunities in the formal sector, it is crucial to foster a dynamic agribusiness sector that caters to the needs of young individuals. To promote youth agripreneurship, implementing rigorous empowerment and training programs becomes critical in developing the technical competencies needed for better business performance. This is particularly significant given that numerous young agripreneurs lack adequate skills and experience (Adeyanju *et al*., 2023). Therefore, the government and development partners must devise strategies to increase investment in agripreneurship empowerment programs. Additionally, there should be an effort to expand and extend the duration of existing

programs beyond the typical one-time period, ensuring sustained support for the development of capable and successful young agripreneurs.

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5

Agribusiness opportunities in farm mechanization

Suma Nair*, Suresh Appukuttan and Ayisha Mangat

Author contact: suma.nair@kau.in*

Agriculture is still the primary source of livelihood for 58 % of India's population. It has an 18 % share of the Indian economy and has proven capability for robust growth even in times of unprecedented distress. Agriculture, the backbone of rural development in India, provides farmers with constant employment. However, the agriculture sector is presently confronting many challenges. The exponential growth of the world population is creating an unprecedented demand for food. From 1.6 billion at the beginning of the 20th century, the world population grew to 6.1 billion at the start of the 21st century, and currently, it stands at 8.1 billion. As is evident, the increase in population has mainly occurred over the last two centuries, and it is predicted that the world population will hit 10 billion by the year 2050. This growth in population puts a vast demand on all natural resources, including water, land, and food. Urbanization, climate change, migration of labour, changing demographics and food habits, and the increased presence of women in the workforce have all led to a never before demand for food. It is estimated that to feed the expected population of 10 billion humans in 2050, approximately 70% more food will have to be produced than in the present day. But, the degradation of land resources, unpredictable vagaries of weather, fast depletion of freshwater, and lack of quality inputs in agriculture are leading to decreased productivity, which becomes a challenge to producing more food for the growing population.

With the increasing global demand for food, there is a growing need for efficient and productive agricultural practices. It is imperative that the perspective with which agricultural technology is being approached currently be drastically changed and revamped to produce more food from fewer resources to meet the food demand of the future. Agriculture must become an agribusiness and cross-industry applications and linkages must be established to take advantage of technologies being used in other sectors to enhance the productivity of the agricultural industry.

Key growth drivers such as increased investment in agricultural infrastructure, use of genetically enhanced crops, increase in minimum support price, and increasing mechanization can help take Indian agriculture forward. Improved infrastructure such

as better roads, railways, and ports to enhance connectivity between the farm and the market, modernizing irrigation systems by adoption of water saving micro irrigation techniques, better and more accessible storage and warehousing facilities, easier access to credit, insurance, and subsidy, etc. will result in empowerment of the farmers. Infrastructure investments can also support agricultural research and development institutions. This promotes the dissemination of innovative techniques, crop varieties, and best practices among farmers, leading to sustainable agriculture and increased yields, thereby helping to improve the efficiency and productivity of the Indian agricultural sector. This can lead to higher incomes for farmers, lower food prices for consumers, and increased food security for the nation.

In India, farm mechanization is crucial for optimizing agricultural productivity, especially given the prevalence of small and fragmented landholdings. Implementing mechanized techniques on these smaller plots helps farmers overcome labour shortages, streamline operations, and improve overall efficiency, contributing to increased yields and economic sustainability. Adopting farm mechanization in the context of diverse and smaller landholdings is essential for addressing the unique challenges faced by Indian agriculture.

Farm mechanization

Mechanization encompasses a wide range of farming activities, including the production, distribution, processing, storage, and utilization, using various tools and equipment, ranging from basic hand tools to advanced motorized equipment (Mangat, *et al*., 2022). It alleviates strenuous labor, addresses shortages in the workforce, enhances productivity and timeliness in agricultural tasks, optimizes resource usage, improves market accessibility, and aids in mitigating climate-related risks. Sustainable mechanization takes into account technological, economic, social, environmental, and cultural factors, thereby contributing to the sustainable development of the food and agricultural sectors. (FAO, 2023)

Increasing mechanization has several positive impacts on the Indian agricultural sector, including improved agrarian productivity by reducing the amount of time and labor required to complete tasks, reduced costs, improved quality agricultural products, increased cropping intensity by reducing the time it takes to complete farming tasks enabling the framer to grow more crops on the same land leading to higher incomes, reduced drudgery, thereby making farming more attractive to young people and help to address the problem of rural-to-urban migration (Daum, 2023).

In addition to these direct benefits, mechanization also has many indirect benefits, such as increased investment in the agricultural sector, as it can help improve the profitability of farming and increase employment in the farming sector. It creates new jobs in the manufacturing and maintenance of agricultural machinery, exports of agricultural products by increasing the competitiveness of Indian agricultural products in the global market.

Agribusiness

Agribusiness refers to the integration of various agricultural activities, including production, processing, marketing, and distribution, within a single business entity or across multiple entities. It encompasses the entire agricultural value chain, from farm to fork, and involves the commercial production and marketing of agricultural products and services. It combines agrarian production with business principles and practices to maximize the farming sector's efficiency, profitability, and sustainability.

Agribusiness activities range from farming to crop and livestock production, agrochemicals, seed production, agricultural machinery and equipment manufacturing, food processing, distribution, marketing, and retailing. It also involves related sectors such as research and development, finance, and agricultural policy. Agribusinesses can be large-scale commercial operations or small family-owned businesses, and they play a vital role in the global economy by ensuring a stable food supply, generating employment, and contributing to economic development.

Agribusiness opportunities in farm mechanization

Agribusiness opportunities in farm mechanization are rapidly expanding, transforming traditional farming methods with advanced technologies and machinery. Farm mechanization offers a wide array of opportunities, from the manufacturing and distribution of agricultural machinery to providing technical support and training services to farmers. Entrepreneurs can tap into this sector by investing in innovative technologies, automation solutions, and precision farming equipment, catering to the evolving needs of modern agriculture. By embracing agribusiness opportunities in farm mechanization, entrepreneurs contribute not only to their own financial growth but also to the overall development and sustainability of the agricultural industry.

The Indian agricultural sector is undergoing a rapid transformation, with a growing focus on mechanization. This is creating several opportunities for

agribusinesses to provide farmers with the machinery and services they need to improve their productivity and incomes. Entrepreneurs and businesses can explore various avenues within the farm mechanization sector.

Some of the key agribusiness opportunities in farm mechanization include:

- **Manufacturing and selling agricultural machinery:** There is a growing demand for agricultural machinery in India, as farmers shift from traditional to mechanized farming practices. Agribusinesses can capitalize on this opportunity by manufacturing and selling agricultural machinery such as tractors, harvesters, threshers, and planters. Wide geographical variations in agricultural lands indicate the need for customized, crop-specific, and location-specific machinery. Most Indian farmers fall under the small and marginal category and there is a huge market for small farm machinery.
- **Providing custom hiring services:** Many smallholder farmers cannot afford to purchase their own agricultural machinery. Agribusinesses can provide these farmers access to agricultural machinery by offering custom hiring services. Under custom hiring arrangements, agribusinesses provide farmers with access to agricultural machinery on a rental basis. The farmers benefit from timely agricultural mechanization services, improving productivity and profit.
- **Providing agricultural machinery repair and maintenance services:** As the stock of agricultural machinery in India grows, there is a growing demand for repair and maintenance services. Agribusinesses can provide these services to farmers directly or through a network of dealers. Facilitating the availability of spare parts too is an essential critical agri business opportunity.
- **Providing agricultural machinery training and support services:** Many farmers are not familiar with using agricultural machinery. Agribusinesses can provide these farmers with training on using and maintaining agricultural machinery. Agribusinesses can also provide farmers with support services, such as advice on selecting and purchasing agricultural machinery.
- **Providing agricultural machinery financing:** Many farmers cannot afford to purchase agricultural machinery for want of capital. Agribusinesses can provide farmers with financing for farmers looking to invest in mechanized farming equipment options like lease-to-own schemes and loans. This can facilitate broader adoption across various farm sizes.

- **Technology solutions for agriculture:** The agricultural technology developers can provide technology solutions in different areas, including irrigation and precision farming, by developing farming tools, sensors and farm management softwares.
- **Renewable Energy integration:** Developing technologies for integrating various sources of solar power, and biofuel through converting agricultural waste and biomass can align with farm mechanization. Providing farmers with solutions for sustainable disposal of crop residues and generating bioenergy can be both environmentally friendly and economically viable.
- **Data Analytics in Agriculture:** New age farm management needs to collect and understand data from various sources including weather, farm equipments operations, etc. to make informed decisions. Agri-businesses are providing data analytics services and precision agriculture solutions that help farmers make data-driven decisions for better crop management, resource optimization, and yield improvement.
- **Farm Experience and Tourism:** Offering farm experiences showcasing crops and modern practices can also generate farmer revenue. This can provide avenues for learning and recreation at the farms.

Farm mechanization in India

The history of farm mechanization in India has evolved over several decades, with significant changes occurring during the post-independence period. Before independence, agriculture was largely manual and traditional with farmers using tools like wooden ploughs and bullocks for tilling and other practices. Investment in farm machinery went up during green revolution during the 1960s and 1970s along with the introduction of high yielding crop varieties and mega irrigation projects. Government schemes subsidizing the purchase of farm tractors and other machinery improved the adoption of farm machinery in different parts of the country. Many state governments also set up Agro Machinery Corporations in the 1970s to manufacture and supply agricultural machinery including tractors and tillers to farmers at subsidized rates. This improved the use of tractors and other modern equipment at the grassroot level thereby improving productivity and reducing farm drudgery to a great extent. The technology interventions in promoting oilseeds and pulses also improved the cultivation, production and processing of pulses and oilseeds.

The opening up of the Indian economy in the 1990s saw the increased role of the private sector in the manufacturing and distribution of machinery. Many foreign

companies also forayed into the Indian market to set up production for domestic business and exports to other countries. The National Mission on Agricultural Mechanization (NMAM) was launched in 2010 to promote the use of farm machinery, improve access to credit for farmers and establish custom hiring centers for farm equipment. Currently, there are many schemes for supporting farmers to improve the adoption of farm machinery in India. A few of the projects are listed below:

Sub-Mission on Agricultural Mechanization (SMAM)

The SMAM scheme (Sub-Mission on Agricultural Mechanization) was launched in 2014-15. The scheme is being executed across all states in India to encourage the adoption of farm mechanization at a grassroots level and raise the farm power-to-cultivable unit area ratio to 4.0 kW/ha by the year 2030 (NABARD, 2023). Under the SMAM scheme, Indian farmers are eligible for subsidies ranging from 50 to 80 per cent when purchasing agricultural machinery, with a particular focus on providing benefits to women farmers. This subsidy system allows farmers to obtain agricultural machinery at reduced costs, facilitating easy and affordable access. This program is open to all landholding farmers' families, including Self Help Groups (SHGs), User Groups, Cooperative Societies, Farmer Producer Organizations (FPOs), and entrepreneurs are especially encouraged to establish 'Custom Hiring Centres' to address the challenges of small landholding and the high costs associated with individual ownership of machinery. (MoA&FW, 2023)

Agriculture Export Policy (AEP)

In 2018, AEP strengthened exports and public-private partnership in India. The Agriculture Export Policy emphasized fostering agriculture export-oriented production, promoting exports, enhancing farmers' earnings, and aligning with the policies and programs of the Government of India. It was realized that a "Farmer Centric Approach" is essential to enhance income through on-site value addition, ultimately reducing losses throughout the entire value chain. The policy led to a focus on agriculture export-oriented production, export promotion, better farmer realization, and synchronization, including establishing institutional frameworks for pursuing market access, managing sanitary and phytosanitary concerns, facilitating farmers in capitalizing on export opportunities in international markets, etc. (GoI, 2017)

Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM-AASHA)

Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM-AASHA) is a government initiative in India to ensure remunerative prices for farmers and protect

their income. The Ministry of Agriculture and Farmers Welfare, Government of India implements the scheme. State governments are also actively involved in the execution of PM-AASHA. It was announced in September 2018 with the aim of ensuring that farmers receive a Minimum Support Price (MSP) for their crops annually. This scheme primarily focuses on oilseeds and pulses, as these are critical crops for Indian agriculture. (NPI,2023)

Pradhan Mantri Kisan Samman Nidhi Yojana (PM-KISAN)

The Pradhan Mantri Kisan Samman Nidhi Yojana (PM-KISAN) is a government scheme in India that provides income support to small and marginal farmers. The scheme was launched in December 2018. PM-KISAN aims to provide direct income support to eligible farmers to help them meet their financial needs for cultivation and reduce their dependence on informal credit sources.

Under PM-KISAN, eligible farmers receive direct income support of Rs. 6,000 per year in three equal installments of Rs. 2,000 each. The amount is directly credited to the bank accounts of the beneficiaries through the Direct Benefit Transfer (DBT) system. The scheme is implemented by the Ministry of Agriculture and Farmers Welfare, Government of India. State governments and Union Territories are actively involved in the identification of beneficiaries and disbursement of funds. The beneficiaries are identified based on the land records. (MoA&FW, 2023)

Pradhan Mantri Kisan Urja Surakhsa Utthaan Mahabhiyan (PM-KUSUM)

The Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) is a government scheme in India aimed at promoting the use of solar energy among farmers and providing them with a reliable source of power for irrigation purposes. PM-KUSUM aims to support farmers in adopting solar-powered agriculture pumps and encourages the use of barren or unused land for setting up solar power plants. The scheme provides financial assistance and subsidies to farmers for the installation of solar pumps and solar power plants. The main components of this scheme are:

- Component-A (Installation of Solar Pumps):

This component focuses on the installation of solar pumps for irrigation purposes. It aims to enhance the income of farmers by reducing their dependence on diesel pumps and providing them with a sustainable and cost-effective energy solution.

