

SCOPE AND IMPORTANCE OF AGRICULTURE ENTREPRENEURSHIP

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1. INTRODUCTION

Entrepreneurship is one of the key drivers for economic development. During an economic crisis, the importance of entrepreneurship development increases. Entrepreneurship has been linked to improved growth, increased wealth and quality of life. In developing countries like India, planning and implementation for development of entrepreneurial programmes are essential for raising the living standard of the vast majority of the backward regions because of their over-dependence on agriculture for employment (Uplaonkar and Biradar 2015). Thus, entrepreneurship development appears to be the best substitute to find employment opportunities, income generation, poverty reduction and improvements in nutrition, health and overall food security in the national economy.

Agriculture is considered as the main economic activity which adds to the overall wealth of the country. In the past, agriculture was seen as a low-tech industry dominated by numerous small family firms, which are mostly focused on doing things better rather than doing new things. However, over the last two decades, this situation has changed dramatically due to economic liberalization and a fast changing society. Agricultural companies have to adapt to the erratic demands of the market, varying consumer habits, stringent environmental regulations, new requirements for product quality, food safety sustainability, and so on. These changes have opened the way for new entrants, innovation, and portfolio entrepreneurship. Farmers, researchers, agricultural business and governments have recognized this and emphasized for a more entrepreneurial environment in

the farming business (De Lauwere et al., 2002; McElwee, 2008; Pyysiäinen et al. 2006). Agricultural entrepreneurship has a significant impact on business growth and survival (Verhees et al., 2011). Therefore, it calls both small scale and large scale farmers to practice entrepreneurial agriculture.

The entrepreneurial skills of farmers need to be developed and addressed by all stakeholders in the agricultural socio-economic network. There are various strategies available to farmers for survival and changing their economic environment which results in business growth. For example, the farm enterprise may be expanded through tourism or other forms of non-agricultural business, or by integration of the value chain by engaging in food processing, direct marketing, or through organic production. The social and economic environment of farming should not be underestimated when studying and promoting the development of entrepreneurial skills. Entrepreneurship can only be improved when the entire agricultural socio-technical network is involved in the process. Thus, strategies to stimulate and strengthen the entrepreneurial culture of the farming business and sustainable development in rural areas are needed. In this chapter we will discuss the role of agri-entrepreneurs in agriculture development, its scope, opportunities, importance and success stories of agri-entrepreneurs.

2. DEFINING ENTREPRENEURSHIP

Entrepreneurship is the capability to develop ideas and attain success with them. Innovation, ability to accept change and risk and the organization of resources are some of the factors involved in creating a sustainable enterprise. The entrepreneurial spirit is responsible for generating employment, competitiveness and the ability to exploit any sector or business (European Communities, 2003). Entrepreneurship is a feasible approach for upward mobility, as a 1% increase in entrepreneurial activities decreases the poverty rate by 2% (Singh, 2014). Entrepreneurs with successful businesses are self-employed.

The word entrepreneurship means a dynamic process of creating progressive asset (Shailesh et al., 2013). This asset is produced by individuals who take the major risks in forms of equity, time and career obligation of giving worth to some product or services. There are chances that the product or service may or may not be new or unique but value must be inculcated by the entrepreneur. Simply we can say that entrepreneurship is the use of energy for commencing and building an enterprise (Mishra et al., 2010). Consequently, entrepreneurship is a fascinating notion, widely used and defined as a creative and innovative response to the environment (Chandramouli et al., 2007).

It can also be defined as a process in which a representative manages to visualize and implement an idea, belief, service, product or activity (Bernier and Hafsi 2003). Stevenson et al. (1999) describe it as the quest of an opportunity, whether enough resources are available or not. Other authors see it as an individual's efforts to turn a vision into reality, despite of probability of success. This might indicate that anyone can be an entrepreneur who has the potential to develop that vision by which creates his own.

Moreover, it could be interpreted that entrepreneurship is a mutual phenomenon in which society as a whole can contribute to general well-being by means of social deal in new products and services.

3. AGRI-ENTREPRENEURSHIP

Investigation suggests that the agricultural sector is comparably more effective in reducing poverty as any other sector. Food prices reduce for poor people by increased crop productivity resultant decreased poverty.

Agri-entrepreneurship in common language can be defined as sustainable, community-oriented, directly-marketed agriculture. Sustainable agriculture refers a system oriented approach to farming that put emphasis on the interrelationships of social, economic, and environmental processes. It is the beneficial combination of agriculture and entrepreneurship and convert your farm into an agribusiness. This association of agriculture and business promotes agripreneurs who innovate, identify markets, and satisfy needs by developing different ways. The term agri-entrepreneurship is similar with entrepreneurship in agriculture and describes agribusiness establishment in agriculture and allied sector (Bairwa et al., 2014a).

Entrepreneurship in agriculture can also be defined as the formation of novel economic organization for the intention of growth under risk and uncertainty in agriculture (Dollinger, 2003). Contrary, Gray (2002) defines an entrepreneur as an individual who controls a business with the purpose of growing the business along with leadership and managerial skills necessary for achieving those goals.

3.1 NEED AND IMPORTANCE OF AGRI-ENTREPRENEURSHIP

Traditionally, farmers are ignorant of scientific agriculture and effective agri management systems. Thus, they are unable to deal with delayed monsoons, drought, crop debts, fake seeds and shortage of fertilizer, as a result opt to commit suicide. Hence, the managerial, technical and innovative skills of entrepreneurship applied in the field of agriculture may

build a well trained Agri-entrepreneur who becomes a role model to all such depressed farmers.

Agri-entrepreneurship has the prospect of social and economic development, for example, employment generation, poverty reduction, improvements in nutrition, health and overall food security in the national economy especially in rural areas. In the face of growing unemployment and poverty in rural areas, there is urgency of entrepreneurship in agriculture for more productivity and profitability. Agri-entrepreneurship can be used as chief remedy for the solution of this complexity such as lower the burden of agriculture, produce employment opportunities for rural youth, control migration from rural to urban areas, boost national income, sustain industrial development in rural areas and cut down the pressure on urban cities.

Agri-entrepreneurship program is crucial to build up entrepreneurs and management staff to deal agricultural industry across the world (Bairwa et al. 2014b). Agri-entrepreneurship is greatly affected by the economic situation, education and culture (Singh, 2013). Agri-entrepreneurship is important for national economy in following ways (Sah, 2009)-

- 1) Firstly, it helps in achieving productivity profit by small farmers and amalgamating them into local, national and international markets.
- 2) Secondly, it helps in decrease in food costs, and provides high-quality diets to the rural and urban poor in the country.
- 3) Thirdly, it accelerates growth, diversifying income and develops entrepreneurial opportunities in both rural and urban areas.

3.2 ENTREPRENEURIAL SKILLS AND CHARACTERISTICS FOR AGRI-ENTREPRENEURSHIP

Entrepreneurial development is an efficient and a proscribed development of a person to an entrepreneur. The development of an entrepreneur refers to inculcate the entrepreneurial skills into a common person, including the desirable knowledge, higher technical, financial, marketing and managerial expertises, and building the entrepreneurial outlook. Entrepreneurial development programmes may be defined as a program planned to assist an individual in escalating his entrepreneurial drive and in inculcating skills and capabilities necessary for playing his entrepreneurial role effectively. In real sense, entrepreneurship expertises are those competencies which are vital to carry out tasks and activities related to the farm business, can be developed by learning and experience.

Agribusiness is prominently affected by the personal qualities of an agri-entrepreneur (Brockhaus and Horwitz, 1986; Nandram and Samson, 2000). Actually, entrepreneurs exhibit general qualities such as consistency, drive, aspiration, resourceful, problem solving, realistic, and goal-oriented. An entrepreneur is one who can recognize an unmet need and takes the risk to chase it. In addition, other qualities include managing productivity, quest for new markets (Singh, 2013), self criticism, leadership, market orientation and creativity.

Open minded farm entrepreneurs will identify more problems in dynamic environment (Hanf and Muller, 1997). According to Man et al., (2002) entrepreneurial competences are classified in six key areas viz. opportunity recognition skills, bond building, managing, strategic competences, abstract thinking and problem solving skills. Another author selected seven important success aspects which are organizing and strategic planning, ecosystem knowledge, skilled and professional staff, thoughtful of the value chain view, craftsmanship, aptitude to learn and search for opportunity and creative personal characteristics (Lauweres, 2002). Management and organizing skills are the complete package that a farmer would utilize in order to develop the farm business.

Small-size farmers enhanced their competitive ability with the help of producer organizations and technology innovation. Farmers required adapting to new situations for survival due to fluctuating agricultural markets such as ICT, reduced subsidies for agriculture, shifts in consumer demand, new food production standards (Lans et al., 2013). Agri-entrepreneurship is entirely different from traditional entrepreneurship as modernization of agriculture is narrowly focused on highly specialized areas, efficiency, and productivity in farm management.

Agri-entrepreneurs need to be innovative, curious, determined, persistence, visionary, hard working, honest, taking risks, being proactive in identifying opportunities for success, integrity with strong management and organizational skills (Bairwa et al., 2014a). We can say characteristics of agri-entrepreneur are an integration of agri-entrepreneur qualities and competencies (Figure 1).

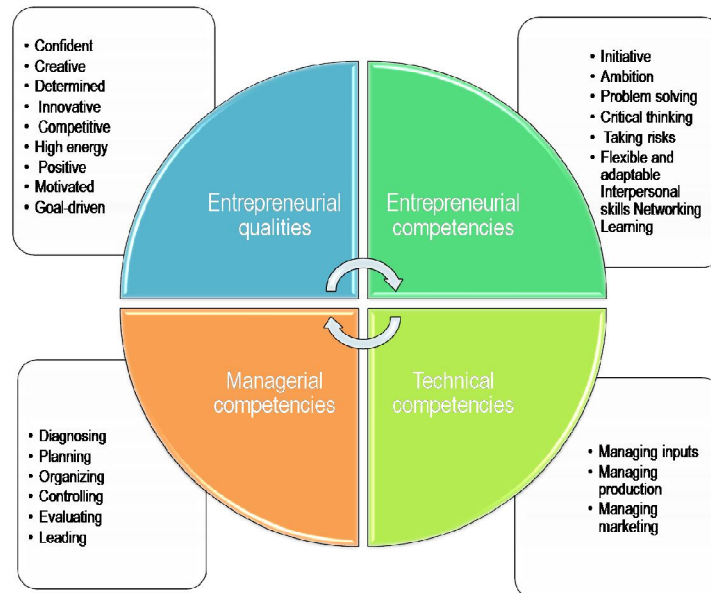


Figure 1. Integration of agri-entrepreneur qualities and competencies.

McElwee and Smith (2012) advocated that agri-entrepreneurs should be confident in their abilities to develop a successful business. Or we can say, they are internally driven to succeed. Characteristics most associated with agri-entrepreneurs (Figure 2) includes-

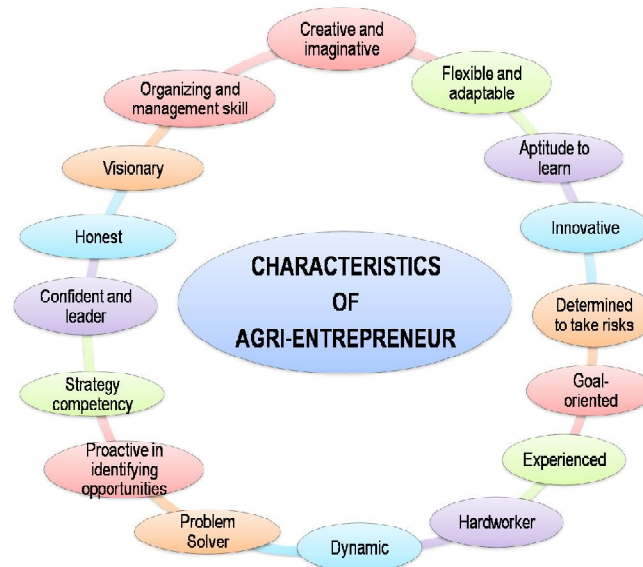


Figure 2. Characteristics related with agri-entrepreneurs.

4. ENTREPRENEURSHIP DEVELOPMENT OPPORTUNITIES IN AGRICULTURE

Due to globalization of trade and agriculture and the policy reforms at national level, the scope and opportunities in the agri-entrepreneurship have significantly expanded, leading to an extraordinary business interest in this sector. The world wonders and hopeful for the fast growing Indian rural market, which is crucial for building corporate growth strategy in the country. According to surveys, total rural market in India is larger than urban market.

Agribusiness has offered a large number of prospects for value addition, packaging, retailing, and exports of agricultural products with advance technology and management. A large part of Indian population is reliant on agriculture and this area also supplies raw material for different industries. Agribusiness is most likely to control the progressive growth of Indian economy. In present scenario, about one fourth of our fruits and vegetables are getting spoiled before reaching to the consumer, due to lack of adequate infrastructure. However, due to rapid shift in the nature of agribusiness, demand for competent and dynamic professionals has developed multiple times from last few years. Since policy reforms are introduced by the WTO regime, the scope and opportunity in the agri-business has been increased. A huge number of opportunities have opened in the industries like packaging, supply of raw material, processed agri-food manufacture, export of agricultural products and other allied fields. Rising of micro financing, relaxed government regulations, accessibility to high technology, guidance and workshops on agri and related areas have changing outlook of highly skilled personnel and resultant they are opting for self employment in agriculture, mounting the agripreneurship's prospective in India (Bairwa et al., 2014a). Pandey (2013) suggests numerous areas of entrepreneurship in agriculture which include dairying, sericulture, goat rearing, rabbit rearing, floriculture, fisheries, shrimp farming, sheep rearing, vegetable cultivation, nursery farming and farm forestry.

The feasible opportunities of entrepreneurship in agriculture are: -

- i) Agro produce processing units – Here no manufacture of any new product done and simply the processing of the agriculture produce occurs Example- rice mills, dal mills, decorticating mills etc.
- ii) Agro Produce manufacturing units – Here the entirely new products produced based on the agricultural produce as the main raw material. Example- sugar factories, bakery, straw board units etc.

- iii) Agro-inputs manufacturing units – Here production of goods done either for mechanization of agriculture or for increasing manufacturing plants, Example- fertilizer production units, food processing units, agricultural implements etc.
- iv) Agro service centres –These comprise the workshops and service centre for repairing and serving the agricultural implement used in agriculture.
- v) Miscellaneous areas – Moreover, the following areas may be hopeful to establish agri enterprises like setting up of Apiaries ,feed processing units, seed processing units, mushroom production units, commercial vermin-compose units, goat rearing farmers club, organic vegetable and fruits retail outlet, bamboo plantation and jatropha cultivation.

Bansal (2011) has proposed some entrepreneurial areas in agriculture-

- I. Farming- Crop, dairy/poultry/goat, fish, rabbit, vegetables, flowers, ornamental plants, palmrosa, fodder, sericulture, agro-forestry, beekeeping, mushroom.
- II. Product Marketing- Wholesale, retail, commission agent, transport, export, finance, storage, consultancy.
- III. Inputs Marketing- Fertilizer, agricultural chemicals, seeds, machineries, animal feed, poultry hatchery, vetmedicines, landscaping, agriculture credit, custom service, bio-control units, bio-tech units.
- IV. Processing- Milk, fruits, vegetables, paddy, sugarcane, , cashew, coir, poultry, cattle, tannery, brewery.
- V. Facilitative- Research and development, marketing information, quality control, insurance, energy.

5. TYPES OF ENTERPRISES

According to Uplaonkar and Biradar (2015), different types of enterprises in agri-entrepreneurship are as follows-

- i) *Farm Level Producers*: Here family is treated as enterprise for augmenting the production by utilizing the high level of technology, possessions and demand in the market.
- ii) *Service Providers*: There are varied categories of services

indispensable at the village level. These include the input borrowing and distribution, employing of equipment such as tractors, sprayers, seed drills, threshers, harvesters 'dryers. It also consists of scientific services for example setting up of irrigation facilities, weed curb, plant security, yielding, threshing, conveyance, warehouse etc. and related opportunities present in the livestock husbandry region for breeding, immunization, disease diagnostic and treatment services, along with provision of cattle feed, mineral combination, forage grains, etc.

- iii) *Input Producers*: There are many booming enterprises which require significant contribution and such inputs can be produced by the home entrepreneurs at the village level are biopesticides, soil amendments, biofertilizers, vermicompost, plants of diverse species of vegetables, fruits, ornamentals, root media for raising plants in pots, production of cattle feed concentrate, agricultural tools, irrigation accessories, mineral mixture and complete feed. Additionally, opportunities are available in fishery, sericulture and poultry as well.
- iv) *Processing and Marketing of Farm Produce*: Highly qualified and skilled persons and higher investment required for well-organized management of post-production processes. Such enterprises can be controlled by People's Organizations like cooperatives, service joint stock companies or societies. The most successful illustrations are the dairy cooperatives sugar cooperatives and fruit growers' cooperatives.

6. MICRO, SMALL AND MEDIUM-SIZE ENTERPRISES

Small-size farmers can deal with issues such as under-employment and need for new jobs through entrepreneurship as opportunities exist for farmers to produce value-added agricultural products that are sold in local markets. Consumer aspires for clearness in the food supply chain which contributes to localization of agri-food systems (LAS) (Requier-Desjardins et al., 2003). Rural agri-entrepreneurs can compete against larger corporations by forming Local Production Systems (LPS) that controls major quantities of local farm products (Requier-Desjardins et al., 2003). Such clusters enhance effectiveness in production activities in micro/small/medium-size enterprises (MSMEs) and decrease business costs.

Micro-businesses are described as employing one to nine people; small-size businesses have 10–49 employees and the workforces of medium-

size businesses range from 50 to 250 people (Andersén, 2012). Additionally, MSMEs because of workforce sharing establish cooperative–competitive relationships in these clusters (Trienekens, 2011). Workforce sharing enables MSMEs to be alert and regulate products or services in response to market demands. Clustering also assist knowledge sharing, diffusion and innovation among businesses.

7. VALUE-ADDED AGRIBUSINESS

New opportunities for agri-entrepreneurs have produced due to preferences of consumer for value-added and locally grown agricultural products (DeLind, 2002). Value-added products include organic vegetables, BST-free cheese, unbleached flour, gluten-free food, and heritage apples. Value-added products are significant as sales of these products produce extra income for agri-entrepreneurs and for the local and regional economy (Vogel, 2012). Value-added agri-entrepreneurs embrace technical services and farm equipment rentals, agro-tourism, forest products and community-supported agriculture. Hence, farmers with agribusinesses usually earn more income than those without enterprises. Consumer demand for locally grown and organic agricultural products has increased (Ikerd, 2011). Agribusinesses need to label their products properly so that consumers have to pay the best price for the product. Altogether, such sustainable agribusinesses practices are important for ecological integrity and economic gain (Ikerd, 2008). It is observed that agri-businesses using sustainable agricultural practices have better topsoil and moisture retention, with less erosion and economic loss, as compared to farmers not practicing sustainable agriculture (Altieri et al., 2012). Even it is a good opportunity for agri-entrepreneur in developing countries to benefit from consumers in developed countries who are willing to pay more for these products as they connect class with sustainable product (Elliott, 2013). However, there are constraints in developing value-added products such as lack of access to market information and resources, infrastructure and institutional barriers. It is important for agri-entrepreneur to analyze how they can add value to a product and sponsor related costs. According to Lingelbach et al. (2005) few loans are available to agri-entrepreneurs in developing countries and networks exist to ensure product distribution. Lastly, agri-entrepreneurs look for ways to promote their value-added activities like new products or services could be offered to consumers, improvement in the distribution network position, or partnership can be established in order to nurture their businesses. A direct connection is established between the consumer, farmer, farm and bioregion which develops a sense of place and connects consumer, producer and place; and important to one's social self (Feagan, 2007). This approach is successful

at local and national level.

8. SCOPE FOR AGRI-ENTREPRENEURSHIP IN INDIA

Bansal (2011) presented a detailed account regarding the scope of agri-entrepreneurship in India and can be understood easily in Figure 3-

1. India is gifted with diverse agro-climate, which assists production of temperate, sub-tropical and tropical agricultural produce.
2. Demand for agricultural inputs like feed and fodder, inorganic fertilizers, bio-fertilizers have increased.
3. Applications of biotechnology in agriculture is boon for production of seed, bio-control agents, industrial harnessing of microbes for different products.
4. Economic growth will be enhanced by harnessing the export. According to World Trade Organization (WTO), India has immense potential to recuperate its present position in the World trade of both raw and processed form of agricultural commodities. At present processing is done at primary level only and the rising standard of living expands opportunities for secondary and tertiary processing of agricultural commodities.
5. Large coastal line and internal water courses should be utilized for production of marine and inland fish. Ornamental fish culture already gaining popularity due to growing aesthetic value among the citizens of India.
6. The livestock wealth provides vast scope for production of meat, milk and milk products, poultry products etc.
7. The forest resources can be utilized for production of forestry by-products.
8. Beekeeping and apiary can be taken up on great extent in India.
9. By improving technique of production, enhancement in domestic consumption and export of mushroom production can be done.
10. The farmers should be encouraged and educated for organic farming as organic farming has highest potential in India as the pesticide and inorganic fertilizer application are less in India compared to industrial nations of the world.
11. Huge opportunities for production and promotion of bio-pesticides

and bio-control agents for protection of crops.

12. Due to plateauing in the productivity of high yielding varieties; seeds, hybrid and genetically modified crops have the highest potential in India in the future.
13. Owing to declining groundwater level and labor scarcity for agricultural operations like weeding, transplanting and harvesting, micro-irrigation systems and labor saving farm equipments have potential in coming years.
14. Production of vegetables and flowers under green house conditions can be harnessed for the export.
15. Trained human resources in agriculture and allied sciences will acquire on agricultural extension system due to deteriorating state finance resources and down-sizing the present government agricultural extension staff as consulting services.
16. Lastly, employment opportunities have increased in marketing, transport, cold storage and warehousing facilities, credit, insurance and logistic support services because of enhanced agricultural production.



Figure 3. Scope of Agri-entrepreneurship.

9. BARRIERS TO AGRI-ENTREPRENEURSHIP DEVELOPMENT

From the viewpoint of Uplonkar and Biradar (2015), agri-entrepreneurship development is necessary for improving the production and productivity. Despite of the fact, the rate of attainment is extremely low in India due to following reasons-

1. Agriculture is largely a means of livelihood for most of the farmers. It is difficult for the uneducated small owner to turn their farming into an enterprise due to lack of adequate information, capital, technology and connectivity with the market.
2. There is a need to create consciousness among the farmers about the benefits of these services as they are unaware about it.
3. The free service provided by the Government organizations for promotion of services should be discontinued. As lots of farmers, especially the politically associated leaders feel that the government is liable for providing extension and technical advisory services to the farmers. In addition, the services of these organizations do not reach to small farmers, particularly those living in distant areas. This concept of free service makes the farmers reluctant to avail compensated services offered by the local self-employed technicians.
4. There is need of regular back up services for self-employed technicians, contact with the marketing agencies, suppliers and research stations who are involved in the development of modern technologies.
5. They have to face several legal restrictions and obstacles and private traders involved in such business generally ignore these rules and disturb the fair trade environment.
6. Lastly, Organizations feels risk in making heavy investments and implementing modern technologies which affect the profitability. Thus, resultant farmer members lose interest in their own enterprises as well as in that of their leaders.