- Component-B (Installation of Solar Power Plants):

Under this component, farmers are encouraged to set up small solar power plants on their barren or unused lands. The generated power can be utilized for self-consumption, and surplus power can be sold to the grid.

- Component-C (Solarization of Grid-connected Agriculture Pumps):

This component involves the solarization of existing grid-connected agriculture pumps to make them more energy-efficient and environmentally friendly.

PM-KUSUM is implemented by the Ministry of New and Renewable Energy (MNRE), Government of India. State Nodal Agencies and DISCOMs (Distribution Companies) are involved in the implementation at the state level. The scheme aims to reduce the carbon footprint by promoting the use of clean energy, enabling the farmers to generate additional income by selling surplus power and providing a reliable and sustainable source of power for agricultural activities. (HPDoA, 2023)

National Food Security Mission (NFSM)

The National Food Security Mission (NFSM) is a flagship program of the Government of India aimed at increasing the production of rice, wheat, and pulses to ensure food security in the country. The mission, launched in October 2007 under the 11th Five-Year Plan and extended into subsequent plans, aims at increasing production, promoting sustainable agriculture by the adoption of improved agricultural practices, technologies, and inputs, ensuring remunerative prices for farmers, reducing yield gaps in targeted crops by promoting the use of high-yielding varieties, efficient irrigation, and better crop management practices, enhancing farmers' income and promoting Public-Private Partnership (PPP). The mission provides assistance up to 50% cost of machinery such as pump sets, tractors, tractor mounted sprayers, seed drills, zero till seed drills, etc. (DoAC&FW,2018)

Rashtriya Krishi Vikas Yojana (RKVY)

The Rashtriya Krishi Vikas Yojana (RKVY) was initiated in the fiscal year 2007-2008 as the primary program of the Department of Agriculture & Farmers' Welfare (DA&FW). The program underwent a transformation and was relaunched as the Rashtriya Krishi Vikas Yojana - Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR) in the year 2017-18. The revised scheme places significant emphasis on enhancing pre- and post-harvest infrastructure while also fostering agri-entrepreneurship, encouraging innovations, and promoting value addition in the agricultural sector. The programme also aims at setting up custom

hiring centers to support farmers with farm equipments. The assistance is provided to procure tractors, combine harvesters, sugarcane harvesters, cotton pickers etc.

Mission for Integrated Development of Horticulture (MIDH)

The Mission for Integrated Development of Horticulture (MIDH) is a Centrally Sponsored Scheme designed to facilitate comprehensive advancement in the horticulture sector, encompassing fruits, vegetables, root and tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa, and bamboo. Under the scheme of horticulture mechanization, assistance is provided for the procurement of power-operated machines and tools as well as the import of new machines. The facility is provided to grower associations, farmer groups, SHGs, women farmer groups with more than 10 members who are engaged in the cultivation of horticulture crops. (MIDH, 2023)

Latest trends in Agriculture

The unparalleled challenge faced by the agriculture and food sectors is the requirement to provide safe and nutritious food for the burgeoning population, mitigate hunger and malnutrition, and ensure a safe environment with minimum damage to and utilization of natural resources. This can be achieved only by thinking outside the box and bringing innovative technologies into agriculture to disrupt the usual way of doing things. New production techniques are necessary to increase production and productivity of crops using hitherto unexplored resources. Incorporating new technologies to increase output, and building up cross industry linkages to strengthen agriculture is also needed to move towards meeting this challenge. The latest trends in agriculture include a mix of technological advancements, sustainable practices, and innovations aimed at addressing challenges and improving productivity.

Precision Farming and Digital Agriculture

Precision farming and digital agriculture look at integrating technologies like GPS, sensors, drones, and data analytics for precision farming enabling farmers to optimize resource use, monitor crop health, and make informed decisions. Through the adoption of precision agriculture practices, farmers can optimize resource utilization, decrease environmental impact, and enhance overall productivity. This approach facilitates more sustainable and effective farming practices amidst challenges such as evolving climate conditions and the imperative to feed a growing global population sustainably.

Hydroponics is a promising technique capable of producing quality food without using land for cultivation. Hydroponics involves growing plants in a water based nutrient solution and may include aggregate substrate or growing media like vermiculite, perlite, coco pith, etc. Different crops can be grown in the system. High value crops such as spinach, lettuce, kale, herbs, medicinal plants, cherry tomatoes, tomatoes, cucumbers, beans, chillies, etc. can be grown to earn substantial, sustained income. Focus is now being placed on making hydroponics systems more sustainable and resource efficient by introducing techniques such as use of treated waste water for growing crops, desalination of seawater which can then be used in hydroponic systems, using solar energy for power generation to run the systems and also for desalination of sea water, thus making the system fossil fuel free, etc.

Aeroponics is a soilless agricultural technique that grows plants by misting their roots with a nutrient-rich solution. It involves amalgamation of various technologies, such as use of ultrasound, timers and controllers and monitoring systems for efficient control of environmental factors, automated nutrient delivery, and the monitoring of plant health etc. It maximizes nutrient absorption while putting less stress on the plant itself, leading to healthier plants having higher nutritional value, better color, texture, and taste. The aeroponics systems use 30% less water as compared to hydroponic systems as there is less evaporation from growing media which is mounted within the system. Though aeroponic systems need a higher initial investment, the growth rate and yield are better and fetch high value.

Sensors find wide application in the agricultural sector. Figure 1 shows the various types of agricultural sensors in vogue. Sensors are available for the measurement of soil temperature, soil moisture, pH, air temperature and humidity sensor, illumination, optical, mechanical sensors, air flow sensors, plant canopy analyzer, microorganisms and pests' sensors, etc. These make use of some electronic, mechanical or electrical properties to detect, record and transfer data. Radar, lidar etc. are some technologies that are used in remote sensing.

Precision farming is an application of IoT technologies. Precision agriculture is a data-driven approach to farming that uses sensors, satellite imagery, GPS, drones, real time data collection and analysis, data analytics and cloud computing, and other technologies to optimize the use of inputs, schedule farm operations, and improve productivity. The fundamental elements of precision agriculture include:

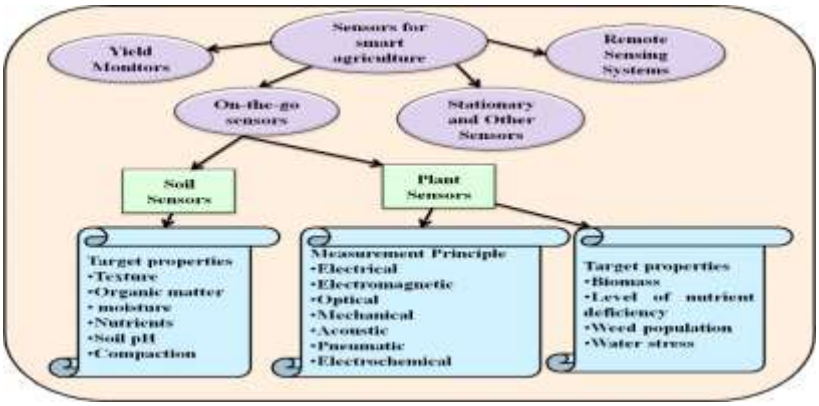

Fig.1.Different types of sensors in agriculture (Source: Krishnan and Kundu, 2022)

- **Data Collection:** Gathering information from diverse sources like satellite imagery, soil sensors, and weather stations to comprehend variations within a field.
- **Data Analysis**: Examining collected data to make informed decisions about crop management, resource allocation, and other agricultural practices.
- **Variable Rate Technology (VRT):** Modifying the application of inputs (e.g., water, fertilizers, pesticides) based on the specific needs of different areas within a field, as opposed to uniform application.
- **GPS Guidance:** Utilizing GPS technology to accurately guide tractors and other farming equipment, enabling precise and controlled operations in the field.
- **Automation:** Introducing automated systems and robotics for tasks such as planting, harvesting, and irrigation.
- **Farm Management Software:** Employing software applications to monitor and manage various aspects of farm operations, including crop planning, inventory management, and financial analysis.

Agribusinesses can provide farmers with precision agriculture technologies and services, such as soil testing, crop monitoring, and variable rate application of fertilizers and pesticides, develop and provide IoT-based solutions to farmers, such as smart irrigation systems, crop monitoring systems, and livestock tracking systems.

Agtech and Farm Management Software

Agtech (agricultural technology) and farm management software have become integral components of modern agriculture, transforming traditional farming practices. These technologies leverage data analytics, sensors, and automation to optimize various aspects of farm operations. Farmers can monitor crop conditions, soil health, and weather patterns in real-time, enabling data-driven decision-making. Agtech solutions enhance precision farming techniques, leading to efficient resource utilization, reduced

environmental impact, and increased crop yields. Additionally, farm management software assists farmers in planning, monitoring, and analyzing their operations, contributing to improved productivity and sustainability in the agriculture sector. Increased use of agricultural technology (agtech), including farm management software and mobile apps, is to be promoted for crop monitoring, inventory management, decision support, and streamlining farm operations.

Vertical Farming and Controlled Environment Agriculture

There is a growing interest in vertical farming and controlled environment agriculture, utilizing indoor spaces, hydroponics, and aeroponics to efficiently produce crops in urban environments while conserving resources. As land available for growing crops is decreasing due to various factors such as soil degradation, changing land use patterns, urbanization, etc., there is an essential need to look for other methods of growing more crops. Vertical farming is growing more crops in the vertical plane, utilizing less land area. This is ideal for large scale production in urban areas where land is scarce and the need for food is greater. Safe food can be grown using minimum resources in a sustainable manner to meet human and animal demand. Resources such as water and agro wastes can also be recycled and used in such a production system. Abandoned and unused urban spaces can be made use of to grow food year-round. Innovative system designs create requirements for specialized machinery that can work in vertical farms, specialized control systems to control and monitor the environment and crop growth, and offer immense entrepreneurial scope in this sector of food production.

Bio and nano technology

Algae are unicellular microorganisms, capable of photosynthesis. They are considered as a potential oleo-feedstock, as they produce lipids through photosynthesis using only carbon, water, sunlight, phosphates, nitrates, and other elements. Hence, they are potential feed stock for synthesis of biofuels. Rich in minerals, proteins and vitamins, algae are used in the human diet in certain parts of the world and can be popularized as a low-cost source of nutritious food. Commercial cultivation of seaweeds such as kelp is being undertaken as an agri-enterprise, making use of seas and oceans for growing food. Algae can be farmed in aquaculture ponds with minimal investment and can provide excellent feed to the fish, thereby reducing the cost of operation. Many algae can be used for waste water treatment as they grow well in such environment, while producing nutrient rich biomatter, which can be used to produce

fish and animal feed, biofertilizers and soil stabilizers. Cultivation of algae with specific medicinal value is also an entrepreneurial area attracting investment.

Nanotechnology and biotechnology are cutting edge areas where fast-growing technology has many novel solutions to current agrarian problems. Advances in genetic editing technologies like CRISPR-Cas9 can be used for crop improvement, disease resistance, and the development of crops with desirable attributes such as high yield, better resistance to disease, pests, salt, high temperature and so on. Nanotechnology is garnering large interest and work is ongoing for the development of novel nanomaterials, nanocomposites and nanostructures for improving the biosensing characteristics. Nano sensors for soil, nano food sensors to detect adulteration on-the-go, antibiotic detection kits using nano sensors, detection of microbial contamination, etc., are just a few of the many possible applications of nano sensors.

Sustainable Agriculture Practices

Sustainable agriculture practices aim to promote environmental health, economic viability, and social well-being. Key strategies include crop rotation to enhance soil fertility and reduce pests, cover cropping during fallow periods to prevent erosion and fix nitrogen, and agroforestry to integrate trees and shrubs for biodiversity and additional income streams. Conservation tillage minimizes soil disturbance, preserving structure and water retention. Integrated Pest Management (IPM) combines biological and cultural controls to manage pests responsibly. Water conservation through efficient irrigation, organic farming principles excluding synthetic inputs, and diversified polyculture systems contribute to holistic and sustainable agricultural practices, fostering resilience and reducing the ecological footprint of farming.

Blockchain in Agriculture

Implementation of blockchain technology is ideal for supply chain transparency, traceability, and ensuring the authenticity of agricultural products from farm to table. Blockchain technology in agriculture has gained momentum, offering innovative solutions to various challenges in the industry. Recent trends and opportunities include:

- **Supply chain transparency:** Blockchain provides a decentralized and transparent ledger, enabling farmers and consumers to trace the entire supply chain, from farm to table, ensuring food safety and authenticity.

- **Smart contracts:** Automation through smart contracts facilitates transparent and efficient transactions, streamlining processes like payments, agreements, and deliveries, reducing the risk of fraud and delays.
- **Traceability and quality assurance:** Blockchain helps track the origin and quality of agricultural products, enhancing trust among consumers and supporting certifications for organic or fair-trade practices.
- **Data security and privacy:** The decentralized nature of blockchain ensures data security, safeguarding sensitive information related to crop yields, financial transactions, and personal details of farmers.
- **Access to finance:** Blockchain facilitates secure and transparent financial transactions, making it easier for farmers, particularly in developing regions, to access loans, credit, and insurance based on their verifiable data.
- **Tokenization of Assets:** Agricultural assets like land or livestock can be tokenized on the blockchain, allowing for fractional ownership and improved liquidity in the market.
- **Decentralized marketplaces:** Blockchain enables the creation of decentralized marketplaces, connecting farmers directly with consumers or retailers, reducing the need for intermediaries and ensuring fair pricing.
- **Climate-smart agriculture:** Blockchain can support carbon credit trading and incentives for sustainable farming practices, promoting climate-smart agriculture and environmental conservation.
- **Real-time monitoring:** Integration with Internet of Things (IoT) devices allows real-time monitoring of farm conditions, crop health, and equipment status, enhancing efficiency and decision-making.
- **Global trade facilitation:** Blockchain streamlines cross-border transactions and reduces paperwork in international trade, fostering smoother agricultural exports and imports while minimizing fraud and delays.