Other authors observed and reported following barriers in agri-entrepreneurship for agri-entrepreneurs. Firstly, agri-entrepreneurs have to face changes in consumption, products sought, distribution systems, new technologies, and industry structure (Boehlje et al., 2011). Parallely, there is cut off between the locations where agricultural products are produced, processed and consumed. Secondly, higher risk and uncertainty in decision

making. There is need of innovation, development, and adoption of new technologies that facilitate increased production efficiency and profitability. Other hindrances are changes, competition, evolving industry structures and climate change. Geographic location, farm size, topography, explosive prices and product supplies, low and erratic earnings, environmental costs, poverty, insecure livelihoods, lack of access to technology, socio-political instability, natural disasters, degradation of the environment, gender discrimination, high start-up costs, problem in obtaining credit for their start-up (McElwee and Smith, 2012; Pettinger, 2016; Faisal, 2010; Richards and Bulkley, 2007) as shown in Figure 4. Another major issue which distress agri-entrepreneurs in developing countries is trans-nationals who purchase property in their country. Trans-nationals search countries with less stringent regulation of direct foreign investment as it helps them to enter a market and gain power of market place activities (Land Matrix, 2015). And resultant there is reduction in opportunities for local agri-entrepreneurs who lack access to public media and money. Gender bias is observed in developing countries (Stupnytska et al., 2014). Transitional economies generally export agricultural products and it increases poverty, displaces farmers and limited supply of food available to people living in these countries, especially those in rural communities (UNIDO, 2015; McMichael, 2005). This affects local consumers' ability to procure food and feed their families.

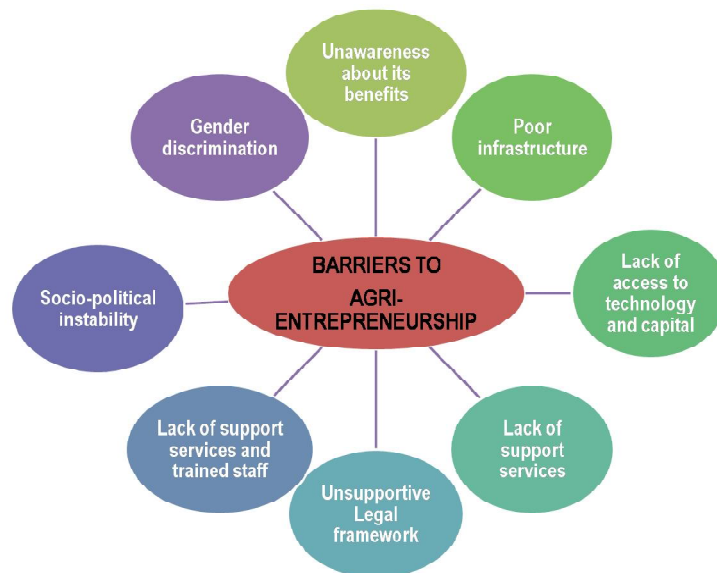


Figure. 4 Barriers to the Agri-entrepreneurship development.

10. MOTIVATION FOR AGRIBUSINESS START-UPS

As we discussed above the challenges and problems encountered by agri-entrepreneurs, then the question arise is that what prompts them to start their own business? These entrepreneurs before entering in this venture assess other job opportunities and impact of that on their family (Lan Matrix, 2015). The major motivation for agri-entrepreneurs is to increase household income and expand primary agriculture business in order that additional family members can be engaged (Agnete et al., 2003). In other words, agri-entrepreneurship may be a source of good living. Secondly, it is good for individuals who do not have other career options. Some wants to take advantage of unique resources and use them for competitive advantage in business operations. Small farmers can remain economically feasible on expanding their activities and selling value-added products (Lowson, 2002; Haugen and Vik, 2008). For increasing the likelihood that consumer will purchase their costly products and provide sufficient profit, product novelty must be maintained.

11. TRAINING AND EDUCATION PROGRAMME FOR AGRIBUSINESS (Uplonkar and Biradar 2015)

India trains over 12000 graduates/year from agriculture and allied sectors, but only a few are able to find employment. Thus, policy makers feel urgency to deal with this serious matter through proper educational planning. Central Sector Scheme of Agri-Clinics and Agri-Business Centres (AC&ABC) was started on 9th April, 2002 with an objective to complement the efforts of public extension by assisting qualified agricultural professionals to set up agri-ventures and can deliver value-added advisory services to farmers at their door step, besides providing self-employment opportunities to Agri-entrepreneurs. Under the Ministry of Agriculture, Government of India, The National Institute of Agricultural Extension Management (MANAGE), Hyderabad is implementing the scheme of Agri-clinics and Agri-Business centers. The aim of scheme is to enhance existing extension network to hasten process of technology transfer in agriculture and strengthening input supply and services. The educated individuals of such programmes include agri-graduates, post graduates and diploma holders in agriculture and allied fields who can set up their Agri-Clinics and Agri-Business Centers and offer professional extension services to farmers. Thus, the scheme provides self-employment to the agricultural graduates and makes availability of better methods of farming to farmers. Specialized training is provided free of cost to the eligible agricultural graduates. This course encompasses various aspects of entrepreneurship and business

management. Centre for Entrepreneurship Development, (CED) Hyderabad is one of the recognized Nodal Training Institutes to provide two months Training Programme.

Other institutes and programmes

1. National Bank for Agriculture and Rural Development (NABARD)- RBI started NABARD in July 1982 to pay full attention in areas of agriculture, small-scale cottage and agro-based industries in rural areas. NABARD is managing all activates of the RBI pertaining to rural development and agro based activities successfully.
2. Agricultural Technology Management Agencies (ATMAs)- ATMAs are functioning at district level to make use of the services of established Agri-entrepreneurs in providing value-added extension services to farmers on Public Private Partnership mode.
3. Panchayatmandi (Agri-Mandi)- The idea of Panchayat mandi is to reduce the control of middlemen and traders. This can be feasible only when working of the Zilla Panchayat is in coordination with state marketing boards and APMC (Agriculture produce market committee).
4. State Agricultural marketing banks (SAMB)- Such banks are set up to actively control markets for food crops and oilseed in bigger markets of towns and cities.
5. NCOSAMB (The national council for state marketing board)- The government of India provides grants in aid to states to set up training facilities with modern facilities and NCOSAMB manage such programmes of training.
6. State Trading Corporation (STC)- STD is foremost international trading house possessed by the government of India. The corporation handles bulk international trades.
7. Farmers Market- This is original initiative from some of the state governments popularly known by Uzhavar santhai (Tamil Nadu), Rythu Bazaars (Andhra Pradesh), Apna mandi (Punjab). This type of market investigates the vast scope for agribusiness entrepreneurship training to develop business skills and imparted through KVK.
8. Domestic and Export Market Intelligence Cell (DEMIC)- This indirectly support business entrepreneurship skills and decision

making skills of agri-entrepreneurs. In addition, it also performs function of forecasting of prices of commodities.

9. Agro biotechnology agency for rural employment and development (ABARD)- It is a plan of KAU (Kerala Agriculture University) and provides training on technologies.
10. Pasumai Padai- It is initiated by Pondicherry government and focused on farmer's interests and take actions like hiring agriculture equipments and machinery.
11. Grape wine growers Association, Maharashtra- It consists of 150 co-operative societies and 500 farmers. This association worked as international supplier for quality grape.
12. ITC- e-choupal- It empowers farmers knowledge about weather and price, provide direct linkage between business objectives and societal goals and provide expertise on business skills and entrepreneurship skills.
13. Agribusiness Incubators- The agri-business incubation (ABI) program launched in 2003. It is a joint venture of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and India's Department of Science and Technology (DST). It sponsors agricultural technologies developed by ICRISAT, other R&D centers of excellence, universities and other institutions.

12. EXAMPLES OF SUCCESSFUL AGRI-ENTREPRENEURS

Various success stories of agri-entrepreneurs have been reported from different sectors and states suggesting their growing importance in agricultural extension (Srinivas IAS et al., 2014). This chapter presents some handpicked success stories. This will enhance the awareness of state agricultural universities, banks, NABARD, Krishi Vigyan Kendras (KVKs) and ATMAs about the prospective of AC&ABC Scheme in strengthening agricultural extension. It would inspire and encourage more budding agricultural professionals to build a wonderful career for themselves.

1. Apple Planet Agri- Clinics

Mr. Bukhari has completed the AC&ABC training at Indian Society of Agri-Business Professionals [ISAP], Srinagar, during December, 2012. He decided to open an Agri-Clinic to assist the farming community and creating self-employment. In J&K mostly fruit crops are grown especially Apple, which needs many sprays of pesticides

besides several doses of different fertilizers. He provides extension service and suggests right doses of pesticides, fertilizers, seeds and other inputs so that the farmers can grow their crop profitably and in a sustainable manner. Mr. Bukhari assembled 500 farmers and bring them under one association, “Apple Planet Agri- Clinics”.

2. *Xcell Breeding and Livestock Services pvt. ltd.*

Dr. Gajendrakumar Kantilal Bamanian, a 33-year old veterinary doctor with MBA degree in International Agribusiness Management joined AC&ABC training program at International School for Public Leadership (ISPL), Ahmedabad. He decided to develop his business in rural areas, where the necessity of veterinary services is more as compared to urban areas. He set up a firm “Xcell Breeding and Livestock Services pvt. ltd.” He also developed software to monitor the breeding services provided to dairies and set up a full fledged laboratory. He is providing the following services to farmers including semen sales, cattle sourcing, cattle sale, herd recording, artificial breeding merchandise, cattle breeding advice, bovine semen sale and supply of AI accessories like tags, sheath, gloves and other farm products.

3. Mobile Agricultural School & Services’(MASS)- Shri Vijay Bharath laid the foundation of ‘Mobile Agricultural School & Services’(MASS) for helping farmers of remote villages in Jharkhand and Bihar in utilizing modern agriculture technology at their door step. He got training under “Society for Rural Industrialization” Ranchi, under AC&ABC scheme. MASS is a kind of mobile bus service. The bus equipped with audio visual aids having the information about the latest farm technologies and market information. The bus carries seeds, fertilizers and pesticides for sale to the farmers at cheaper costs.
4. Ocean Foods- Shri. Uday Veer Singh Rana, from Haryana, joined the 2-month training programme of AC&ABC at Indian Society of Agribusiness Professionals (ISAP), Haryana. During the training, he noticed a scientific procedure of honey processing. He then started the honey processing unit by the name of “Ocean Foods”. He started obtaining and processing honey, flower-wise. The processing unit is having good storage facility and skilled labours are engaged in bottling, packing, labeling etc. In the first year itself, he earned a net profit of 15 lakhs with total sale of Rs. 80 lakhs.

13. CONCLUSION

Agri-entrepreneurship is the call of hours to make agriculture a more attractive and profitable business enterprise. Agriculture has great scope for entrepreneurship and this can be harnessed only by effective management of agri elements such as – soil, seed, water and market needs. Agriculture and domestic businesses provide about 50% of employment in half of all jobs in developing countries (World Bank, 2012) but do not produce adequate income to raise people out of poverty. Thus, entrepreneurial actions associated with agriculture generate a solution for growing household incomes. The good managerial skills and entrepreneurial expertise infuse with government measures would facilitate accomplishment of the growing needs of agri-business. An individual who is confident, risk bearer, honest, visionary and innovative can prove to be a right agri-entrepreneur. Agri-entrepreneurship contributes to the national income along with direct employment and income to the larger and especially rural areas. Value-added products offer entrepreneurs with larger return-on-investment and profit. Therefore, entrepreneurs have to take benefit of change in consumer demand and satisfy consumers' needs with value-added products, such as organically grown coffee.

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PROCESS OF ENTREPRENEURSHIP DEVELOPMENT

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1. INTRODUCTION

The word entrepreneur originates from the French word, *entreprendre*, which means “to undertake”. In a business context, it means to start a business. The Merriam-Webster Dictionary presents the definition of an entrepreneur as one who organizes, manages, and assumes the risks of a business or enterprise. An entrepreneur has been defined as “a person who starts, organizes and manages any enterprise, especially a business, usually with considerable initiative and risk”. Peter F. Drucker (1985) defines an entrepreneur as one who always searches for change, responds to it and exploits it as an opportunity. Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service. The entrepreneur is commonly seen as an innovator - a designer of new ideas and business processes. Management skills and strong team building abilities are often perceived as essential leadership attributes for successful entrepreneurs. Political economist Robert Reich (2002) considers leadership, management ability, and team-building to be essential qualities of an entrepreneur. The entrepreneurial activity is governed by varying combination of socio-economic, psychological, cultural and other factors like caste/religion, family background, level of education, level of perception, occupational background, migratory character, entry into entrepreneurship, nature of enterprise, investment capacity and ambition/moderation. Entrepreneurship has been described as the “capacity and willingness to develop, organize and manage a business venture along with any of its risks in order to make a profit”.

It is an attempt to create value through recognition of business opportunity. It is basically communicative and management functions to mobilize financial and material resources. Entrepreneurship may operate within an *entrepreneurship ecosystem* which often includes:

1. Government programs and services that promote entrepreneurship and support entrepreneurs and start-ups.
2. Non-governmental organizations such as small business associations and organizations that offer advice and mentoring to entrepreneurs (e.g., through entrepreneurship centers or websites).
3. Small business advocacy organizations that lobby governments for increased support for entrepreneurship programs and more small business-friendly laws and regulations.
4. Entrepreneurship resources and facilities (e.g., business incubators and seed accelerators).
5. Entrepreneurship education and training programs offered by schools, colleges and universities.
6. Financing (e.g., bank loans, venture capital financing, and government and private foundation grants).

2. RELATIONSHIP BETWEEN SMALL BUSINESS AND ENTREPRENEURSHIP

The term “entrepreneur” is often conflated with the term “small business” or used interchangeably with this term. While most entrepreneurial ventures start out as a small business, not all small businesses are entrepreneurial in the strict sense of the term. Many small businesses are sole proprietor operations consisting solely of the owner, or they have a small number of employees, and many of these small businesses offer an existing product, process or service, and they do not aim at growth.

In contrast, entrepreneurial ventures offer an innovative product, process or service, and the entrepreneur typically aims to scale up the company by adding employees, seeking international sales, and so on, a process which is financed by venture capital and angel investments. Successful entrepreneurs have the ability to lead a business in a positive direction by proper planning, to adapt to changing environments and understand their own strengths and weakness.

3. ENTREPRENEURIAL CHARACTERISTICS

An entrepreneur is a person who takes the risk of setting up his own venture for perceived reward. He is a person who initiates the idea, formulates the plan, organizes resources and puts the plan into action to achieve his goals. Being an entrepreneur requires specific characteristics and skills that are often achieved through education, hard work, and planning.

Desire to succeed: An entrepreneur has a strong desire to succeed in life. Their dreams are not just limited to achieving one single goal but they constantly work to achieve higher goals.

Vision: An entrepreneur has a dream and he visualizes the ways and means to achieve the dream. In doing so he visualizes market demands, socio-economic environment and technological environment based on which, he visualizes a future for his business venture.

Technical knowledge: An entrepreneur has full knowledge about all the technicalities of his business- be it technological, operational, financial or market dynamics. Entrepreneurs like to know how things work. They take the time and initiative to pursue the unknown.

Innovativeness: Entrepreneurs do not follow the conventional rules of thumb. They have a constant desire to introduce something new to the existing business. They imagine solutions to problems that encourage them to create new products and generate ideas.

Independence: An entrepreneur's desire for control and the ability to make decisions often makes it difficult for them to work in a controlled environment. An entrepreneur needs independence in work and decision-making. They don't follow the rules of thumb but make their own rules and destiny.

Moderate Risk taker: Risk is an inherent and inseparable element of entrepreneurship. Begley and Boyd concluded that the entrepreneurs who take moderate risks earn higher returns on their assets than those who take no risks at all or who take extravagant risks. The entrepreneur assumes uncertainty of future and minimizes risk through research, planning, and skill development. An entrepreneur guarantees rent to landlord, wages to employees and interest to the investor in the hope of earning more than the expenses in future.

Leadership: Gary Yukl (1994) defines leadership as "the process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives". Entrepreneurs exhibit the qualities

of a leader. They are good planners, organizers, motivators, have good communication skill, good decision makers, take initiative to implement plans and are result-oriented.

Human relations ability: An entrepreneur must have good relations with his clients to earn profit and win their confidence in his products/services. He must also maintain good relations with his employees to run his venture on profitable lines.

Hardworking: Entrepreneurs exhibit a great deal of energy to see a venture start and succeed. At times they are called workaholics. Work is worship for them. They put in continuous efforts to achieve success and know that there is no substitute for hard work.

Persistence: True entrepreneurs face bureaucracy, make mistakes, receive criticism, and deal with money, family, or stress problems. But they still stick to their dreams of seeing the venture succeed. They are highly optimistic about achieving their vision. They perceive problems as opportunities and challenges.

Self-confidence: Entrepreneurs believe in themselves. Their self-confidence takes care of any doubts they may have.

Flexibility: Entrepreneurs must be flexible in order to adapt to changing trends, markets, technologies, rules, and economic environments.

4. TYPES OF ENTREPRENEURS

Entrepreneurs can be classified on the basis of several dimensions, some of which are mentioned below:

A. Classification on the basis of Ownership

1. **Founder or “Pure Entrepreneurs”:** These are individuals who are the founder of their business. They are the ones who conceptualise a business plan and then put in efforts to the plan successful. For example, Dhirubhai Ambani of the Reliance Group.
2. **Second-generation operators of family-owned business:** They are individuals who have inherited the business from their fathers and forefathers. For example, Mukesh Ambani and Anil Ambani, the two sons of Dhirubhai Ambani of the Reliance Group now split into two - Reliance Industries Limited and Reliance-Anil Dhirubhai Ambani Group.
3. **Franchisees:** It is a method of doing business wherein the parent owner licenses his trademarks and ‘tried and proven methods’ of doing business

to a franchisee in exchange for a recurring payment. For example, NIIT has given its franchisee operations to local players after thorough scrutiny and proper training.

4. **Owner - Manager:** When a person buys a business from the founder and then invests his time and resources in it, he is called the owner - manager. For example, Sabeer Bhatia and Jack Smith were the founder entrepreneurs of Hotmail, which is now owned by Microsoft and is known as Outlook.com.

B. Classification based on Personality Traits

1. **The Innovator-Achiever:** These types of entrepreneurs have a very high level of motivation to excel. The only drive that pushes them is the desire to achieve something in life, the desire to make a mark in the society, the desire to prove their excellence. They do not need any external stimulus, but are self-driven. These entrepreneurs sense the opportunities for introduction of new ideas, new technology, new markets and creating new organizations.
2. **The Induced Entrepreneur:** These types of entrepreneurs are induced or motivated by some external factors to start a business. The external factors could be like government policies, unemployment, family support, facilitating institutional support, etc.

C. Classification based on the type of Business

1. **Industrial Entrepreneur:** Industrial entrepreneur is an entrepreneur who is into manufacturing of a product. He identifies the needs and wants of the customers and accordingly manufactures products to satisfy their needs and wants.
2. **Trading Entrepreneur:** Trading entrepreneur is one who undertakes trading activities and is not concerned with the manufacturing of products. He identifies potential markets, stimulates demands and generates interest among buyers to purchase a product.
3. **Corporate Entrepreneur:** Corporate entrepreneur is a person who demonstrates his innovative skill in organizing and managing a corporate undertaking which is registered under some act that gives it a separate legal entity.
4. **Agricultural Entrepreneur:** Agricultural entrepreneurs are those entrepreneurs who undertake business related to agricultural activities, like seed, fertilizers, pesticides, farm equipments and other inputs of

agriculture.

5. **Social Entrepreneur:** Social entrepreneur is a person who undertakes a venture to address some social problems like illiteracy, child marriage, drug abuse, environmental issues, terrorism, *etc.* Often such entrepreneurs do not have profit making motive.

5. ROLE OF ENTREPRENEURS

The position of the entrepreneur in modern production is like that of the director of a play. Modern economic development is closely linked with production which is highly complex in nature. The role of an entrepreneur in modern economic development has at least three aspects:

1. The entrepreneur co-ordinates the other factors of production. This involves assembling of the factors and ensuring their best combination for the production process.
2. The entrepreneur takes risks. It is an important function of the entrepreneur since the quantum of profit he receives is directly proportionate to the risks he takes. Risks are generally based on the anticipation of demand.
3. Finally, the entrepreneur innovates. Innovation is different from invention. Invention is the work of scientists. Innovation implies the commercial application of an invention. As an innovator, the entrepreneur assumes the role of a pioneer and an organizational leader.

6. IMPORTANCE OF ENTREPRENEURSHIP IN ECONOMIC DEVELOPMENT

Every country tries to achieve maximum economic development, which depends on human resources to a large extent. But human resource alone will not produce economic development, there must be dynamic entrepreneurs. Entrepreneurship is one of the most important inputs in the economic development of a country. Entrepreneur plays a pivotal role not only in the development of industrial sector of a country but also in the development of farm and service sector. The major roles played by an entrepreneur in the economic development of the country are described as follows:

1. **Employment Generation:** Growing unemployment particularly educated unemployment is an acute problem of the nation. If a hundred persons become entrepreneur, they not only create a hundred jobs for themselves but also provide employment to many more. These

enterprises further grow, thereby providing direct and indirect employment to many more. Thus, entrepreneurship is the best way to fight the evil of unemployment.

2. **Promotes Capital Formation:** Entrepreneurs promote capital formation by mobilizing the idle savings of public. They employ their own as well as borrowed resources for setting up their enterprises. Such type of entrepreneurial activities leads to value addition and creation of wealth, which is very essential for the industrial and economic development of the country.
3. **Dispersal of Economic Power:** When a society produces a small number of entrepreneurs, the enterprise due to lack of competition grow into a few big business houses. This results in concentration of wealth in a few families. This can have a serious social and national implication. When the number of entrepreneurs increases, a large amount of national wealth is also shared by a large number of entrepreneurs, thus dispersing wealth.

Also, small-scale entrepreneurship enables such marginalised groups as women, SC, ST and OBC to pursue their economic dreams through agro-based rural industries and craft-based cottage industries. As there are no entry barriers in terms of educational qualifications, entrepreneurship is an even more attractive career option for such marginalised groups. This dispersal of wealth promotes the real socialism and makes the economy healthy.

4. **Balanced Regional Development:** A rapid development of entrepreneurship ensures a balanced regional development. When the new entrepreneurs grow at a faster pace, the increasing competition in and around the cities force them to set up their enterprise in the smaller towns away from big cities. The growth of industry and business in these areas leads to a large number of public benefits like road, transport, health, education, entertainment, *etc.* This helps in the development of the backward regions, thereby promoting balanced regional development.
5. **Development of Backward and Forward Linkages:** Every new business creates opportunities for the suppliers of inputs (this is referred to as backward linkages) and the marketers of the output (what is referred to as forward linkages). These immediate linkages induce further linkages. So, via a chain-reaction, entrepreneurship provides a spur to the level of economic activity.