These trends showcase the diverse applications of blockchain in agriculture, offering opportunities to revolutionize traditional practices, improve efficiency, and create a more transparent and sustainable agricultural ecosystem.

Robotics and Automation

Increased use of robotics and automation is being found in agriculture for tasks such as planting, harvesting, weeding, and monitoring, reducing labour dependency and improving efficiency. AI-driven robots can now assess real-time sensor data and conduct cultural operations such as weeding, pest control, harvesting, etc., using

computer vision, image analysis, ML, etc. Predictive analytics is being used to forecast yield, occurrence of weather phenomenon, pests and diseases, right time of harvest etc. This encompasses the use of data science, machine learning, and other AI techniques to arrive at a conclusion. AI has a significant role in post-harvest operations in quickly and precisely sorting fruits, vegetables, flowers, etc. to ensure product quality and price. AI, drones, cameras, computer vision and ML can be used in herd management in livestock production, enabling remote monitoring of the health of cattle, food intake and other physical attributes of healthy livestock. Agricultural robots (agrobots) are being used to automate a variety of repetitive, precise and labour-intensive tasks on farms, such as weeding, harvesting, and milking livestock, thereby permitting better time and labour management and reducing drudgery, and hence cost. Agribusinesses can develop and sell agricultural robots to farmers or provide robotic services to farmers on a contractual basis.

IOT, AI and ML in Agriculture

Integration of artificial intelligence (AI), internet of things (IOT) and machine learning (ML) algorithms for predictive modelling, disease detection, and optimization of agricultural processes is a possibility with the increased data collection and connectivity available now. The advent of big data analytics, cloud computing, real time data transfer through sensors, computer vision and AI have revolutionized the agricultural sector.

In this era of digital transformation, we can observe the influx of the Internet of Things (IoT) into the agricultural domain. It is estimated that by 2050, an average farm will generate 4.1 million data points per day. The increased number of IoT connected devices brings great opportunities for innovative interventions in agriculture. The use of cognitive technologies that help to learn, understand, reason, interact and increase efficiency can be made towards this end. The IoT is being used to develop a wide range of innovative solutions for the agricultural sector.

Agricultural drones are devices that find increasing application in faster and precise agriculture. AI integrated drones can be used for intelligent plant protection applications, by using computer vision and machine learning for the identification of pests and diseases. Yield mapping, which employs ML to analyze large datasets, along with soil sensor data and ML, can help farmers predict the yield from their crops. The accuracy of such systems is increasing rapidly, making them more farmer friendly.

Maturity of fruit crops can be detected using computer vision on drones to determine the time of harvest (Lavanya *et al.,* 2020).

3D Food Printing

The 3D printing or additive printing technology being used in the manufacturing sector can be applied to the food industry to produce niche and targeted foods. 3D printers with hydrocolloids could be used to substitute traditional food bases with renewable, nutritious substances such as algae, duckweed, grass, etc. 3D printing allows for the customization of food, personalized nutrition, printing plant and animal-based meat, making nutritious food pellets for people with special medical needs, and bringing unconventional but highly nutritious foods (insects, for example) to the table.

These are just a few of India's many agribusiness opportunities in farm mechanization. As the sector continues to grow and evolve, new opportunities will emerge. Agribusinesses that can identify and capitalize on these opportunities can play a vital role in the transformation of the Indian agricultural sector. Entrepreneurs in the agribusiness sector can tap into these opportunities by providing innovative, efficient, and sustainable solutions to farmers, thereby contributing to the modernization and improvement of agricultural practices.

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Agribusiness opportunities in agricultural waste management

Girija D.

Author contact:devakigirija@gmail.com

Agricultural waste includes crop residues (leaf litter, seed pods, stalks, stems, straws, husks, weeds), livestock wastes (urine, dung, wash water, residual milk, waste feed), poultry waste (spilled feed, feathers, droppings, bedding material), slaughterhouse waste (blood, hair, hides, flesh, bones etc.), waste from food processing industries like bagasse, molasses, peels (orange, potato, cassava), pulps (orange, apple, mango, guava, pomegranate, pineapple, papaya and tomato), oil-seed cakes (palm kernel cake, groundnut, soybean, mustard, coconut and aquaculture wastes (uneaten feed, faecal waste) (Bhupendra Koul *et al*.,2022; Duque-Acevedo *et al.,* 2020).

Generation of agricultural waste-Indian scenario

India produces approximately 350–990 Mt/year, which constitutes a major portion of the total solid waste. The Country is the world's second-largest producer of agricultural waste. Every year about 130 million tonnes of paddy straw is produced, out of which 50 per cent is used as fodder and the other 50 per cent is discarded (Singh and Sidhu, 2014). The practice of burning rice stubbles after harvest in the northwestern region creates substantial air pollution and raises public health concerns (Shyamsundar *et al.,* 2019). Improper disposal of crop residue leads to a variety of problems like the generation of greenhouse gases (GHGs) including carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). This poses a threat to human beings, animals and the environment (Kaab et al., 2019).

Problem of agricultural waste accumulation

Agricultural waste, if left in the field as such, will decompose only slowly. In many parts of the country, agricultural waste is disposed of by burning or used for landfill. Burning of agricultural waste including stubbles and weeds leads to environmental pollution. Open burning is responsible for about one third of all black carbon emissions. Black carbon is a short-lived climate pollutant that contributes to air pollution and climate change. It also leads to air pollution-related illnesses. Moreover, it leads to the destruction of soil organic matter and microbes, which maintain the soil

health. Agricultural residues contain all the minerals required for plant growth and hence recycling of these nutrients from the organic form to the inorganic form will return the nutrients removed from soil by the plant. Therefore, appropriate agricultural waste management technologies must be adopted in order to protect the environment and ensure sustainable agriculture.

Composting

Among the different methods for managing organic waste, such as landfilling and incineration, biological decomposition is considered the most effective. Composting is a low-cost method of biological decomposition. This is carried out with the help of microorganisms which decompose the complex organic molecules present in bio-degradable waste. Microbes derive energy, carbon and other nutrients from the waste material. During the process, organic forms of nutrients are converted into the inorganic form, which are taken up by plants, when the decomposed organic material (compost) is used as manure.

Composting is defined as the biological conversion of solid waste of either plant or animal origin, with the help of microorganisms. Though composting can be carried out both under aerobic and anaerobic conditions, aerobic microorganisms are more efficient in decomposing the organic matter. During the process, complex organic materials are broken down by microorganisms like bacteria, fungi and actinobacteria into simpler forms. Minerals present in plant and animal residues are converted to their inorganic forms, which can be taken up by plants. In addition to providing mineral nutrients, the application of compost improves the texture of the soil, enhances water holding capacity and also soil aeration. Many of the microbes present in compost can improve the growth of plants.

Stages of composting

Four different stages can be differentiated in the process of composting. During the first mesophilic phase, bacteria, fungi and actinomycetes break down complex organic compounds, at 15-40^{0}C. Mesophilic microorganisms that degrade C rich organic molecules include *Aspergillus, Penicillium, Nocardia, Lactobacillus, Acetobacter*.

Rapid microbial metabolic activity results in the production of heat, resulting in the second phase: the thermophilic phase. During this phase, temperature increases and reaches 70^{0}C. Now the mesophilic microorganisms are replaced by thermophilic microbes (*B. circulans, B.coagulans, B.licheniformis,* and *B.subtilis*). Degradation

continues and as there is a decrease in the availability of organic molecules, microbial activity slows down. The third phase is called the second mesophilic phase. Temperature is reduced from 65^0C to 50^0C, as there is a decrease in microbial activity. Mesophilic microorganisms take over once again, and continue the decomposition process. At this stage, lignin and cellulose degrading fungi and bacteria are predominant (eg. fungi like *Absidia*, *Mucor*, *Chaetomium* and Actinomycetes - *Nocardia*, *Streptomyces*.

The final stage is the cooling or maturation phase. The quality of compost improves during this phase, as the strong odour disappears, pH becomes near neutral and mineral nutrient content increases.

Methods of composting

We may classify the composting methods into two, depending on whether it is carried out on a large scale or small scale. If done on a small scale, like at the household level, small devices are sufficient. If the quantity of biomass is large, we have to accordingly adopt an appropriate model.

Composting at household level

Pit composting

Composting in large pits has been in practice, since long. This is one of the low cost methods available for composting. Depending on the availability of land and the quantity of agricultural waste available for composting, pits of suitable size may be prepared. Agricultural residues and cow dung are layered in the pit until it is full. The biomass is then left undisturbed for degradation, while the second pit is used for adding waste. By the time the second pit is filled, the manure in the first pit will be ready for use. To avoid rain water getting into the pit, a

Biobin composting

Various types of biobins made of different materials are available in the market. Kerala Agricultural University has launched a biobin under the name ‘KAU Smart Biobin’, made of stainless steel coin mesh. The bin is a two ring structure, the outer ring made of stainless steel and the inner ring, of galvanized iron (GI). The area between the two rings is filled using dry leaves. These help in preventing foul smell, promoting aeration and absorbing leachate, if formed. The bio-solid waste can be added to the bin, followed by the addition of two-three handfuls of coir-pith based inoculum. If fresh cow dung is available, it can be made into a thick slurry and sprinkled above the layer.

Volume goes down, as composting proceeds and within 20-25 days, compost falls into a tray that is fitted just below the ring. This may be collected once in a week and used as organic manure for vegetable/ ornamental plants. Since the bin has many holes throughout, good aeration will be there and therefore, no leachate/ foul smell/ larvae will be present. The temperature inside the biomass rises up to 60^{o}C and therefore, human and animal pathogens will be killed.

KAU Smart Biobin

Thumburmuzhy Model Composting Unit

Pot composting

Earthen or plastic pot/s could be used for composting. It can be a multi-tier system with three pots, or a single pot. Residues along with inoculum (cow dung or microbial inoculum) are added till the pot is almost full. The Period required for conversion of the residue to compost depends on the nature of the residue. If soft material is used as the biomass, the composting process will be completed in almost a month. If the biomass is woody in nature (lignin and cellulose content high), it takes longer duration. In case of three tier system, the topmost pot is first filled, then it is placed at the bottom and the second pot is used for filling the waste. As this becomes full, it is placed at the bottom and the third pot is used for composting. By the time this becomes filled, the contents of the first pot would have become a black coloured powder (compost). Pot composting can be used if the quantity of agricultural waste is small. This is a simple method requiring very less space. A tray may be placed at the base of the pot, to collect any leachate that comes out through the hole can be collected.

Composting using black soldier fly

Black soldier fly (BSF) is a non-pest insect found globally. Adult flies are harmless and mimic the appearance of wasps. Larvae or maggots are the immature legless stage of the fly and they are the decomposers. They feed on waste and each of

them can eat around 200 g of waste per day. Meat and decayed waste are their favourite food. BSF is being used to compost organic waste, creating nutrient rich manure. The life cycle of BSF is completed within 38 days. There should be a bin to contain the organic waste and a card board may be suspended in the compost bin, for egg laying by the flies. Adult flies are attracted by the smell of organic waste and the presence of other BSF. Compost can be harvested from the bin within 21 days. Larvae can be used to feed animals including chicken and fish, as it is a good protein supplement. Besides protein, it also contains the mineral calcium.

Vermicomposting

Vermicomposting is the process of converting biodegradable waste, using earthworms as biological agents, into nutrient rich vermicompost. This compost is an excellent form of natural manure, which is a cost-effective, simple and effective method for waste management. Vermicompost is actually the faecal castings of earthworms, rich in all major and minor nutrients in plant-available forms. In addition, it contains enzymes, vitamins and plant growth hormones. *Eudrillus eugineae* is identified as the best species for vermicomposting under Kerala conditions.

Pits of size 2.5 m length, 1 m breadth and 0.3 m depth are prepared in a shed, with sides left open. At the bottom of the pit, a layer of coconut husk is spread, with concave side upwards, to ensure drainage of excess water and proper aeration. The husk is moistened and above this, agricultural residues mixed with cow dung, in the ratio 8:1 is spread to a height of 30 cm above the ground level and water is sprinkled daily. After partial decomposition of waste for 7-10 days, worms are introduced at 500-1000 numbers per pit. The pit is covered with coconut fronds. Moisture is maintained at 40-50 %. When compost is ready, it is removed from the pit along with worms and heaped in shade with ample light. The worms will move to the bottom of the heap. After 1-2 days, the compost from the top of the heap is removed. The undecomposed residues and worms are returned to the pit for further composting.

Worms are delicate organisms and hence sufficient care must be taken to protect them from direct sunlight, ants, predatory birds etc. composting area should be provided with sufficient shade. Waste materials like egg shells, acidic materials including pickles, tamarind, lemon peels may be avoided, as these will harm the worms. Depending on the extent of weathering of leaves used for composting, 70 % of the material will be composted within a period of 60 to 75 days. At this stage, watering may be stopped to facilitate the separation of worms from the compost. Compost can

be collected from the top layers, which can be sieved and dried under shade. Earthworms aggregated at the bottom layers can be collected and used for further vermicomposting.

For household purposes or when the quantity of agricultural waste is small, the large tanks/pits may be replaced with earthen/ plastic pots or wooden boxes.