6. **Economic Independence:** Entrepreneurship is essential for national self-reliance. Businessmen export goods and services on a large scale and earn the scarce foreign exchange for the country. Such import substitution and export promotion help to ensure the economic independence of the country.
7. **Reducing Unrest amongst Youth:** Many problems associated with youth and social tensions are rightly considered to be due to youth not being engaged in productive work. In the changing environment where we are faced with the problem of recession in wage employment opportunities, alternative to wage career is entrepreneurship. The country is required to divert the youth with entrepreneurial traits from wage career to self employment career. Such alternate path through entrepreneurship could help the country in defusing social tension and unrest amongst youth.
8. **Augmenting National Income:** National Income consists of goods and services produced in the country and those imported. The goods and services produced are for consumption within the country as well as to meet the demand of exports. The domestic demand increases with increasing population and standard of living. The export demand also increases to meet the needs of growing import due to various reasons. An increasing number of entrepreneurs are required to meet this increasing demand for goods and services. Thus, entrepreneurship increases the national income.
9. **Improvement in Living Standards:** Increase in the standard of living of the people is a characteristic feature of economic development of the country. Entrepreneurs play a key role in increasing the standard of living of the people. They set up industries which remove scarcity of essential commodities and introduce new products. They also adopt latest innovations in the production of wide variety of goods and services in large scale at a lower cost. This enables the people to avail better quality and wide variety of goods at lower prices which results in the improvement of their standard of living.

While entrepreneurship leads to economic development, the *vice versa* is also true *i.e.* economic development also fosters entrepreneurship development. Growing economies provide a fertile soil for the flourishing of entrepreneurship.

7. PREDICTORS OF ENTREPRENEURIAL SUCCESS

There are several factors which contribute to the success of an

enterprise *viz.* organizational, marketing and human relations strategies adopted by the entrepreneur. Some of the important factors that may predict entrepreneurial success have been listed below:

1. Methods

- Establishment of strategies for the firm, including growth and survival strategies.
- Maintaining the human resources (recruiting and retaining talented employees and executives).
- Ensuring the availability of required materials (*e.g.*, raw resources used in manufacturing, *etc.*).
- Use of firm's unique competitive advantages.
- Ensuring good organizational design, sound governance and organizational coordination.
- Congruency with the culture of the society.

2. Market

- Use of Business-to-business (B2B) or business-to-consumer (B2C) models.
- High growth market.
- Targeting of customers or markets that are untapped or missed by others.

3. Team

- Large, gender-diverse and racially diverse team with a range of talents.
- Management experience prior to start-up.
- Work experience in the start-up industry.
- Full-time employment prior to new venture.
- Prior entrepreneurial experience.
- Full-time involvement in the new venture.
- Motivated by a range of goals, not just profit.
- Social ties and breadth of business networks.

4. Company

- Written business plan.
- Focus on a unified, connected product line or service line.
- Competition based on a dimension other than price (*e.g.*, quality or service).
- Early, frequent, intense and well-targeted marketing.
- Tight financial controls.
- Sufficient start-up and growth capital.
- Corporation model, not sole proprietorship.

8. RISKS OF BEING AN ENTREPRENEUR

Business is all about taking risks since nothing is certain in business and an entrepreneur has to take chances or risks to earn profit. These risks can at times give fruitful result and at times may lead to losses. Given below are some of the major risks faced by an entrepreneur:

1. Operational risk: Since the entrepreneur is fully responsible for the business, its success or failure entirely rests on him or her only. The entrepreneur should acknowledge the production costs and make sure there is no waste of time and money in order to create and maintain efficient production.

2. Strategic risk: New entrepreneurs or competitors coming into the market often prove to be the good replacement for products or services of an unrecognized firm. Hence, the entrepreneur has to adopt an excellent, creative and innovative strategy in order to be successful in the market for long time.

3. Technological risk: In the new venture, there occur several unexpected developments which need to be tackled effectively in order to sustain in the business. Many a times, a new and more efficient technology renders the old technology as redundant. Therefore, the entrepreneur has to keep vigil on the technological developments and adapt to the changing technologies.

4. Financial risk: Many new businesses don't make much money in the beginning, so the entrepreneur has to bear the risk of income during the initial period. Sometimes, government policies, taxation laws and fluctuating currency exchange rate significantly alter the profit from the business.

5. Loss of leisure time: It is not unusual for entrepreneurs to work a lot

of extra hours to make their business successful. This is especially true during the initial start-up process. This results in lack of leisure time for recreation and relaxation.

9. FACTORS AFFECTING ENTREPRENEURSHIP DEVELOPMENT

Entrepreneurship is influenced by four distinct factors: economic development, culture, technological development and education. These conditions may have both positive and negative influences on the emergence of entrepreneurship. Positive influences constitute facilitative and conducive conditions for the emergence of entrepreneurship, whereas negative influences create inhibiting milieu to it.

Economic Factors:

Economic environment exercises the most direct and immediate influence on entrepreneurship. This is likely because people become entrepreneurs due to necessity when there are no other jobs or because of opportunity. The economic factors that affect the growth of entrepreneurship are as follows:

1. *Capital*: Capital is one of the most important factors of production for the establishment of an enterprise. Increase in capital investment in viable projects results in increase in profits which help in accelerating the process of capital formation. Entrepreneurship activity too gets a boost with the easy availability of funds for investment. Availability of capital facilitates for the entrepreneur to bring together the land of one, machine of another and raw material of yet another to combine them to produce goods. Capital is therefore, regarded as lubricant to the process of production.

2. *Labour*: Easy availability of right type of workers also effect entrepreneurship. The quality rather than quantity of labor influences the emergence and growth of entrepreneurship. Most less developed countries are labor rich nations owing to a dense and even increasing population. But, the potential advantages of low-cost labor are regulated by the deleterious effects of labor immobility. The problem of labor immobility can be solved by providing infrastructural facilities including efficient transportation.

3. *Raw Materials*: The necessity of raw materials hardly needs any emphasis for establishing any industrial activity and its influence in the emergence of entrepreneurship. In the absence of raw materials, neither any enterprise can be established nor can an entrepreneur be emerged. It is one of the basic ingredients required for production. Shortage of raw material can adversely affect entrepreneurial environment.

4. Market: The role of market is very important for the growth of entrepreneurship. In modern competitive world no entrepreneur can think of surviving in the absence of latest knowledge about market and various marketing strategies. The fact remains that the potential of the market constitutes the major determinant of probable rewards from entrepreneurial function. The size and composition of market both influence entrepreneurship in their own ways.

5. Infrastructure: Expansion of entrepreneurship presupposes properly developed communication and transportation facilities. It not only helps to enlarge the market, but expand the horizons of business too. Apart from the above factors, institutions like trade/ business associations, business schools, libraries, etc. also make valuable contribution towards promoting and sustaining entrepreneurship in the economy.

Social Factors:

Social factors can go a long way in encouraging entrepreneurship. In fact it was the highly helpful society that made the industrial revolution a glorious success in Europe. The social setting in which the people grow, shapes their basic beliefs, values and norms. The main components of social environment are as follows:

1. Family Background: This factor includes size of family, type of family and economic status of family. Occupational and social status of the family influence mobility and provide a source of entrepreneurship to its members. It has been found that 2-3 times more business is owned by the children of industrialists than those whose parents do not own a business. The would-be entrepreneur gains valuable experience through informal learning and apprenticeship that occurs while working in a family business.

2. Education: Education enables one to understand the outside world and equips him with the basic knowledge and skills to deal with day-to-day problems. In any society, the system of education has a significant role to play in inculcating entrepreneurial values. Although education is not an essential criterion for an individual to take up entrepreneurship, an educated person is supposed to be better equipped to understand the intricacies of a business as compared to an illiterate person.

3. Attitude of the Society: A related aspect to these is the attitude of the society towards entrepreneurship. In the less developed countries, monetary incentives have relatively less attraction and people are not economically motivated. People have ample opportunities of attaining social distinction by non-economic pursuits. Men with organizational abilities are, therefore,

not dragged into business. They use their talents for non-economic end. On the other hand, certain societies encourage innovations and novelties, and thus approve entrepreneurs' actions for profit-making, acquisition of prestige and attainment of social status.

It is said that in the nineteenth century in Russia, the upper classes did not like entrepreneurs. For them, cultivating the land meant a good life. They believed that land belonged to God and the produce of the land was nothing but god's blessing. Russian folk-tales, proverbs and songs during this period carried the message that making wealth through business was not right. Similarly, strict compliance of non-violence in Jainism induced its followers to take up business and leave farming.

4. Political Support: Entrepreneurs flourish in a social setting where there is ample support from the administrators and policy makers. Peaceful social environment and supportive taxation policies trigger motivated individuals to start up a business. Tax holidays and soft loans announced by the government encourage the entrepreneurs to start new venture or expand the existing ones. On the other hand, the societies marked by law and order problems like crime, riots, *etc.* seldom witness entrepreneurial endeavors. These phenomena can easily be observed across different states of India.

Psychological Factors:

Many entrepreneurial theorists have propounded theories of entrepreneurship that concentrate especially upon psychological factors. These are as follows:

1. Motives: Motives impel men to action. Entrepreneurial growth requires proper motives like profit-making, acquisition of prestige and attainment of social status. Ambitious and talented men would take risks and innovate if these motives are strong. Cole is of the opinion that besides wealth, entrepreneurs seek power, prestige, security and service to society. Stepanek points particularly to non-monetary aspects such as independence, persons' self-esteem, power and regard of the society. Rostow has examined inter gradational changes in the families of entrepreneurs. He believes that the first generation seeks wealth, the second prestige and the third art and beauty.

2. Need Achievement: The most important psychological theories of entrepreneurship was put forward in the early 1960s by David McClelland. According to McClelland 'need achievement' is social motive to excel that tends to characterise successful entrepreneurs, especially when reinforced by cultural factors. He found that certain kinds of people, especially those

who became entrepreneurs, had this characteristic. Moreover, some societies tend to reproduce a larger percentage of people with high 'need achievement' than other societies. McClelland attributed this to sociological factors. Differences among societies and individuals accounted for 'need achievement' being greater in some societies and less in certain others.

3. *Withdrawal of Status Respect:* Everett Hagen also stressed the psychological consequences of social change and explained the psychological roots of entrepreneurship. Hagen says, at some point many social groups experience a radical loss of status. Hagen attributed the withdrawal of status respect of a group to the genesis of entrepreneurship. He believes that the initial condition leading to eventual entrepreneurial behavior is the loss of status by a group. He had postulated four types of events that can produce status withdrawal:

- i. The group may be displaced by force;
- ii. It may have its valued symbols denigrated;
- iii. It may drift into a situation of status inconsistency; and
- iv. Its status may not be accepted on migration in a new society.

10. ENTREPRENEURIAL DEVELOPMENT PROGRAMME

Entrepreneurial Development Programme (EDP) means a programme designed to help a person in strengthening his entrepreneurial motive and in acquiring skills and capabilities necessary for playing his entrepreneurial role effectively. In other words, EDP is primarily concerned with developing and motivating entrepreneurial talent and growing an individual as an effective entrepreneur. An entrepreneurial development programme consists of three broad phases:

A. Initial or Pre-training Phase: This phase includes:

1. Activities and preparations required to launch the training programme;
2. Identification and selection of potential entrepreneurs and providing initial motivation
3. Identification of suitable enterprise for the potential entrepreneur.