The leachate from the tanks/pits/pots could be collected through PVC pipes. This brown coloured liquid is called vermi-wash and can be used as a bio-insecticide for vegetable cultivation.

Ring composting

Two or more concrete of fero-cement tanks of circular shape, with 0.75 m diameter and 0.5 m diameter can be used for ring composting. Five Kg of cow dung needs to be added as the first layer, above which waste may be added. Dry leaves can also be used, if available, which will help in reducing the moisture content. The biomass will be decomposed to compost within a period of 60 days.

Thumburmuzhi model aerobic composting

This model of aerobic composting was designed by Dr. Francis Xavier of Kerala Veterinary and Animal Sciences University, Thrissur, Kerala, at the Cattle Breeding Farm, Thumburmuzhy, for the composting of dead cattle. Later on, this model has been used for composting of bio-solid waste at the community level (flats, residents' associations, municipalities and corporations).

Two or more units need to be installed so that when one becomes full, the other one can be used. The unit is a 4x4x4 m^3 ferrocement box, made of four pillars at each corner and removable reepers on four sides. A lowermost layer of 6 inches of fresh cow dung is made and then a similar layer of dry leaves is added. Above this, 6-inch layer of waste material to be decomposed is placed. These layers are repeated until the unit is almost full. The same process is repeated with the second unit. By the time the second unit is filled, the waste in the first unit will be decomposed. It can be sieved, if meant for sale. The undecomposed components are returned to the unit for further decomposition. Generally, three months are required for the decomposition process to be completed.

Suchitha composting

This technology was developed at College of Agriculture, Vellayani, for rapid conversion of degradable waste to value-added organic fertiliser within a day, under the

leadership of Dr. C.R. Sudharamyi Devi, Professor (Patent No. 321857 of Government of India). This technology involves thermo-chemical treatment of biodegradable waste. The segregated waste is pulverized ground to obtain a uniform mass. The ground material is transferred to the processing vessel, where it is subjected to chemical treatment, followed by addition of water absorbing material like coir-pith and charcoal. Then the material is exposed to sun drying or electrical drying and the dried product fortified with a small quantity of essential nutrients. One Kg of organic waste yields about 250-300 g organic manure. Fortified manure can be used as an ideal potting mixture with soil and coir pith in the proportion 1:1:1 on a volume basis.

Organic waste converter (OWC)

OWC is an electrically operated bio-mechanical equipment that can convert organic waste to odour-free mixture in 15 min and to mature compost within a period of 10 days. Organic waste is fed into the container of OWC. If the moisture content is high, the addition of saw dust up to 30 per cent (depending on moisture), along with microbial inoculant (approximately 1 g Kg^{-1} of waste) is carried out. The biomass is mixed, aerated, agitated and crushed for 15-25 min. Material is then collected in a trolley and filled in trays, followed by spraying of water. After 8-10 days of curing, the mixture turns into good quality compost.

Windrow composting

Large volumes of agricultural or any other waste are decomposed by the windrow method. Long beds or piles (called windrows) are prepared along with the inoculum. Suitable for waste generated by communities and collected by local governments, and high-volume food-processing businesses like restaurants and food processing industries. In arid regions, beds may be covered to prevent evaporation of water and in tropical regions with heavy rainfall, roofing may be required to prevent rain water seepage. There may be provisions for the collection and treatment of leachate from the beds. Two types of windrows are common: aerated (turned) windrow and aerated static pile.

In the aerated (turned) windrow, beds of height between four and eight feet and a width of 14 to 16 feet, depending on the availability of land, are made. These beds are large enough to generate sufficient heat and at the same time, small enough to allow oxygen flow to the core of the bed. The biomass is turned over either manually or mechanically with the help of large equipment called compost turner, at regular

intervals, for proper mixing and aeration. Within a period of six months, the biomass turns into good quality compost.

Aerated static pile composting produces compost relatively quickly (within three to six months). Organic waste is arranged in a large pile or bed. Layers of loosely packed bulking agents like wood chips or coir pith are added air passage occurs inside the pile. The entire bed is placed over a network of pipes with holes, that deliver air in and draw air out of the pile. Air blowers are also used to ensure proper aeration. However, no turning over is carried out for static windrows.

Requirement of large area of land, costly equipment, formation of leachate etc are the major limitations of windrow method of composting.

Biogas

Biogas is a renewable energy source produced by the breakdown of organic matter by certain bacteria, under anaerobic conditions. It is a mixture of methane, hydrogen and carbon dioxide. It can be produced from agricultural waste (dry leaves, sugarcane trash, potato tops, grass, waste from food processing industries), cattle dung, night-soil, poultry litter and food waste. Organic matter decomposes only in a wet environment. The organic matter dissolves in water and forms a sludge rich in nutrients, which can be used as a manure.

Biogas plant has five components: an inlet to feed the slurry, fermentation chamber where biogas is produced by the activity of microbes, gas storage tank to store the gas produced; outlet for the used slurry; exit pipe for removing the gas produced.

Biogas is an eco-friendly fuel. The required raw materials for biogas production are available abundantly. It gives biogas, and also provides nutrient rich slurry which can be used for crop production. Availability of biogas reduces the use of firewood, and hence trees could be saved.

Biofuel from agricultural waste

Cellulose, hemicellulose, starch and sugar present in crop residues and food processing waste can be converted into bioethanol, with the help of yeast under anaerobic conditions, through fermentation. The ethanol produced can be used for mixing with petrol, so as to reduce pollution due to emission carbon monoxide and sulphur oxides. It has been also reported that mixing ethanol in petrol also increases the efficiency of the fuel.

Agribusiness opportunities

1. Start up for waste management devices and services

Though several technologies are available, often the user is not aware of appropriate management of the system, which leads to failure of the same. Many a times, the provider of the device does not extend follow up after the initial installation. All devices suited for a house/ flat/ apartment/ office could be introduced and the best one provided to the customer. Follow up for one year also may be given, on payment basis. Any problem like leachate formation, foul smell, presence of maggots etc will have to be addressed.

2. Sale of composting inoculum

Generally, cow dung is used as a natural source of microbes for composting. However, in urban and peri-urban areas where availability of cow dung is not easy, microbial consortia formulations may be used. These formulations are easy to use and help in rapid decomposition of organic matter. If aseptic conditions for microbial culturing are available, inoculum can be prepared and marketed. Liquid formulations for large scale composting units and coir pith based and talc-based formulations for small scale units can be marketed.

3. Collection of waste and composting, sale of compost and value-added products

When land is available, agricultural waste and other bio-solid waste can be collected from houses/ farms and using appropriate technology, this can be recycled into good quality manure. Compost can be marketed as such, or value-added products may be prepared by mixing with biological control agents (*Trichoderma viride, Pseudomonas fluorescens*) or biofertilizers (*Azotobacter*, *Azospirillum*, phosphate solubilizing bacteria etc.). These value-added products will fetch premium price from the market.

4. Making handicrafts from waste

Waste material for one person may be a resource for another person. Many beautiful handicraft items can be prepared out of agricultural waste. Beautiful vases and useful ladles are made from coconut shell; paddy straw can be used for making crafts on black paper or canvas. Similarly, fibres from banana and water hyacinth are also used for making baskets and small craft materials.

5. Slaughter house waste

Slaughter house waste, if not disposed appropriately, will lead to many environment related problems like foul smell, presence of maggots, stray dogs etc. apart

from composting, technologies are now available for converting meat, bone and fish into nutrient pellets for fish and chicks.

Conclusion

Various technologies are available for recycling of agricultural waste, either at household level or on a commercial scale, to manure or energy. Creating awareness about these technologies and environmental hazard of not properly managing these waste materials is the need of the hour. With the help of recent developments in these technologies, the challenges in the field of agricultural waste management may be converted to entrepreneurial opportunities, which will pave the way for not only revenue generation, but help to maintain a pollution free environment for life to continue on this earth, on a sustainable basis.

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7

Agribusiness opportunities in the animal husbandry

Smijisha A. S.

Author contact: smijisha.as@kau.in

Livestock has played an indispensable role in the Indian economy. Animal husbandry is culturally and economically integrated into the society. Livestock is a source of protein, livelihood and draught power. Indigenous stock has higher resistant to diseases and can better adapt to climate change. They act as a buffer to crop failure and sudden monetary losses. Technological backwardness, financial constraints, and inadequate veterinary services are few issues that hinder the progress in the sector (Shanmathy et al.2018). Animal husbandry and dairying activities, along with agriculture, continue to be an integral part of human life since the process of civilization started. Owing to conducive climate and topography, animal husbandry and dairying sectors have played prominent socio-economic role in India. Livestock sector is an important subsector of the agriculture in Indian economy. It forms an important livelihood activity for most of the farmers, supporting agriculture in the form of critical inputs, contributing to the health and nutrition of the household, supplementing incomes, offering employment opportunities, and finally being a dependable "bank on hooves "in times of need. It acts as a supplementary and complementary enterprise. The Gross Value Added (GVA) of livestock sector is about Rs. 11,14,249 crores at current prices during FY 2020-21 which is about 30.87% of Agricultural and Allied Sector GVA and 6.17% of total GVA (Annual Report 2022-23)

Dairy farming

Dairy farming is the oldest and most widely accepted agri allied sector for life thriving. Lots of people are getting job opportunities in this sector. India has vast livestock resources. The livestock sector contributes 4.11% of GDP and 25.6% of the total Agriculture GDP. Besides, it provides our country with food security.

The main points to be considered while starting a dairy farm

- Selection of genetically superior cows
- Modern stable with basic facilities
- Proper scientific feeding schedule
- Good maintenance practices

Once the breed is decided, the availability of cows becomes very important for an entrepreneur. In Kerala, most farmers prefer Holstein Friesian as a breed of choice in dairy farming. So, while considering Holstein Friesian cows, they are mainly purchased in Kerala from the market in Kolar, Karnataka, and crossbred cows are mainly bought from Pollachi, Salem, and Coimbatore regions of Tamil Nadu. It is better to buy 5-10 cows from the farmers' houses in the same locality or region where the farm will be established. Regarding buffaloes, Murra breeds can be bought together from Punjab, Gujarat, and Haryana states.

A farm can be profitable only if more than nine litres of milk are obtained from a cow per day. A long 305-day milking period is obtained from cows, while more than 200 days of milking from buffaloes are more labour intensive. Although the fat content of buffalo milk is high, milk production from buffaloes is low. The first calving should take place within two and a half years of life in a good dairy cow. Do not buy cows that have calved more than three times to the farm. At least eighty percent of the cows on the farm should be in the milking period. Older ones should be avoided every year.

Proper scientific feeding schedule: A non-pregnant dairy cow needs 1.5-2 kg concentrate, 5 kg green grass,s and 5 kg strawberries. Additional concentrate feed should be given to dairy cows at the rate of 2.5 kg for every 1 kg of milk along with fodder. A pregnant cow should be given 1.5-2 kg of concentrate feed and 30 kg of green grass. There should be a provision of an additional 1 kg concentrate feed from the sixth month of pregnancy onwards. Only clean water should be given to cows. Drinking plenty of water at night can help increase milk production. A mixture of vitamins and minerals should be included in the feed. Do not feed mouldy or stale feed to cows.

Good maintenance practices: The stable should be cleaned daily. Lime and bleaching powder can be used to disinfect the soil. The whole milk should be milked out. Any minor cuts and scrapes on the udder should be treated. Seasonal changes in care should be made during postpartum, calving, and weaning periods. It is better to do artificial insemination two months after calving. Proper preventive methods need to be taken to

control diseases like vaccination against infectious diseases like hoof disease and foot-and-mouth disease. Dewormers should be given within the first two weeks after birth.

Marketing: Milk can be sold directly or as value-added products, depending on marketability. Pure milk can be sold as 'Fresh milk.' Excess milk can be converted into curd, curd, and ghee. On an industrial basis, the units can sell ice cream and other dairy products. The dung can be dried and powdered and sold as Vegetable Manure and Garden Manure for vegetable cultivation and horticulture. Kudumbashree units can be linked with marketing.

Model Dairy farm

Jersey Cow

Friesian

Holstein

Goat farming

All the parameters that need to be considered while starting dairy farming are also crucial for a goat farm. However, compared to a dairy farm, a goat farm needs less space. Less labor, too. The ears and nose needed to be clear and without any infection. There should not be any ectoparasites on the skin, and the skin should be shiny and smooth without any rough coat. The anal and vaginal regions must be transparent without any discharges. Faecal material must be in its standard size without any infection. Last and finally, a goat with a good gait needs to be selected. The goat house

needed to be low-cost and long-lasting, according to the weather conditions, providing health to the goats and reducing illness. While considering feeding, the following points to be considered

- Feed needs 3 -3.5% dry matter of live body weight
- Avoid dusty and mouldy feed
- Gradually change the feed
- Feed during excellent hours, morning and evening
- Feed twice daily
- Provide clean water (about 4-5 lit/day for an adult goat)

Jamunapari

Beetal

A model goat farm unit for ten goat

Poultry farming (broiler, laying hen)

It is a highly growing sector in India. The poultry sector in India is valued at about Rs. 80,000 crore (2015-16). Eighty percent of this sector is highly organized. The

remaining twenty percent of the unorganized sector includes backyard poultry supplements income generation and family nutrition to our country's poorest poor.

How to make it profitable?

- Good breed of chickens
- A balanced diet
- Proper care
- Best ideas in marketing

Vaccination schedule for broilers: 1st day-MarekS, 7th day -F1/Lasota/B1, 14th day IBD, 21st day Lasota and 28th day IBD.

Vaccination schedule for layers: 1st day-MarekS ,7th day -F1/Lasota/B1,14th day IBD, 28th day IBD, 30th day-Fowl pox and 60th day-R2B.

Rabbit farming

Selective breeding of rabbits began before the 16th century. They are multipurpose animals. They are used for meat, wool, fur, laboratory purposes, as pets, show, and manure. China contributes most of the world's rabbit population. Rabbits are very susceptible to heat stress. High temperatures and humidity can lower reproduction. So, the housing should find a way to avoid such problems according to the climate. Take the doe (female) to the buck (male) cage for breeding. Put nest boxes twenty-eight days after breeding. Wean at 4 to 8 weeks after kindling. Provide clean adlibitum drinking water all the time. The feed should be clean and without any mold.

Quail rearing

Laying starts at six weeks, which is very early compared to poultry. Peak production reaches by 9-10 weeks. They produce 280-290 eggs per year. Egg lying time is between 3 and 6 pm. The weight of eggs ranges from 6.7 to 13.8g. The salient features of rearing quail are the less space requirement for many eggs at a time and less feed requirement to sustain the birds.

Duck farming

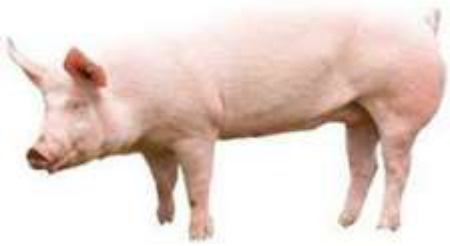
Duck egg size is significantly higher than chicken eggs. Ducks are long, productive, and profitable. Ducks supplement their feed by foraging, reducing the feed cost. Marshy, swampy riversides, wetlands, and barren lands unsuitable for chickens can be used for duck rearing. Duck farming has a symbiotic relationship with paddy cultivation. Ducks can be easily trained for their daily routine, and it reduces the

management labor. Lighting duration of 14-16 hours is necessary for optimum egg production.

Pig farming

- Low capital investment
- More prolific (6-12 piglets in a farrowing)
- Lower feed costs
- More ability to convert leftover food into good edible meat
- Environmentally friendly farming system

Pigs' gestation period is 112-114 days. Average number of kids is six. Each piglet weighs 1-1.5 kg. The optimum time for weaning is 35-45 days. Male pigs attain puberty at ten months (90-100 kg) and females at eight months (90 kg).



Landrace

Large white York shire

A modern farrowing unit

Buffalo farming

In the total export of meat from India, a significant portion is obtained from Buffalo beef, and the rest is obtained from sheep and goats. Deboned frozen meat buffalo is in high demand in the global market.

Salient features

- Low investment
- More profit
- Accommodation at a low cost
- Unused areas can be used
- Management of buffaloes is easier than dairy cows

Lab animal farming

Lab animals are defined as animals used for experimental and diagnosis purposes and may resemble in result with human beings. They can be used well for various biological experiments and biomedical, veterinary, and animal science research. The main lab animals reared are mice, rats, guinea pigs, hamsters, and rabbits.

Integrated farming and farm tourism

The principle involved in such farming are cyclic, rational, and ecological sustainability. As it is cyclic, the management decisions related to one component may affect the others. Rational use of farm resources is a significant route to get over

poverty. For poor farmers, correctly managing crop residues and optimally allocating scarce resources leads to sustainable production.

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8

Innovations in Agribusiness firms: Experiences of Fuselage Innovation Private Limited

Amrutha A P*, Athira A P, Devan Chandrasekkharan

Author contact: apamrutha70@gmail.com*

Agribusiness management encompasses the entire spectrum of activities involved in producing, processing, and distributing food and agricultural products. This includes everything from the supply of seeds and fertilizers to farmers, to the storage and transport of harvested crops, to the marketing and sale of finished products to consumers.In today's rapidly changing and increasingly competitive global market, innovation is crucial for success in the agribusiness industry. Constant advancements in technology, changing consumer preferences, and environmental concerns all necessitate a dynamic and innovative approach to agribusiness management.

The agribusiness landscape is characterized by its intricate web of interconnected processes, from seed selection to final product delivery. Each stage presents unique challenges and opportunities, demanding innovative solutions to ensure efficiency and profitability. In recent years, the concept of the "fuselage" has emerged as a powerful framework for navigating this complex ecosystem. Drawing inspiration from the aircraft's structural core, the fuselage in agribusiness management refers to the central framework that integrates and facilitates seamless communication and collaboration between various stakeholders. This includes farmers, producers, distributors, retailers, and consumers, all working in unison to deliver value across the agri-food chain.

In terms of agricultural drone technology, Fuselage Innovation Private Limited is the industry leader. The company's mission was to transform agriculture into a more effective, efficient, and sustainable industry when it was created. Modern drones that are specifically designed to meet the needs of farmers and agriculture professionals are created by a team of skilled engineers and agricultural specialists working together at the company. They supply a range of agricultural drones, including those for crop mapping, crop spraying, and animal observation. The drones can offer accurate data on crop health, soil moisture, and other important aspects thanks to their state-of-the-art

sensors and algorithms. Farmers can make better agricultural decisions, boost yields, and save waste with the help of drones.

Fuselage Innovations addresses the need to increase the efficiency and sustainability of the farming business by deploying the most advanced solution for mapping and diagnostics of farmland through dedicated UAVs/drones. Fuselage's vision is sustainable agriculture and food security through our digital farmland model to access agronomy knowledge and best farming practices. Fuselage innovation private Limited is a leading company in the field of agricultural drone technology which is situated in Maker Village, Kerala Technology Innovation Zone, Kinfra Hi-Tech Park, Kalamassery, Kochi, Kerala Pin: 683503.This was started in 2020.

Kerala experienced severe problems with the 2017–18 flood. Floods have an impact on soil nutrient condition as well as agricultural yield loss in cash and food crops. They might discover through their interactions with various players in the agricultural ecosystem that farmers are having issues with plant treatment techniques and crop damage. They normally offer foliar treatments to the entire crop acreage to manage a small area of crop damage. Thus, the business considered how the plant treatment strategy based on soil and leaf features would function! They examined new pest species, the agriculture industry's post-natural disaster issues, and the farm's non-scientific procedures before coming up with the solution. Crop stress is linked to both biotic and abiotic factors. They may discover that farmers are dealing with issues like crop damage and plant treatment techniques throughout their interactions with them. They typically offer foliar treatments to the whole crop acreage in order to manage a small area of crop damage. An acute labor shortage already affects the agriculture industry. Natural disasters alter the properties of the soil, hence agriculture 4.0 demands that plant treatments be determined by the features of the plant's leaves.

Managing Director (Devan Chandrasekhar) and Director (Devika Chandrasekhar) of Fuselage Innovations Pvt. Ltd.

Fuselage Innovations provides agriculture drones as well as provides value-added products such as FITS tracker to counter illegal transfer of agro machinery,

firefighting solutions, and precision farming protocols to ensure profitable farming. Fuselage Innovations proposes an integrated operation of Nireeksh drone to the FIA drone, to tackle the specific problems in the ecosystem. The process makes a 20-40% additional yield increase and reduction of agriculture inputs by up to 70%. The solutions were validated by UNDP and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Uniqueness is the proposed process of the act on data, at which target application of the plant treatments based on data from leaf analysis. Inspect the data gathered from sensors like NIR, IR, RED, RED EDGE, RGB. instead of satellite images, and based on the report an opinion from experts of the agronomy team is sought out, corroborating the report and opinion of experts, the prescription is given. Better prediction and early detection will help to farmers to predetermine the farming activities before harvest.

The prescription of controlled application through dedicated nozzles, so that plant can consume in accordance to the need. Generally, it has been found that no such scientific reasoning is given to the prescriptions of other players in the market, which allows Fuselage to edge ahead. Fuselage drones ensure data security and offering the product with GIS handling capability as well as the data accuracy from Nireeksh AG less than 10 cm. Indigenous Integrated NavIC system alerts multiple messages related weather parameters. The controlled application through dedicated nozzles, so that plant can consume in accordance to the need.

The future of agribusiness is undeniably intertwined with technological advancements, and fuselage innovation represents a pivotal leap forward. By enabling efficient and precise aerial application of pesticides, fertilizers, and other agricultural inputs, fuselages are revolutionizing agricultural practices. This not only enhances crop yields and resource utilization but also promotes environmental sustainability by minimizing waste and potential ecological damage. As fuselage technology continues to evolve and become more accessible, it has the potential to transform agribusiness across the globe, paving the way for a more productive, sustainable, and profitable future for the industry.

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Export opportunities in agribusiness sector-initiatives of APEDA

Mridula N.* and Ashwni Vashisht

Author contact: mridula.n@kau.in*

The Agriculture and Processed Food Products Export Development Authority Act, which was approved by Parliament in December 1985, gave rise to the government's creation of the Agricultural and Processed Food Products Export Development Authority (APEDA). On February 13, 1986, the Act became operative. The Processed Food Export Promotion Council (PFEPC) was superseded by APEDA, which is headquartered in New Delhi. The APEDA has established 13 virtual offices in Thiruvananthapuram, Bhubaneshwar, Srinagar, Chandigarh, Imphal, Agartala, Kohima, Chennai, Raipur, Ahmedabad, Bhopal, Lucknow, and Panaji in addition to five regional offices in Mumbai, Bengaluru, Hyderabad, Kolkata, and Guwahati. The development and promotion of exports for the fourteen agricultural and processed food product types included in the APEDA Act's Schedule is the responsibility assigned to APEDA. Furthermore, to this it has also been given the duty of overseeing the import of sugar.

Functions of APEDA

- Registration of individuals as scheduled product exporters upon payment of any applicable fees
- Development of industries related to the scheduled products for export through financial assistance or other means for conducting surveys and feasibility studies, participation in inquiry capital through joint ventures, and other reliefs and subsidy schemes
- Improving the packaging of the Scheduled products
- Improving the marketing of the Scheduled products outside of India
- Fixing standards and specifications for the scheduled products with the intent-ion of exporting

- Inspecting meat and meat products in slaughterhouses, processing facilities, storage fa cilities, vehicles, and other locations where such products are kept or handled in order to ensure the quality of such products

Major initiatives of APEDA in agribusiness sector and its impact

- On May 2, 2001, the National Programme for Organic Production (NPOP) was approved by the government, and APEDA was assigned as the program's secretariat.
- APEDA took a number of steps in the area of quality development, including the preparation of standards, procedures for identified potential products, development of residue monitoring protocol, recognition of laboratories, and implementation of traceability systems, etc., in light of the significance of food safety and traceability required by the importing countries of developed economies
- APEDA pioneered its first traceability system for export of grapes to EU countries in the year 2005-06. GrapeNet, the first traceability system in the horticulture industry, was created by first making the system paper-based and then enabling IT. Following the grape industry's successful implementation of traceability, similar efforts were made for other products
- The APEDA website is providing online facilities for the issuance of Registration-cum-Membership Certificate (RCMC), Registration-cum-Allocation Certificate (RCAC) and submission of financial assistance schemes applications.
- As part of its initiative to boost agricultural exports, APEDA offers financial support to registered exporters through the "Agriculture Export Promotion Scheme of APEDA" plan scheme, which has four sub-components: market development, infrastructure development, quality development, and transport assistance
- APEDA has implemented initiatives like paperless offices (re-engineering, digital signatures, electronic payment facility), APEDA mobile app, phase-wise delivery of online services, monitoring and evaluation, uniform access, and virtual trade fair to make governance more efficient and effective
- APEDA has embarked on IT initiatives like these with the goal of taking export of agricultural products to a new level.
- APEDA has been concentrating on promoting the export of agricultural products from indigenous and ethnic groups as well as Geographically Indications (GI) that are tagged and sourced locally. Trial shipments have been made easier as a result of the identification of new goods and export markets. There are currently 417 registered GI

products, and approximately 150 of those with GI tags are food and agricultural GI goods

- Some of the ethnic and GI-tagged goods that India exports are dragon fruit, patented village rice, jackfruit, jamun, Burmese grapes, dehydrated mahua flowers, and puffed rice. These exports are made in 2020–21 and during the current fiscal year. Mango varieties labelled as GI, such as Shahi litchi, Bhalia wheat, Madurai malli, Mihidana, Sitabhog, Dahanu Gholvad Sapota, Vazhakulam pineapple, Jalgaon banana, and Marayoor jaggery.
- The state-specific action plans for 21 states and two UTs (Ladakh and the Andaman & Nicobar Islands) have already been finalized, meaning that the revised Agricultural Export Policy is almost ready for implementation. To take advantage of the opportunities presented by the COVID-19 pandemic, country-specific agri-export strategy reports have been prepared for 60 countries in collaboration with the Indian embassies.
- In order to support farmers' exports, APEDA is collaborating with state governments to guarantee traceability and market connections. It is pushing for the formalization of tenancy for farmers and the digitization of land records, both of which contribute to an increase in exports
- A Market Intelligence Cell has been constituted in APEDA and the activity of dissemination of E-market intelligence reports comprising detailed market analysis has commenced
- APEDA has also established a Farmer Connect Portal on its website to give cooperatives and Farmer Producers Organizations (FPOs) or Farmer Producer Companies (FPCs) a platform to communicate with exporters. To date, 3,315 exporters and 3,295 FPOs/FPCs have registered on the portal
- APEDA has included a block chain solution into its GrapeNet traceability platform to encourage the usage of hybrid technology. APEDA Trust Chain, a block chain tool, assists in tracking every aspect of the export consignment, including the vineyards' locations
- APEDA's development of the Varanasi Agri-Export Hub in record time has been a huge step towards turning landlocked Purvanchal into a new destination for agri-export activity. Agri-export activity is booming in the Varanasi region, although it was formerly minimal due to a lack of basic infrastructure. About 20,000 tonnes of

agricultural products have been shipped from the Purvanchal region in the previous six months, demonstrating the remarkable changes the Varanasi region has witnessed in the export scenario and the many first-of-its-kind accomplishments it has achieved in a short period of time.