B. Training or Development Phase: During this phase the training programme is implemented to develop motivation and skills among the participants. The objective of this phase is to bring desirable changes in the behaviours of the trainees. The trainers have to judge how much and how

far the trainees have moved in their entrepreneurial pursuits.

C. Post Training or Follow-up Phase: This phase involves assessment to judge how far the objectives of the programme have been achieved. Monitoring and follow-up reveals drawbacks in the earlier phases and suggests guidelines for framing the future policy. In this phase infrastructural support, counseling and assistance in establishing new enterprise and in developing the existing units can also be reviewed. Some common activities in the monitoring and follow-up process are as follows:

- i. Preparing and maintaining a separate file for each trainee.
- ii. A history card indicating the bio-data of each entrepreneur and the work done by him.
- iii. Keeping in touch with every entrepreneur and passing the desired information to him well in time.
- iv. Visiting every entrepreneur periodically for necessary guidance and help.

11. WOMEN ENTREPRENEURSHIP

Women Enterprise is defined as an enterprise owned and controlled by women having a minimum financial interest of 51% of the capital and giving at least 51% of employment generated in the enterprise to women. The industries promoted in India by women entrepreneurs usually are Agarbatti manufacturing, Papad making, Embroidery, Handicrafts for exports, Batik Paintings, Apparels manufacturing, Catering service, Running restaurants, snack bars, sweetmeat stalls, soft drink stalls, etc., Running crèches, Running tutorial classes, typewriting/shorthand institutes, Florist shops and dry cleaning, Pickle manufacturing, Running working women's hostels, etc.

Women constitute around half of the total world population. For centuries women were treated as home makers. They were confined to the four walls of houses performing household activities. But now, they have come out of the four walls to participate in all sorts of activities. Women are treated equally in teaching jobs, hospitals and administrative cadres. The global evidences buttress that women have been performing exceedingly well in different spheres of activities like academics, politics, administration, social work and so on. Now, they have started plunging into industry also and running their enterprises successfully. In western countries women entrepreneurs take up any activity of their choice like electronics, engineering, building construction.

However, the Indian women mostly take up enterprises in low cost, low value items like food items (pickles, papads, eatables) on embroidery, handicrafts, lunch packages, *etc.*. They lack talent and resources, encouragement from family and conducive environment to take up challenges. Therefore, the development of women entrepreneurs in the country is of paramount important for economic development.

12. STEPS IN SETTING UP AN ENTERPRISE

1. **Search for Business Ideas:** The first step of entrepreneurial system is search for business ideas. The idea may originate from various sources like success story of friend or relative, demand for certain products, visits to trade fairs and exhibitions, study of project profiles, market potential surveys, meetings with government agencies, *etc.*

2. **Processing of Ideas:** Once business ideas are discovered, screening and testing of these ideas is done to assess their technical feasibility and commercial viability. Technical feasibility is judged in terms of availability of required technology, machinery and equipments, skilled labours, and raw materials. Commercial viability refers to cost-benefit analysis through study of potential demand, expected sales volume, selling price, cost of production, break-even point, *etc.*

3. **Idea Selection:** After taking into consideration various factors for each idea, a selection matrix is prepared to analyse the diverse data collected for selection of the best feasible idea. After the selection of a business idea, the findings are presented in the form of a report known as 'Project Report' or 'Business Plan' indicating how to start and run the enterprise successfully. This report is useful for getting finances, license, *etc.*

4. **Selecting Business Location:** In order to be successful, the entrepreneur has to select a customer-friendly location and comply with the business zoning laws of the country.

5. **Financing the Business:** If sufficient funds are not available with the entrepreneur to start the enterprise, options are available in the form of government-sponsored schemes, bank loans, venture capital, research grants, *etc.* There are numerous programmes available to assist start-up of an enterprise for different categories of entrepreneurs.

6. **Determining Legal Structure of Enterprise:** The next step for an entrepreneur is to decide which form of ownership is best - like sole proprietorship, partnership, Limited Liability Company, corporation, nonprofit or cooperative organization.

7. Getting Tax Identification Number: The entrepreneur has to register the enterprise with a 'Business Name' and enroll with the government agency to obtain a tax identification number, employee provident fund, workers' compensation, unemployment and disability insurance, *etc.*

8. Obtaining Business Licenses and Permits: As per the laws of the country, the entrepreneur has to obtain licenses and permits from central/state governments required for doing the business.

9. Selection of Personnel: Human resource is the most valuable asset of an enterprise. An entrepreneur has to make decisions regarding:

- i. Number of personnel required for management, technical and other positions in the enterprise;
- ii. Qualification and experience of personnel required to perform the job effectively;
- iii. Procedure and methods for selecting the best candidates;
- iv. System and criteria for evaluating the performance of employees;
- v. Policies and methods for remunerating the personnel; and
- vi. Facilities for safety, health and welfare of the staff.

10. Establishment of Enterprise: This is the last step wherein the entrepreneur integrates all the necessary resources and establishes the enterprise.

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START-UP PROGRAMME FOR AGRI ENTREPRENEURSHIP

R.K.Naresh, Peyush Punia, Vivek and Sunil Kumar

1. INTRODUCTION

India is predominantly an agrarian economy with 55% population driving its livelihood from agriculture. In the last two decades, powered by the Government policies and strong engagement of the industry and institutions, agriculture is rapidly evolving into agribusiness in terms of approach and structure. However, in the last one decade, the sector has been thronged by the stream of educated youth, fired by the ideas, passion and innovations to launch newer kinds of technology and business models to lift the face of agriculture from primitive to hi-tech one. These start-ups are providing missing links in the agri value chain and delivering efficient products, technologies and services to the farmers on one hand and the consumers on the other hand. Entrepreneurial development is a systematic and a controlled development of a person to an entrepreneur. The development of an entrepreneur refers to inculcate the entrepreneurial skills into a common person, providing the desirable knowledge, getting higher the technical, financial, marketing and managerial expertise's, and building the entrepreneurial approach. Entrepreneurial development programmes may be defined as a program designed to help an individual in strengthening his entrepreneurial motive and in acquiring skills and capabilities necessary for playing his entrepreneurial role effectively. This situation can be changed by generating employment opportunities for them in rural areas itself. Agro entrepreneurship can be used as paramount medicine for the solution of this complexity. Developing entrepreneurs in agriculture will solve the entire problem by following means:

- (a) Trim down the burden of agriculture
- (b) Create employment opportunities for rural youth
- (c) Control migration from rural to urban areas
- (d) Increase national income
- (e) Sustain industrial development in rural areas
- (f) Cut down the pressure on urban cities etc.

2. THE WORLD OF THE AGRI/FARMER-ENTREPRENEUR

Farmer-entrepreneurs are free and independent, they do not work alone. They operate in a complex and dynamic environment. They are part of a larger collection of people including other farmers, suppliers, traders, transporters and processors, each of whom has a role to play in the value chain. For farmers to cope with the risks they will face in the complex world in which they compete, they need to develop an entrepreneurial spirit. A farmer with an entrepreneurial spirit energetically, enthusiastically and carefully makes many different decisions about his farm in the context of the value chain that influences the profits of the farm business. This is all happening in a dynamic, ever-changing and uncertain setting.

The ‘way of life’ of a farmer-entrepreneur

- Freedom in making decisions about the business and the relationship with family
- Control over what has to be done, when and in what order
- Working alone often in solitude
- Coping with a wide range of managerial and ‘day to day’ tasks
- Lives with uncertainty; if you can’t generate profit you may not survive in the future
- Risking personal assets and security
- High level of responsibility and risk of failure
- Lives with an inability to control the actions of stakeholders upon whom the success of the business depends
- Develops trust and alliances with other stakeholders where mutual benefits exist
- Works long and irregular hours to meet demands

- Closely interwoven family and business life
- Social status is linked to the success of the business
- 'Learns by doing' under pressure from stakeholders, by solving problems, experimenting, seizing opportunities, and learning from competitors

Agri. Entrepreneurial businesses evolve through five phases:

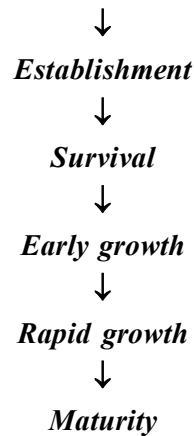
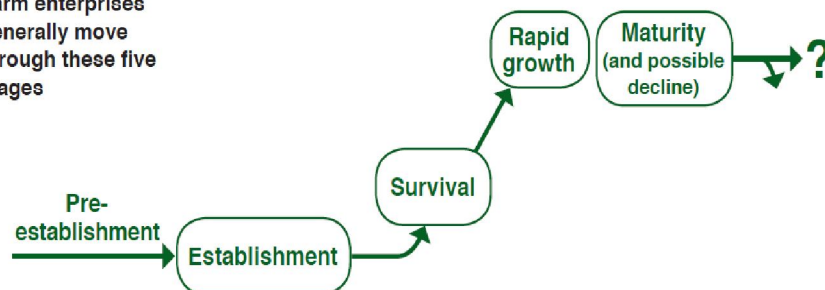


Figure 3
Farm enterprises
generally move
through these five
stages



Five stages of farm enterprise development

3. ENTREPRENEURIAL QUALITIES

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 potential to grow and develop is an entrepreneur.

Entrepreneurial farmers look at their farms and see ways to make them more profitable; they develop ideas and then translate them into action. They need self motivation, perseverance and confidence with an ability to plan and organize the farm business. These qualities enable entrepreneurial farmers to seek-out business opportunities, conceptualize and initiate new business ideas and guide the farm business to accomplish the goals set.

Knowledge

Entrepreneurs need more than just their personality or personal traits. They need ideas, opportunities, and resources. Knowledge allows farmers to make informed choices. It puts them in a better position to compare the current practices being used with alternatives. Farmers obtain knowledge through experience and observation - from listening to and learning from other farmers, observing how things are done and then practicing it themselves. Extension workers are another source of knowledge. Information and its communication is an important aspect of knowledge creation and accumulation.

Farmers need knowledge in each of the key areas of farm management: planning, implementing and controlling. They also need information about primary production, harvesting, processing, wholesaling and retailing and about input supply, financial services, and transport, packaging, promotion and advisory services.

Entrepreneurial Competencies

There are nine key entrepreneurial competencies for a farmer-entrepreneur: initiative, ambition, focused problem-solving, creative thinking, taking risks, flexibility and adaptability, interpersonal abilities, networking and readiness to learn. With these competencies, farmers will be more able to compete in this new environment and make profits by taking advantage of new market opportunities. These competencies can be acquired through practice, experience and training.

Technical Competencies

In addition to being entrepreneurs, entrepreneurial farmers must also be excellent farmers. This requires technical competencies particularly in three areas: managing inputs, managing production and managing marketing.

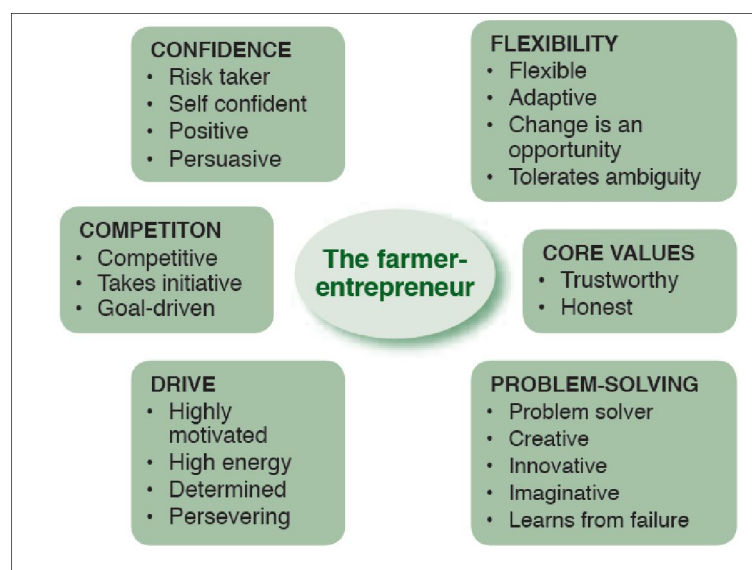
Managerial Competencies

Entrepreneurial and technical competencies need to be

complemented by managerial competencies in the functions of diagnosis, planning, organizing, leading and controlling. The farmer-entrepreneur performs these functions in each of the key areas of the farm business: managing inputs, production and marketing.