Role played by APEDA to boost Agri-Export:

- APEDA is now a key component of the government's success in encouraging agricultural product exports. Cereals and fresh horticultural products make up 59% of APEDA's share of agricultural product exports, followed by cereal preparations and other processed goods at 23% and animal products at 18%.
- APEDA has supported IT-enabled initiatives for ease of doing business in the promotion and development of exports from India in order to enhance agricultural exports. To improve the effectiveness and efficiency of governance, it has implemented projects including the paperless office (re-engineering, digital signatures, and electronic payment facility), the APEDA mobile app, phased delivery of online services, monitoring and evaluation, uniform access, and virtual trade fair
- In response to the Prime Minister's appeal for "vocal for local" and "Atmanirbhar Bharat," the authority has been concentrating on promoting exports of Geographical Indication (GI) products sourced locally in addition to indigenous, ethnic agricultural products
- Trial shipments have been made easier in accordance with the new items and export locations that APEDA has identified. Almost 100 registered GI tagged agricultural products—such as cereals, fresh fruits and vegetables, processed goods, etc.—fall under the APEDA scheduled product category out of the 150 GI tagged agricultural products to date
- Country-specific agri-export plan papers have been created for 60 nations to exploit the potential of exports and give them an additional boost. APEDA has established a Market Intelligence Cell, and it has started releasing E-market intelligence reports with in-depth market analysis.
- To facilitate communication between cooperatives and exporters, APEDA has established a farmer connect portal on its website for farmer producers organizations (FPOs) and farmer producer companies (FPCs). Thus far, 3,315 exporters and 3,295 FPO/FPCs have registered on the portal.

- APEDA's GrapeNet traceability platform, a web-based software system for certification and traceability that tracks the export of fresh grapes to the European Union, now includes a Block chain solution. APEDA Trust Chain, a block chain-based service, assists in tracking every aspect of the export shipment, including the vineyards' exact locations.
- APEDA has been managing product safety and international marketing for all of its product categories over the course of time, putting more than 800 tariff lines at risk. APEDA has been informing its trade exporters about export requirements as a result of the growing agricultural knowledge of environmental and food safety issues in the importing nations, as well as the on-going changes in consumer tastes and food norms
- APEDA has taken a number of initiatives in the area of quality development, including the preparation of standards, procedures for identified potential products, development of residue monitoring protocol, recognition of laboratories, and implementation of traceability systems, in light of the significance of food safety and traceability required by the importing countries of developed economies
- In 2005–2006, APEDA created the first traceability system for grape exports to EU nations. It is now available for organic products (Tracenet), meat products (Meat.net), and peanuts (Peanut.net). More product traceability solutions are being developed
- A number of events were arranged by APEDA, including a virtual buyer-seller meet, a virtual trade fair platform displaying the power of Indian agri-exports, collaboration with ministries, and the convergence of other programs conducted by involved organizations and line ministries.

The path ahead

APEDA has been implementing the Agri Export Policy (AEP) with a targeted manner. APEDA has been holding a number of meetings and implementing the agricultural export policy through a number of initiatives. Agriculture Export Policy, 2018 aims to double agricultural exports from their current level of $39 billion (April–December 2022) to over $100 billion in the ensuing years, under a stable trade policy framework and to increase high-value and value-added agricultural exports, with particular emphasis on perishables, and to diversify the export basket and destination list. The policy also encourages the export of innovative, native, organic, ethnic, traditional and non-traditional agricultural products, offers an institutional framework for seeking market entry, and removes obstacles, and handles hygienic and phytosanitary problems. Agriculture Export Policy also works to integrate as swiftly as

possible with the global value chain in an effort to quadruple India's share of global agricultural exports, making it possible for farmers to profit from export prospects in foreign markets.

With its comprehensive approach, the Policy seeks to tackle a host of issues that might catapult India into the forefront of agricultural exports. It has long been acknowledged that one of the most reliable ways to implement the finest agricultural practices while also achieving cost competitiveness and productivity increases is through integration into the global value chain. Raising the farmer's income to twice its current level will inevitably mean both greater financial security and improvements throughout the food value chain. India has been able to establish itself as a reliable and high-quality provider of agricultural products by virtue of APEDA's creative approach and strong and persistent efforts.

10

Agribusiness plan formulation and execution

Hema M.* and Anoop R.L.

Author contact: hema.m@kau.in*

As a fast-growing economy, India leaps forward, attaining a top place among the developed economies—the aim of our nation is to become an economy playing a decisive role in global trade. Our country is heading towards that dream with the strong support of our young generation, as India is home to around 20 per cent of the global youth. The public or private sectors in the country provide sufficient employment; hence, a nation can prosper only when more people become job providers than job seekers. With this vision, the honourable Prime Minister launched 'Atmanirbhar Bharat Abhiyan' in 2020 during the Covid-19 lockdown period. The campaign envisaged self-reliant India became materialised when more youth turned to entrepreneurs. As an agrarian economy, more agripreneurs are required to bring the nation to farm sector prosperity.

Right business opportunity identification

The critical factor in becoming an agripreneur is to select the right business opportunity. The agribusiness ranges from horticulture, animal husbandry, aquaculture, vegetable farming, floriculture, mushroom cultivation, fertiliser and bio inputs distribution, and numerous agri and allied sectors. The right business opportunity can be selected by identifying business and personnel goals, own interests, promising industry segments and market opportunities. The best way is to identify feasible solutions where the problems exist. It can be done by living with/listening to people, understanding the existing solutions, studying the competitors, listening to the successful entrepreneurs and so on.

The entrepreneurs can select their product/service based on their experience in the sector, reviewing the governments' promotional schemes, availability of raw materials and other infrastructural facilities. Once identified, the idea's next step is to evaluate its viability. It can be through checking whether the idea creates significant value/use to the customers/consumers, solves a critical or unmet problem, has strong market potential and is fit to develop an organisation team. Identifying the right business opportunity is the critical factor behind the success of any business venture.

What is an agribusiness plan?

A business plan is a document covering every minute aspect of agribusiness. It helps the entrepreneur organise his or her venture activity-wise and can be used to secure funds from investors or lending agencies. It explains the business opportunity, vision and mission, description of the product/service, pricing strategies, distribution networks, marketing and operations plans, financial analysis, team details and similar ones. It acts as a blueprint which helps the entrepreneurs monitor their idea from inception to launch and further as a tracker to realise the deviations or lacunae from the original plan. Hence, it is a management tool comprising details of planning and direction of running a venture.

Why is it prepared?

A business venture needs a plan to keep track of growth and development. Any relevant business plan starts by framing the goals and detailed action plan to achieve these goals by the entrepreneurs. The detailed plan is prepared to raise sufficient funds from investors or lending agencies. Hence, it should be systematically prepared, covering every minute detail of the business idea. The business plan should be clear, brief, and easily comprehended, highlighting any business opportunities' uniqueness. Such a solid plan arouse the interest of the investors or lending agencies, which help to attract sufficient fund to the business. However, there are other purposes besides raising funds in developing a good business plan. Preparing the business plan will provide enough opportunities for the entire team to think and relook at the key elements of the venture. Checking the initial draft prepared will pinpoint missed points like opportunities ignored, unnoticed weaknesses and unrealistic forecasts. Such scrutiny will increase the chance of attracting funds and possible future failure. The plan will specify the financial allocation for human resources, equipment/machinery and sales and marketing. Hence, a business plan is a feasibility checkpoint, understanding every aspect of the proposed business plan.

The thumb rule of preparing a business plan is to give readers the requisite information to make the right decision. Hence, apart from being a powerful tool for raising funds, a business plan acts as a ready reckoner document for regularly reviewing the course of actions and making corrective steps when required. Farmers or agripreneurs can use a business plan as an operational tool to check the business cycle's key elements. It helps them to plan their finances by keeping an eye on return on

investment, interest rate, break-even point, etc. A complete business plan will mention a specific action plan for addressing risk and contingencies.

Style of writing a business plan

Write the business plan in a style that follows the rule of good writing. Use simple words and sentences, avoid jargon or complicated terminologies, and use pictures and graphics wherever needed; however, be cautious about the colour combination. Instead of numerical data, charts are easy to understand and realise the points highlighted. The complex sentences create confusion and difficulty in comprehending, and also avoid lengthy sentences. Give headings and subheads to emphasise the key ideas. It will attract the reader's attention to the critical points in the plan. Heading and subheads help to break large paragraphs into shorter ones. Numbered or bulleted points are easy to follow.

Structure of Business Plan

1) Title page and table of Contents

The content or index allows the reader to understand the location of different aspects of the business plan. The step-wise details of the plan will be presented in the content.

2) Executive Summary

A brief description of the entire business idea is presented in the executive summary. It can be considered a snapshot or the trailer of the entire business idea. It helps the reader capture the entire idea within two or three minutes. A well-documented executive summary arouses the interest and attention of the reader.

3) Industry Analysis

The business plan should have details about the business, opportunities ahead, its size, expected share in the market, and description of various players like customers, investors, lenders, suppliers, distributors and likewise.

4) Enterprise's Description

The complete information regarding the enterprise/ agribusiness unit will be given here. It contains vision, mission, prior experience in the field and tagline, if any. The vision will be the dream or the target the enterprise aims for using its resources, and the mission will be achieved through realising the goal of the enterprise. The purpose of the enterprise should be mentioned in the mission document. The vision and mission should be realistic and achievable. The tagline helps the customers easily

recollect the product once they used it. Remember the famous tagline 'The taste of India'. Hearing the word AMUL comes to everyone's mind. A tagline can make a strong connection with the customer. The resource inventory of the enterprise, like land, labour, machinery, capital and likewise, can be mentioned.

5) **Market Analysis**

The market analysis focuses on the segment of the enterprise. It can be done through geographic, demographic, behavioural or psychographic market segmentation. The competitor of the enterprises will be thoroughly analysed to understand their strategies. Market trends and customer demand can be identified through market analysis.

6) **Marketing plan**

The marketing plan explains the entire marketing strategies of the enterprise. There are 5 P's of marketing: product, place, price, promotion and people. The marketing plan contains details of the product, sale volume and marketing strategies to reach customers (physical or online), product delivery mechanism, pricing to be followed, and promotional approaches planned and designed. There should be a clear description of the customers, expected numbers and channels involved in marketing like distributors, wholesalers and retailers. A mention of the competitors, including strengths and weakness and their reactions when the enterprise product reaches the market, will be given. The product will only reach the potential customer with a proper marketing plan.

7) **Product or Service design**

The product of the enterprise should be mentioned. The specialities or uniqueness of the product/service can be described in this part. Explain how the product or service is going to meet customers' demands. A graphical or pictorial representation of the product will have added advantages in arousing interest.

8) **Operational Plan**

The operation plan explains step-wise step details of the various operations in the business. The details of converting an input to output and other production strategies will be mentioned. However, minute details are optional. This section helps the readers to understand the production details to be followed in the enterprise.

9) Management Team and Company Structure

A detailed description of the core team of the enterprises using their resumes. It helps to understand the mentors or advisors involved in the functioning of the enterprise. This part helps the reader to understand the whole team of the business and their past experiences at a glance. The funding agencies are critical of the team, and the robust team will increase the chances of getting sufficient funds.

10) Time frame

The details of the timeline of major activities like setting up types of machinery, production initiation, the launch of the product in the market, and customers' feedback will be mentioned. The significant milestones can be highlighted. The Gantt chart's graphical representation of the time frame will increase the readability.

11) Financial Projections

The vital part of the business plan is where investors and lenders are specifically looked upon to assess the need and volume of the fund. It can be considered as the backbone of the business plan. The financial plan includes details of capital requirements, including seed, fixed and working capital; projected sales; projected financial statements like balance sheet, income statements and cash flow; break-even analysis profitability timeline; and fund/loan required. The budget outlined under the financial plan will avoid unnecessary spending; otherwise, it will affect the business's liquidity.

12) Appendices

Include additional information like resumes of the team members, a report of the market survey conducted, photographs, etc.

SWOT analysis

After preparing the business plan, a SWOT analysis can be done to identify the proposed business idea's strengths, weaknesses, opportunities and threats. It can be done by examining the strengths of the operations, weaknesses where the operation does not function well, opportunities available and threats or unfavourable conditions of an operation. This analysis helps the entrepreneurs understand the business's potential and take corrective action if required.

Benefits of a solid business plan

- A blueprint document showing the goals and strategies of the enterprise.
- Give direction and focus to various operations in the business.

- A clear depiction of interactions with different players in the business, *viz.* investors, employees, suppliers, distributors and other stakeholders.
- A tool to identify deviations from the envisaged plan and take corrective action.
- The timeline of each activity will be prepared in advance and specified, avoiding
- Delays and saving time and energy for the business team.
- Step-by-step details will help to recognise the risks involved.
- A systematic business plan gives details of competitors and similar products in the market.
- The plan will tell how much can be paid for employees, promotional and other expenses.
- Step-by-step approach in drafting a business plan with an example
- Secure the identified land – proof of ownership or lease agreement.
- Get a farm map or geographical map of the farm that includes farm boundaries and or watering points.
- Identify potential markets, requisite licensing formalities and other details or entrance into the market.
- Identify different resources available for utilisation.
- Take into consideration the ability, experience and access to information before deciding the crop to be cultivated.
- Prepare a financial plan and check its viability.
- If favourable, go forward, and if not, repeat the above steps
- Gather information on the different forms of businesses.
- Decide on what business form will be the best suit.
- If the business form needs to be registered, proceed with the process.

(Source: Dharmasena, 2016)

Conclusion

Always make sure that the target audience can apprehend the business plan. It should convey the idea in a simple and explicit mode. Preparing a business plan will help the team revisit each business element several times. The executive summary should be a thumbnail sketch of the business. Arrange the business plan in a presentable mode with proper headings, subheads, graphics, numbered or bulleted in short paragraphs. A well-prepared business plan acts as a roadmap for the enterprise. Hence, a business plan can be considered a complete guideline for the operation and execution of the business, including budget.

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11

MSME registrations and initiatives for agripreneurs

Mridula N.* and Martin P. Chacko

Author contact: mridula.n@kau.in*

MSME industries are the cornerstone of the economy. They are alternatively known as Small-Scale Industries (SSIs). The Indian government offers Micro, Small, and Medium Enterprises (MSME) registration to industries that fall under this category. The government offers MSMEs an array of incentives for their formation and expansion, and MSME registration facilitates these benefits.

When the government first instituted MSME registration in 2006, the MSME categorization was determined by the amount invested in machinery and equipment. The government added annual investment and annual turnover to the MSME categorization in 2020. Additionally, the MSME definition's difference between the manufacturing and service sectors was eliminated. MSMEs are hence dependent on turnover and investment.

To determine if an entity qualifies as an MSME, use the most recent amended MSME classification, which is as follows: (Table 1)

Revised MSME Classification (Table 1)

Criteria	Micro	Small	Medium
Investment	< Rs.1 crore	< Rs.10 crores	< Rs.50 crores
Annual turnover	<Rs.5 crores	< Rs.50 crores	< Rs.250 crores

Nearly 111 million people are employed by the 633 lakh MSME units that make up the Indian MSME sector. They provide 40% of exports and make up 38% of the GDP. Technology centres serve as Common Facility Centres for Process and Product Development, offer technical consulting assistance, and train the unemployed youth and industry personnel.

Items not covered by the Micro, Small and Medium Enterprise Development Act of 2006's Section 7 when it comes to the manufacture, production, delivery or rendering of goods or services are shown in the table 2 below

NIC Code	Activity
02	Forestry and logging
03	Fishing and aquaculture
45	Wholesale and retail trade and repair of motor vehicle and motorcycles
46	Wholesale trade except of motor vehicles and motor cycles 47
47	Retail Trade Except of Motor vehicles and motor cycles
97	Activities of households as employees for domestic personnel
98	Undifferentiated goods and services producing activities of private households for own use
99	Activities of extraterritorial organization and bodies

The NIC 2-digit activity 01- crop, animal production, hunting and related activities would also not be included as per Section 7 of the Act except for the sub-classes of activities at 5-digit level given in table 3

NIC Code	Activity
01462	Production of eggs
01463	Operation of poultry hatcheries
01492	Bee-keeping and production of honey and beeswax
01493	Raising of silk worms, production of silk worm cocoons
01612	Operation of agricultural irrigation department
01620	Support activities for animal production
01631	Preparation of crops of primary markets ie; cleaning, trimming, grading disinfecting
01632	Cotton ginning, cleaning and bailing
01633	Preparation of tobacco leaves
01639	Other post-harvest crop activities nec
01640	Seed processing for propagation

Regarding status update, an enterprise must continue to benefit from all non-tax advantages of the category it was in prior to the reclassification for a period of three years following the date of the upward change if there is an increase in investment in plant and machinery, equipment, turnover, or both, and the reclassification follows.

Trade Receivable Discounting System (TReDS)

MSMEs have to adopt the TReDS platform. A platform known as TReDS, is used to finance and discount trade receivables. It allows (Electronic Bill Factoring Exchange), MSME bills to be electronically accepted and auctioned off against larger corporations, ensuring that MSMEs receive quick payment. CHAMPIONS Portal is the grievance redressal method.

Introducing the various schemes under MSME

Procurement and Marketing Support (PMS) Scheme: This program encourages the development of new market access activities, such as planning or attending national

and international trade shows, exhibits, MSME expos, etc. They spread knowledge and awareness about MSMEs.

Export Promotion Schemes

The goal of international cooperation schemes is to enable MSMEs to access export markets facilitate participation at foreign conferences and trade shows and reimburse for different export-related expenses. It includes (i) Market Development Assistance (MDA), which assists MSMEs in organizing and participating in international exhibitions, buyer-seller meetings, conferences, and other events both inside and outside of India, and (ii) Capacity Building of First-Time MSME Exporters (CBFTE), which makes it easier for MSMEs to register, pay for export insurance, and test and certify the quality of goods and services they purchase to export products.

Schemes for Adoption of Best Practices

MSME- INNOVATIVE SCHEME (Incubation Component): Promoting and encouraging creative concepts in the concept stage is the goal. Up to Rs. 15 lakh might be allocated for every idea in order to develop and nurture them through Host Institutes that have been approved. MSME-INNOVATIVE SCHEME (IPR Component) : The aim of this initiative is to compensate patents (domestic patents worth Rs. 1 lakh and foreign patents worth Rs. 5 lakh), trademarks (worth Rs. 0.10 lakhs), geographical indications (worth Rs. 2 lakh), and designs (worth Rs. 0.15 lakhs).

MSME Sustainable ZED Certification Scheme

Through this effort, MSMEs can implement zero defect, zero effect solutions to achieve maximum quality with minimal environmental impact. The certification subsidies are 80%, 60%, and 50% for Bronze, Silver, and Gold certification levels, respectively**.**

MSME Competitive Lean Scheme

The goal of the MSME Competitive (LEAN) Scheme is to give Indian MSMEs a road map to being globally competitive by utilizing lean techniques like 5S, Kaizen, Poka Yoke, and others. Through the application of various lean tools that result in resource optimization, improvement of quality, skills, productivity, and profitability along with digital empowerment, a decrease in rejection rates, and industry collaboration, the goal is to increase the competitiveness of MSMEs both domestically and globally.

Credit Schemes

The Prime Minister's Employment Generation Programme (PMEGP) and Collateral Free Loan Schemes are examples of credit schemes. The maximum project/unit cost allowed under PMEGP is ₹50 lakhs in the manufacturing sector and ₹20 lakhs in the business/service sector. The sum that can be applied to the expansion of currently operating successful PMEGP/MUDRA units is ₹25 lakhs for the service/trading sector and ₹1 crore for the manufacturing sector. Collateral-free lending schemes encompass retail trades, the manufacturing and service industries, and all fund-based (working capital, term loans) and non-fund-based (bank guarantees, letter of credit) facilities.

Entrepreneurship Skill Development Scheme

This program encourages the formation of new businesses, builds the capacity of already existing MSME, and fosters an entrepreneurial culture throughout the nation. Professional assistance is offered to SC-ST enterprises by the National SC-ST Hub Scheme.

MSME in agricultural entrepreneurship

In order to address food security, satisfy rising consumer demand, and combat poverty through inclusive and sustainable development, MSME is essential. The following initiatives are in the agriculture sector.

A) The Initiative for the Development of Agricultural Entrepreneurs (IDEA)

The program seeks to advance agribusiness in the Northeast and assist in making it a financially successful endeavour. It also offers other sources of input and services, as well as profitable employment prospects. Agricultural graduates and postgraduates in related fields are eligible to apply. Those with experience and expertise in starting agriculture companies, such as graduates and postgraduates in other professions, may also be given consideration. The suggested units may be corporations, partnerships, or ownership. Promoters or their organizations shouldn't default on any loans from banks, governments, or other agency. The proposed unit for which financial assistance has been sought must be located within one of the eight north-eastern states.

B) Marketing Research and Information Network (MRIN)

Market committees and agricultural marketing boards, as well as the directorate of state government agriculture, may apply. their role includes gathering and sharing market and price information to improve productivity and prepare farmers for emerging

issues; establishing an electronic connection between important agricultural marketing boards and directorates in order to create a national information network AND creating an extensive network of information utilizing information technology (IT) as a means of extension to encourage and raise farmers' awareness of the need to address emerging issues in agricultural marketing.

C) Development of Agricultural Marketing Infrastructure, Grading & Standardization

States that have revised the Agricultural Produce Marketing Regulation (APMC) Act, Direct Marketing, and Contract, as necessary, have put this system into effect to create markets and permit farming in the cooperative and commercial sectors. Credit-linked back-end subsidies are offered for wholesale, rural, or tribal areas, as well as for the selling of agricultural commodities and the modernization and reinforcement of current agricultural markets. State Agricultural Marketing Boards/Market Committees and other state agencies will have the liberty to choose the loan amount and allocate their funds based on their respective requirements

D) Gramin Bhandaran Scheme

SHGs, Companies, NGOs, and Cooperatives can apply. It is an investment subsidy for the construction/renovation of rural warehouses where 25% subsidy is given to farmers, and 15% of the project cost to companies.

E) SFAC (Small Farmers Agribusiness Consortium)

This program organizes training and visits for agribusiness owners, farmers, producer groups, SHGs, and other groups, and offers venture capital support in the form of equity (financial assistance up to Rs. 5 lakhs) to assist in establishing agribusiness projects in close collaboration with banks, to encourage private investment in the launch of agribusiness initiatives, giving farmers a safe market to boost employment and income in rural areas, to make agribusiness projects' backward connections with growers stronger, to support agricultural graduates, producer organizations, and farmers in increasing their involvement in the value chain by using the Project Development Facility and to organize visits and training for agribusiness owners establishing established agribusiness plans.

F) Establishment of Agri-Clinics And Agri-Business Centres

The objective is to create commercially feasible self-employment programs in order to offer farmers extension services in exchange for remuneration. A reputable nodal training institution provides the chosen candidates with two months of agri-

preparation instruction. Additionally, free one-year handholding support is given to trained agriculture graduates to help them establish up their own businesses in the area, secure bank financing, etc.

G) Financial Assistance for Promotion of Youth Activities and Training

It seeks to reduce young migration to cities, promote leadership characteristics, teach rural kids the value of agriculture, and give businesses access to cutting-edge training techniques. The Ministry of Youth Affairs and Sports offers a number of programs to support young people, foster national harmony, and motivate them to combat societal ills. Ages 15 to 35 are eligible to enroll in this program.

H) Promotion and strengthening of agricultural mechanization by training, testing, and demonstration

Specialized training in farm mechanization and agricultural machinery is required for farmers. Agricultural mechanization is strengthened and promoted through testing, training, and demonstration. It offers ten thousand dollars in assistance for emergencies and machinery purchases. Applicants may include farmers, importers, manufacturers, NGOs, and farmers' societies.

I) Post-harvest technology and management

Under the bilateral agreement between ICAR and Self Help Groups (SHG)/Cooperative Societies of Farmers/Non-Governmental Organizations (NGOs) for machinery and emergency expenses per demonstration, the government will provide 40% assistance for the establishment of units using the available post-harvest technologies, scientific storage, packaging technologies, and technologies for by-product management for animal feed and compost developed by ICAR, CSIR, and those identified from within the country and abroad in the production catchments. (Power operated: Rs.3000; Bullock drawn: Rs.1500; Manually operated Rs.1000). For hilly areas cost per demonstration will be about 1.5 times the above cost. Rs.200000 or 40% of cost whichever is less.

A bilateral agreement with ICAR may be entered into by farmers' Self Help Groups (SHGs), Consumer Groups, Farmers' Cooperative Societies, or Non-Governmental Organizations (NGOs) in order to supply units following harvesting with value addition and management utilizing existing technology. The ICAR and CSIR have developed technologies for the management of scientific storage, packaging, and by-products for animal feed and fertilizers that are detected in production captures from both domestic and foreign sources.

J) Capacity Building to enhance the competitiveness of Indian Agriculture and Registration of Organic Production

Support farmers and agriculture-related organizations in developing computerized market information systems tailored to certain commodities. Creation of product-specific / country-specific databases in sanitary / Phyto-sanitary measures, quality standards, and environmental standards affecting trade in agricultural products are also included.

Development of commercial horticulture in an open field: Development of commercial horticulture in open field conditions, including components such as planting material, planting, irrigation, fertigation, precision farming, GAP, etc. Rs. 75 lakhs per project (Rs. 125 lakhs for date palm, olive, and saffron) projects covering an area of more than 2 hectares. Credit linked backend subsidy is 40% of the project cost up to Rs. 3 million per project in the general area and 50% of project cost for NE and hilly and scheduled areas. The scheme is implemented through State Horticulture Mission Societies and other organizations which are assisted

Development of Commercial Horticulture in a protected cover: At Rs. 112 lakhs per project covering an area of more than 2500 sq.m. Nature of assistance– Credit linked backend subsidy @ 50% cost per project limited to Rs. 56 lakhs. The scheme is implemented through State Horticulture Mission Societies and other organizations which are assisted also can apply.

K) Horticulture for Post-Harvest Management Projects

Under this, Rs. 145 lakhs per project with the addition of pre-cooling, grading, etc. Nature of the assistance: Credit linked back-end subsidy at 35% of the cost with a limit of Rs. 72.50 lakhs. Societies and other organizations to which the assistance is provided can apply.

MSME registration

Udyam registration is another name for MSME registration. Applications for MSME registration can be made through the Udyam portal, the government portal, by firms that meet the MSME classification requirements. The Udyam registration portal is where you may access the MSME registration, which is fully online. While obtaining this registration is not required for MSMEs, it is advantageous to do so as it offers numerous advantages in relation to taxation, business setup, credit facilities, loans, and other areas.

MSME Registration Eligibility: Applications for MSME registration are open to all manufacturing, service, wholesale, and retail businesses that meet the updated annual revenue and investment requirements for MSME categorization. Therefore, the yearly turnover and investment of an entity determines its eligibility for MSME registration. All entities classified as Micro, Small and Medium enterprises as per the MSME classification are eligible to apply for MSME registration. An individual cannot apply for MSME registration. A proprietorship, partnership firm, company, trust, Limited Liability Partnerships (LLPs), Self Help Groups (SHGs) or society with an investment below Rs.50 crore and annual turnover below Rs.250 crore are eligible for MSME registration.