Integrating Competencies

Success as a farmer-entrepreneur comes through the ability of the farmer to combine the entrepreneurial, technical and managerial competencies in practice.



Characteristics of an entrepreneur

It is the characteristics that enables entrepreneurial farmers to seek-out business opportunities, conceptualize and initiate new business ideas, gather the physical, financial, and human resources needed to start the business, set goals and guide the farm and all its resources to accomplish those goals. Not all farmer-entrepreneurs have all of these traits to the same degree. But they will have all of them to some degree. Without their core values of trustworthiness and honesty, their problem-solving nature, their flexibility, their drive, the sense competition and their confidence, they would not really be entrepreneurs.

In order for good farm managers to become truly entrepreneurial they will need to utilize their entrepreneurial qualities and managerial skills in effective way by following means:

Capturing value within the value chain

Producing for the market is the first response of farmer entrepreneurs to the opportunities found along the value chain. But like entrepreneurs, farmers will want to diversify their livelihoods to make them more sustainable and more profitable. One way to do this is by capturing value within the value chain.

Enhancing and managing efficiencies in production

Farmer-entrepreneurs need to be skilled at finding and using opportunities to expand their businesses. But they also need to be efficient in utilizing resources, and in transporting and marketing produce.

Promoting new technologies and innovation

New technologies are needed in order to adapt to a changing economy and a changing market. Farmer entrepreneurs are not only consumers and users of these technologies but should also be active participants in designing, testing, adapting and introducing them to the farming system.

Sustaining land management

The foundation of most farm-based businesses is land. While it is tempting to produce as much as possible over the short-term, a successful farmer-entrepreneur knows that the value of the land lies in its ability to continue producing profitably for generations. Sustaining land is a key element of the long-term success of the farm business.

Broadening management skills

As the farm business grows, it becomes more and more complex. Farmer-entrepreneurs need to continue increasing their managerial ability to meet the demands of increasing complexity.

Trustworthiness and respect in business

The long-term success of any business depends on it being conducted with trustworthiness and respect. These qualities assure partners along the value chain that farmers are reliable, that their deeds match their words and that they respect everyone with whom they work.

Promoting group entrepreneurship

Group entrepreneurship can occur when a group of likeminded farmers are willing to work together on a joint enterprise. This often requires

support from extension workers to organize the group and facilitate linkages along the value chain. The challenge is to know when to stop their support and hand over all management and entrepreneurship functions to the group.

Managing farm businesses according to a long-term plan

Daily pressures on the farm business require farmers to make many immediate decisions. These decisions need to be made within a broader vision that guides the development of the business. Farmers must ensure that they are managing their farm businesses with a long term plan for the business so that it stays on course and its direction is not determined by day-to-day decisions.

4. CORE VALUES OF ENTREPRENEURS

- **Trustworthiness:** Worthy of trust and confidence. Includes such values as integrity, keeping promises, loyalty, dependability and reliability. Actions are consistent with words.
- **Truthfulness:** Honest and true in all business dealings.
- **Respect:** Regard for the dignity, worth, independence and essential equality of all people. Treating people with courtesy, politeness and kindness. Tolerance of others.
- **Responsibility:** Acknowledging and performing duties to others. Being self-disciplined and accountable for one's actions.
- **Fairness:** Making decisions based on appropriate factors. Being impartial; avoiding conflicts of interest. Being reasonable and consistent. Playing fair.
- **Caring:** Having regard for the well-being of others. Being kind, compassionate, considerate, unselfish and charitable.
- **Social responsibility:** Recognizing and living up to community and social obligations. Being law-abiding. Doing one's share. Contributing to the betterment of society.

5. DIFFERENT TYPES OF CONTRACTS IN ENTREPRENEURSHIP

- ❖ **Market-specification contracts:** the farmer agrees to produce to an agreed quality.
- ❖ **Production management contracts:** the buyer participates in production management through inspecting production processes and specifying input usage.

- ❖ **Resource providing contracts:** the buyer supervises production and supplies key inputs. The buyer often owns the product and farmers are paid by volume.

Capturing value chain by introducing value-adding enterprises

An important way to capture value along the value chain is by integrating with or buying into the value adding enterprises along the value chain. There are a number of ways – individually and collectively – to do this:

Pre-production enterprises

Start supplying or buy into businesses that supply inputs and other resources such as seed, fertilizer, pesticides, tools and equipment.

Post-harvest handling of products

Start providing or buy into businesses that provide post-harvest operations and processes that add value to products, including cleaning, cooling, packaging labeling, packaging, transport and marketing.

Post-harvest processing of products

Start processing or buy into businesses that process agricultural commodities into more refined products.

- Each of these represents a value-adding possibility in which entrepreneurial farmers can become involved to capture value within the value chain. If they can organize the necessary finances, they can establish a business to provide one or more of these functions.
- However, for many newer farmer-entrepreneurs, expanding into these areas may not yet be possible. Still, they will recognize and evaluate these opportunities and use connections and contacts to find ways to create linkages so they can increasingly capture a share of the value being adding along the value chain.
- Extension workers can play a major role in helping farmers identify, investigate and evaluate opportunities in the value chain. They can also help facilitate access into or linkages with these opportunities in a measured and sustainable way.

6. PROMOTING INNOVATION AND NEW TECHNOLOGIES

- Farmers may need to develop or adopt new technologies and practices in order to cut costs and increase efficiency.

- Extension workers can facilitate farmer-farmer and farmer-research partnerships to identify, develop and test new technologies
- New information and communication technologies are needed to share information with farmers.

6.1 Five Principles of Innovation

These five principles can help farmers take advantage of a new innovation:

- I.** Know what the innovation does and how it works.
- II.** Analyze the opportunity to see if people will be interested in using the innovation.
- III.** Effective innovations are simple and focus on a specific need or opportunity.
- IV.** Effective innovations start small. Focus on a small, limited market, with a product requiring little money and few people to produce and sell it. As the market grows, fine-tune its processes and stay ahead of the emerging competition.
- V.** Aim at leading the market from the beginning. An innovation that aims at leading the market (e.g. dominating a small specialized market) is more likely to be successful.

7. SUGGESTIONS FOR IMPROVEMENT IN STARTUP PROGRAMME FOR AGRI- ENTREPRENEURSHIP

- Provision for separate fund of agri. entrepreneur.
- Provision of special infrastructure facilities required.
- Arrangement of special training programmes of agri. entrepreneurship
- Felicitation of successful rural entrepreneurs to encourage entrepreneurship among people.
- Agri-entrepreneur should more competitive and efficient in the local & international market.

7.1 The Central Government Entrepreneur schemes for Agricultural are listed below:

- Assistance to NCDC Programed for Development of Cooperatives
- Capacity Building to Enhance Competitiveness of Indian Agriculture

and Registration of Organic Products Abroad

- Scheme of Cold Chain for Farmers credit linked subsidy
- Cold Storage Unit - Basic Mezzanine Structure
- Scheme for Cold Storage Unit - PEB Structure for farms subsidy
- Cold Storage Unit using Technology for Controlled Atmosphere
- Dairy Entrepreneurship Development financial support
- Development Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization
- Establishment of Agri-Clinics and Agri-Business Centers.
- Fodder and Feed Development for Farmers, dairy cooperatives, NGOs etc.
- Gramin Bhandaran Yojana A Capital Investment Subsidy for Construction Renovation of Rural Godowns.
- Horticulture for Post-Harvest Management Projects for farmers.
- Scheme of Horticulture in Open Field for farmer's subsidy.
- Horticulture in Protected Cover for organizations subsidy.
- Marketing Research and Information Network Government of India.
- Post-Harvest Technology and Management Grant, machinery and contingency expenditure.
- Promotion and Strengthening of Agricultural Mechanization through Training, Testing and Demonstration.
- Refrigerated Transport Vehicles for Societies and other organizations Subsidy.
- Small Farmers' Agriculture-Business Consortium – Agriculture-Business Development investment.
- Strengthening of Agmark Grading Facilities for farmers expenditure to purchase of equipment, chemicals etc.

7.2 Government of India Schemes for Agriculture Entrepreneurship:

- Government of India Schemes for Chemicals and Fertilizers Entrepreneur

- Government of India Schemes for Commerce and Industry.
- Government of India Schemes for Food Processing Business and Entrepreneurship.
- Schemes for Commerce and Industry.
- Central Government Entrepreneur Schemes for Tribal Affairs.
- Government of India Schemes for Urban Development.
- Scheme of National Urban Information System (NUIS) Financial Aid for urban local bodies.
- North-Eastern Region Urban Development Programed (NERUDP) Financial assistance to states.
- Pooled Finance Development Fund Central Government of India Sponsored Scheme.
- Prime Minister's Rural Development Fellows (PMRDF)- Government of India.

7.3 List of Government sponsored Subsidy Schemes under NABARD

- Government Sponsored Subsidy Schemes in NABARD.
- Centrally Sponsored Scheme – Subsidy For Organic Farming and Production of Bio-fertilizers
- Centrally Sponsored Scheme For Setting up of Rural Godowns and Storage Infrastructure
- Centrally Sponsored Scheme for Agricultural and Marketing Infrastructure Up-gradation
- Capital Investment Subsidy Scheme for Setting up Of Agri-clinics and Agribusiness Centers.
- Warehouse Infrastructure Fund for Construction of Cold Storages, Warehouses, Silos and other Cold Chain Infrastructure.
- Deendayal Antyodaya Yojana – National Rural Livelihoods Mission (DAY-NRLM)
- Scheme for promotion of Women SHGs (WSHG) in backward & LWE districts of India
- Capital Subsidy Scheme for Technology Up-gradation of Micro &

Small Enterprises

- Long Term Irrigation Fund for Farmers to Build Irrigation Canals
- National Livestock Mission for rearing of Pigs, Poultry, Buffalos and Rabbits.
- Funding for Setting up Food Processing Units and Food Parks
- Capital Subsidy-cum-Refinance Scheme for Installation of Solar Off-grid
- GoI Scheme – Dairy Entrepreneurship Development Scheme

7.4 Related Schemes of other Agencies:

- Pradhan Mantri Kaushal Vikas Yojana (PMKVY)
- National Horticulture Board (NHB)
- National Horticulture Mission (NHM)
- Small Farmer Agri-Business Consortium (SFAC) assistance to cold storage
- Agricultural and Processed Food Products Export Development Authority (APEDA) assistance for cold chain
- Development Commissioner Micro, Small and Medium Enterprises (MSME)
- Food Processing Unit
- Venture Capital by Small Farmer Agri-Business Consortium (SFAC)
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USE OF ICTs IN AGRICULTURAL ENTREPRENEURSHIP

**Sunil Kumar, Udit Chaudhary, A.S. Panwar, Kamla Preet Kaur and
N. Ravisarkar**

1. INTRODUCTION

Since time immemorial, timely information and communication have mattered in agriculture. Ever since man began cultivating land, rearing livestock and catching fish, he has sought information on the best farming strategies, improved seeds and feed, and how to realize the best prices for their produce in the market. Farmers may have planted the same crop for centuries, but weather patterns, soil conditions, and pests and diseases have changed over time, and this makes agriculture-related timely information all the more pertinent for the stakeholders. Farmers rarely find the answers to their queries easily, while similar uncertainties arise season after season. Updated information allows the farmers to cope with and even benefit from these changes. Providing such knowledge can be challenging, however, because of the highly localized nature of agriculture that information must be tailored specifically to distinct conditions.