Documents Required for MSME Registration: The MSME registration documents are Aadhaar card and PAN card

Fees: There are no MSME registration fees and it does not require proof of documents. PAN and GST-linked details on investment and turnover of enterprises will be taken automatically by the Udyam Registration Portal from the Government databases since the portal is integrated with Income Tax and GSTIN systems. GST registration is not compulsory for enterprises that do not require a GST registration. However, enterprises that mandatorily need to obtain GST registration under the GST law must enter their GSTIN for obtaining the MSME Registration or Udyam Registration.

MSME registration on Udyam registration portal

MSME registration online can be done under the following two categories in the udyamregistration.gov.in portal. For New Entrepreneurs who are not Registered yet as MSME or those with EM-II. For those having registration as UAM and for those already having registration as UAM through Assisted filing. The registration process for both is different. These are shown on the home page of the MSME government portal.

MSME Registration Certificate

MSMEs in India receive an e-certificate from the Ministry of MSME called the Udyam Registration Certificate, which is also referred to as the MSME registration certificate. After the MSME registration procedure is finished, the entrepreneurs obtain the MSME registration certificate. The enterprise data can be obtained by the QR Code on the certificate. A business that has obtained an MSME registration is referred to as Udyam and the permanent identity number that the Ministry of MSME has granted to

it is called the "Udyam/MSME Registration number." This number is made up of 19 digits MSME Registration Status and certificate can be obtained from Udyam registration portal

As soon as the MSME registration form is filled out and filed on the Udyam R egistration Portal, the MSME registration is finalized.A notification regarding the com pletion of the MSME registration will appear on the screen following the form's subm ission.The Udyam Registration Portal allows users to verify their MSME registration. The MSME Registration Certificate is typically sent three to five days after the MSME registration is completed. The entrepreneur receives the MSME Registration Certificate in their mail. Prior to this, only the manufacturing and service sectors were covered by MSME registration. Traders can now apply for MSME registration for their retail or wholesale trade business with the exception of motor vehicles and motorbikes.

MSME Registration Benefits

Due to MSME Registration India, bank loans become affordable as the interest rate is very low, around 1-1.5%, much lower than interest on regular loans. Additionally, it changed the 10-year maximum carryover period for minimal alternative tax (MAT) credits to a maximum of 15 years.

Government e-Marketplace and several other State Government portals that provide easy access to their marketplace and e-tenders are integrated with Udyam Registration Portal, which facilitates MSME registration and makes obtaining government tenders easier. As numerous rebates and concessions are available, registering lowers the cost of obtaining a patent or starting an industry.

If any MSME payments are outstanding, there is a one-time settlement fee. A government program like the Credit Guarantee Scheme, Credit Linked Capital Subsidy Scheme, Public Procurement Policy, Protection against Delay in Payments, etc. can be benefited by MSMEs with the aid of the MSME registration. Banks may lend to MSMEs in the priority sector. MSMEs can participate in e-tenders with the benefit of a government security deposit waiver.

Any number of operations may be added to or described in a single MSME registration, including manufacturing, services, or both. Barcode registration subsidy, exemption scheme from direct taxes, ISO certification fees reimbursement, electricity bills concession and special consideration in international trade fairs are some other advantages of MSME registration.

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Design and implementation of Entrepreneurship Development Programmes

Darsana S.* S. Helen Sreelakshmi S. and Sushrirekha Das

Author conact*: darsana.s@kau.in

Three revolutions changed human lifestyles: the Industrial Revolution, the Information Revolution and the Innovation Revolution. During the Industrial Revolution, people worked hard and stretched their working hours even if management tortured the employees as the job opportunities were minimal and survival with food, clothing, and shelter was the prime motive of people. During the era of the information revolution, people were exposed to opportunities, and their actions bothered an improved standard of living. The era of social media and technology gave people a quality of life rather than a quantity of materials. Quality and innovations in products and services become necessities of life. This could be ensured by promoting entrepreneurship and orienting entrepreneurs.

Entrepreneurship Development Program (EDP)

An Entrepreneurship Development Program (EDP) is designed to strengthen an individual's entrepreneurial motives and acquire skills to play their entrepreneurial role effectively and efficiently. It is a tool of industrialization and a solution to the unemployment problem for any country. According to N. P. Singh, an Entrepreneurship Development Program (EDP) is designed to help individuals strengthen their entrepreneurial motives and acquire the skills and capabilities necessary to play their entrepreneurial role effectively. In the words of Shane and Venkataraman, "An entrepreneurship development program (EDP) is a formal educational program that provides individuals with the knowledge and skills necessary to start and grow a new business venture."

Importance of entrepreneurship development programmes

R. Thurik and S. Wennekers (1999) have decomposed the phenomenon of entrepreneurship into individual, firm and macro levels and discussed the role of entrepreneurship in economic growth. Entrepreneurial competencies encompass psychological endowments at the personal level, business and managerial competencies at the firm level and socio-economic development at the macro level. Any

entrepreneurship development programme has to promote economic growth, sustainable business, and national development goals. The key objectives of EDP are to empower aspiring entrepreneurs, foster innovation and Creativity, and create jobs. It also includes

- Develop and strengthen the entrepreneurial quality, i.e. motivation or need for achievement.
- Analyse environmental set-up relating to small industry and small business
- Selection of the product and preparation of proposal for the product
- Understand the process and procedure involved in setting up a small enterprise.
- Aware of the sources of help and support available for starting a small-scale industry.
- Acquire the necessary managerial skills required to run a small-scale industry.
- Know the pros and cons of becoming an entrepreneur.

Personal development	**Enterprise development**
Concept of entrepreneurship	Identifying and evaluating opportunities
Characteristics of an entrepreneur	Commercializing a concept
Value of entrepreneur	Developing entry strategies
Creativity and innovation skills	Constructing a business plan
Entrepreneurial and ethical self-assessment	Finding capital
Networking negotiating and deal-making	Initiating the business Growing the business Harvesting strategies

Source: Vesper and Gartner (2001)

Advantages and challenges of EDPs

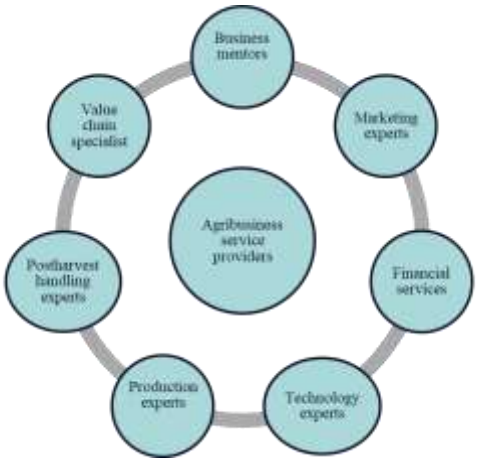
Designing and implementing EDPs requires analyzing the advantages of the programmes. An entrepreneur, being part of an EDP, analyses the benefits of the programmes. Significant advantages of EDP include assessing the market potential for products or services, acquiring the skills in preparing a business plan, conducting the project feasibility, idea and competency in establishing more enterprises, increasing employment opportunities, increasing per-capita income, improving the standard of living, increasing exports and increasing Gross National Product.

Some common criticisms of EDPs include improper methodology, non-standardized course contents, lack of competent faculty, and poor response from

financial institutions. The potential downside of EDPs is that the duration of most EDPs varies between 4 and 6 weeks, which is too short a period to instil basic managerial skills in entrepreneurs. Also, EDPs are not a panacea for all the problems of entrepreneurship development.

Role of extension agents in agri-entrepreneurship

Even though farmers may be innovative and entrepreneurial, they often lack the know-how to engage with markets consistently, and they need the advice and support of extension services to shift from opportunistic sales to regular and consistently profitable sales based on the selection of sales opportunities that support business goals. The prime role of the extensionist lies in this shift of sales options. Entrepreneurship is an interconnected multidisciplinary skill. Farmers have to acquire the skills through Pluralistic extension services. Extensionists play a significant role in the cooperation of private and public initiatives, encouraging service providers to collaborate and work for entrepreneurs. Extensionists need to address the business development service requirements of entrepreneurs. Extension professionals must acquire the competencies to provide technology and product development support, training and technical assistance, input supply, finance, market access, infrastructure, and policy updation for the future entrepreneurial ecosystem. Support programmes for agripreneurs can be designed as workshops, agripreneur competitions, technology incubation facilities, agripreneur accelerators, mentoring and coaching services, informal youth incubators and introductory business courses for youth.



Entrepreneurship development programmes: Design and implementation

Mohammed Tahlil Azim (2015) has proposed a model for designing entrepreneurship development programmes. The design of an entrepreneurial development programme involves three components: Contents (what is to be taught?), Approaches (how to prepare?) and Facilitation (Who should teach?). The programme's content is further divided into traits, skills and knowledge. The trait component highlights the psychological characteristics attributed to entrepreneurs. The traits

included in the model are Need for Achievement, Internal locus of control, Creativity and innovation, Risk-taking, Self-confidence, and Vision. Skills to be acquired by an entrepreneur in the training programme could be categorized as communication, organizing, leadership, decision-making, opportunity recognition, networking, time management, and stress management skills. The knowledge components to be assured in the EDP include entrepreneurship concepts, government incentives, government regulations, sources of funds, support services, market research, business plans, and start-up avenues.

Source: Mohammed Tahlil Azim

Entrepreneurship Training includes three phases: the Initial or pretraining phase, the training phase and the post-training phase. The initial phase consists of arranging infrastructure for training, preparing the training syllabus and application form, arranging guest faculty, designing tools and techniques for selecting the trainees, forming the selection committee and creating a publicity campaign for the programme. The objective of the training phase is to make desirable behaviour changes for the individuals. Training should ensure changes in entrepreneurial outlook and mindset and provide enough knowledge and skill in the enterprise context. Monitoring and follow-up in the post-training phase reveal drawbacks in the earlier phases and suggest guidelines for framing the future policy.

Scheduling Farm Business School

Session 1: Getting to know each other
Session 2: Introduction to the Farm Business School
Session 3: Communication skills
Session 4: Effective facilitation
Session 5: Understanding the FBS curriculum
Session 6: Roll-out of FBS meetings
Session 7: Orientation & mobilization of communities
Session 8: Organizing & managing the FBS
Session 9: Planning the FBS curriculum
Session 10: Evaluation & close

Farm Business School for agri-entrepreneurs

The Farm Business School (FBS) has been developed by the Food and Agriculture Organization of the United Nations to help farmers learn how to make their

farming enterprises and overall farm operations profitable and able to respond to market demands. A Farm Business School is a 'forum' or 'venue' that brings farmers together to conduct collective and collaborative enquiries to address business and marketing problems and opportunities (FAO,2011). The learning takes place at the village level, and farmers' entrepreneurial and management skills capacity is built via a "learning by doing" approach. Extension officers and lead farmers are trained as facilitators and then organize seasonal training courses, where farmers work in small groups at their own pace using materials specially designed for the schools.

In light of the FAO Farm Business School concept, Kerala Agriculture has introduced Farm Business Schools with needed modifications as the state requires under the Kerala state planning board funded project School of Entrepreneurship. The programme is oriented for both existing and upcoming entrepreneurs of the state. The seven-day residential programme is conducted at the university headquarters at regular intervals. Each batch has an intake of 20 entrepreneurs in agriculture and allied sectors. Training methods include lectures, group discussions, field visits, lab visits, entrepreneurial interactions and presentations. Technologies developed at the university are showcased during the programme. Further technical handholding is provided for the entrepreneurs during the establishment phase of the enterprise.

Central Training Institute of Kerala Agricultural University is responsible for the conduct and follow-up action of the farm business school. Five batches of FBS have been completed at the centre. Entrepreneurs attending the paid programme are in the age group of 35 to 50. A higher percentage of trainees had graduation and above as a qualification. Existing entrepreneurs outnumber expecting entrepreneurs. Sessions were finalized and scheduled based on the training needs assessment. Trainees were

found to be more interested in the sessions on high-tech agriculture, food processing, e-marketing and AI-based agriculture technologies. The training introduced Business plan formulation, technical and financial viability assessment, Government schemes and support programmes, and management of agri-enterprises to the trainees. Sessions assured group dynamics among members, collaborations and networking facilities for the future endeavours of the participants. Follow-up activities and technical training are provided to ensure the growth of enterprise and entrepreneurship.

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Enhancing Competency of Extension personnel for mentoring agripreneurs

ABOUT THE EDITORS

Darsana S., PhD (Agricultural Extension), is presently working as an Assistant Professor at the Central Training Institute of Kerala Agricultural University. Her research interests include agripreneurship, impact assessment and seed systems.

S. Helen, PhD (Agricultural Extension), is the Professor and Head of Central Training Institute of Kerala Agricultural University. She has an experience of 30 years in research, education and extension.

Mridula N., PhD (Agricultural Extension), is presently working as an Assistant Professor (Agricultural Extension) at the Central Training Institute of Kerala Agricultural University. She has experience in food security and Information and Communication Technology.

Dr. Shahaji Phand, Deputy Director and Centre Head of Centre for Extension in Agri-allied Sector and also Principal Coordinator, Agri-Clinics and Agribusiness Scheme (AC&ABC), (MANAGE), Hyderabad. He has served more than 15 years in agri-allied sector.

Dr. Sushrirekha Das, MANAGE Fellow, MANAGE, Hyderabad. She is a core extension officer in the field of allied sector. She has contributed more than 6 years in extension service for betterment of farmers.

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