With the background of these challenges, the arrival of Information Communication Technology (ICTs) is well-timed. The benefits of the green revolution greatly improved agricultural productivity. However, there is a demonstrable need for a new revolution that will bring lower prices for consumers (through reduced waste and more efficient supply chain management), contribute to “smart” agriculture, and incentivize farmers (for example, through higher income) to increase their production. Public and private sector actors have long been on the search for effective solutions to address both the long- and short-term challenges in agriculture, including

how to answer the abundant information needs of farmers. ICT is one of these solutions, and has recently unleashed incredible potential to improve agriculture in developing countries specifically.

Technology has taken an enormous leap beyond the costly, bulky, energy-consuming equipment once available to the very few to store and analyze agricultural and scientific data. With the booming mobile, wireless, and Internet industries, ICT has found a foothold even in poor smallholder farms and in their activities. The ability of ICTs to bring refreshed momentum to agriculture appears even more compelling in light of rising investments in agricultural research, the private sector's strong interest in the development and spread of ICTs, and the upsurge of organizations committed to the agricultural development agenda.

But what exactly are ICTs? And can they really be useful and cost-effective for poor farmers with restricted access to capital, electricity, and infrastructure? First, an ICT is any device, tool, or application that permits the exchange or collection of data through interaction or transmission. ICT is an umbrella term that includes anything ranging from radio to satellite imagery to mobile phones or electronic money transfers. Second, these ICTs and others have gained traction even in impoverished regions. The increases in their affordability, accessibility, and adaptability have resulted in their use even within rural households relying on agriculture. New, small devices (such as multifunctional mobile phones and nanotechnology for food safety), infrastructure (such as mobile telecommunications networks and cloud computing facilities), and especially applications (electronic money transfer or tracking an item moving through a global supply chain) have proliferated. Many of the questions asked by farmers (including questions on how to increase yields, access markets, and adapt to weather conditions) can now be answered faster, with greater ease, and increased accuracy. Many of the questions can also be answered with a dialogue—where farmers, experts, and government can select best solutions based on a diverse set of expertise and experience.

2. DAWN OF ICTS IN THE RURAL AREAS OF INDIA

If we go back in time, it was radio that first arrived in the vast space of rural India where about 60% of our population resides. The All India Radio (AIR), which is now more popularly known as *Akashwani*, started broadcasting in the 1930s. The reach of radio in rural India far exceeded that of television for two reasons: it was cost-effective and more accessible. Radio was already contributing significantly in reaching out to farmers and disseminating timely information in the United States of

America. In 1966, the then Union Minister of Agriculture, Bharat Ratna C. Subramaniam, played an instrumental role in introducing Farm & Home Units at seven AIR stations in the country. This marked the beginning of a new era of farm broadcasting in India. The objective condition to utilize the services of All India Radio was the launch of Intensive Agricultural District Programme (IADP), which aimed at providing a package of scientifically evolved and proven agricultural practices to farmers in selected districts of the country. It became imperative that the scheme be supported by strong agriculture information service. Besides creating Information Centers in IADP districts, it was decided that seven Farm & Home Units be located near these centers. In course of time the number of such units was increased to sixty across the country.

From the day it was started, the farm & home programmes of AIR were felt to be enormously powerful and effective to realize the objective of the betterment of farming community. All India Radio supported the Intensive Agricultural District Programme and advocated various improved strains of crops for the farmers of different geo-climatic conditions of the country. The advocacy gained considerable credibility among farmers as the broadcasts were duly supported by suitable linkages at the ground level. The magnitude of farmers' response and faith in radio extension could be gauged from the fact that ADT 27 variety of improved paddy grown by Tanjaur farmers came to be known as 'Radio Rice'.

A novel experiment called "Radio Rural Forum" was jointly sponsored by the Ministry of Information and Broadcasting and UNESCO. All India Radio, Pune organized some listener groups comprising 15-20 people each in 150 villages of 5 districts of Maharashtra, viz. Nashik, Ahmednagar, Pune, North Satara and Kolhapur. The scheme was hailed as a tremendous success and gradually extended to the whole country. Further, another experiment called the "*Charcha Mandal*" for training the farmers was initiated and organized by the Ministry of Agriculture and it was also found to be a wonderful success as more than nineteen thousand *Mandals* were organized in quick time and qualitative interactions were enlisted. Farm School of AIR was one of the most innovative devices based on intensive training modules on specific agricultural and allied subjects. The listeners were registered for each of the specialized courses. After the course, the participating farmers appeared in an examination for the organizers to assess the extent of knowledge transfer. The successful trainees were rewarded with suitable prizes. Altogether 1,200 farmers registered themselves at AIR Bangalore, 950 at AIR Delhi, 30,000 at AIR Cuttack, over 54,000 at Sambalpur, nearly 7,200 at Trichur, 9,529 at Rajkot and 6,682

at Madras. Farm Schools on AIR soon became very popular and studies carried out by various agencies revealed its considerable impact on the cropping pattern of the area.

2.1 Doordarshan: Doordarshan had a modest beginning as an experimental telecast starting in Delhi on 15 September 1959, with a small transmitter and a makeshift studio. Regular daily transmission started in 1965 as a part of All India Radio. *Krishi Darshan* started telecast on Doordarshan on 26 January 1967 and is the longest running program on Indian television.

The television service was extended to Bombay (now Mumbai) and Amritsar in 1972. Up until 1975, only seven Indian cities had a television service and Doordarshan remained the sole provider of television in India. Television services were separated from radio on 1 April 1976. Each office of All India Radio and Doordarshan was placed under the management of two separate Director Generals in New Delhi. National telecasts (DD National) were introduced in 1982. In the same year, colour TV was introduced to India. Now, Doordarshan transmits through a network of nearly 1,400 terrestrial transmitters. There are about 46 Doordarshan studios producing TV programmes that currently reach 92 percent of the Indian

Population, and it telecasts programmes on agriculture and rural development. The DD National programme also telecasts 30-minute agricultural programme, *Krishi Darshan*, in Hindi, six days a week. It covers various aspects of agriculture and related activities such as horticulture, animal husbandry, dairy and rural life. The narrow casting kendra's produce locally relevant programmes in local language and dialect and these 30-minute programmes are telecasted 5 days a week.

2.2 Television: In the nineties, private TV channels like E-TV started telecasting daily programmes on agriculture. E-TV currently telecast agricultural programmes in Telegu, Kannada and Marathi languages every day. Similarly, most of the private regional TV channels telecast agricultural programmes at least once a week. Newspapers (especially local language dailies) and farm magazines are important sources of information for farmers. Newspapers, especially those in local languages, provide at least one page every week for news and articles on different aspects of agriculture. Special farm magazines also reach a large number of farm households. India has one daily on agriculture, *Agrowon*, in Marathi published from Maharashtra. *Agrowon* has a circulation of 100,000 copies and the readership is estimated as 15,00,000. However there is a wide variation among states in this regard and there is a lot of potential for using print

media in those states and districts where literacy levels are higher.

2.3 Kisan Call Centre: The Ministry of Agriculture (MoA) initiated the “Kisan Call Centre” (KCC) scheme in January 2004 to provide information to farmers seeking information on telephone, by the local agricultural specialists in their local language. Farmers could call the nation-wide toll free number of 1800-180-1551 and the calls are picked up in 25 KCCs located across the country by agricultural graduates at Level-I, with provision of escalation to Level II and Level III. Until July 2010, 49.32 lakh calls have been received from the farmers in the KCCs. (Chandragowda, 2010). It uses a backend data support system, which is inbuilt into the overall MIS (Management Information System). The MIS software captures callers’ details and specifications of the query which helps in analysing area-wise and crop wise details within a time space framework and provides preventive, advance action solutions. Lack of adequate experience of fresh graduates at level I and difficulties in contacting concerned experts staff at level II and III (who are located elsewhere and are not often available to answer queries) is currently constraining the implementation of KCCs (Sulaiman et al 2011).

2.4 Mobile Internet: The internet and mobile phones arrived in India in 1995 but it took almost a decade for both mediums to make a real dent. It took even more time for both internet and mobile phones to make their presence felt in rural India. It was not before 2010 that mobile phone sales in rural areas started increasing. According to Telecom Regulatory Authority of India, currently there are 499 million mobile subscribers in rural India (June, 2017) of which 109 million users own smartphones. Furthermore, 47 million use mobile internet (IAMAI and Kantar IMRB’s *Mobile Internet Report 2016*). As brands take the mobile route to reach and engage their target audience in rural areas, it is clear that innovation is the need of the hour. The availability of affordable smart phones and feature phones and better internet connectivity at affordable rates by telecom providers have played a significant role in the adoption of mobile internet in the last one year. According to a report published jointly by the Internet and Mobile Association of India (IAMAI) and KANTAR-IMRB in early 2018, mobile internet penetration in rural India remains as low as 18%. The figure for urban India stands at 59%.

The number of mobile internet users has gone up by 17.22% from December 2016 to December 2017. The rate of mobile internet adoption will continue to increase and is estimated to reach 478 million in 2018. Urban India witnessed an estimated 18.64% year-on-year rise, while rural

India witnessed an estimated growth of 15.03% during the same period. Mobile internet is predominantly used by youngsters, with 46% of urban users and 57% of rural users being under the age of 25. Urban India has around twice the proportion of users over the age of 45, while the age range of 25 to 44 has almost equal distribution of users in urban and rural areas.

3. AFFORDABLE ICT'S

The proliferation of adaptable and more affordable technologies and devices has also increased ICT's relevance to agriculture. Innovation has steadily reduced the purchase price of phones, laptops, scientific instruments, and specialized software. Agricultural innovation in developed countries has become more applicable to developing-country needs. The intuitive design of many technologies and their capacity to convey information visually or audibly make them useful to people with limited formal education or exposure to technology. Mobile-based applications are also becoming more suitable for poor and isolated communities, especially through feature phones. Drawing on simple, available technologies such as SMS, service providers can offer mobile banking, other transactional services (selling inputs, for example), and information services (market price alerts). Other publicly and privately provided services such as extension and advisory services are delivered over mobiles, which are increasingly not just "phones" but are actually multifunctional wireless devices.

Geospatial information is also becoming easier to access and use as mapping tools, such as Microsoft Earth or Google Maps, bring geographical data information to non-specialist users. Scientists and development organizations have created substantial sets of georeferenced data on population, poverty, transportation, and any number of other public goods and variables through more affordable, usable geographic information systems available on standard PCs and mobile devices using web-based tools. Satellite images and similar representations have improved exponentially in quality and detail.

These tools and remote sensors use less energy and require less human attention than in previous years. The capacity to overlay geospatial information with climate and socioeconomic data opens many options for analyzing biophysical trends (such as erosion or the movement of pathogens), making projections (about the effects of climate change or the best location of wholesale markets in relation to transport infrastructure), and selecting particular groups to test new technologies or farming practices (for instance, identifying farmers that are most likely to benefit from using e-vouchers to

purchase fertilizer).

Greatly increased data storage capacity and the ability to access data remotely and share it easily have improved the use of ICT in agriculture. Sharing knowledge and exchanging data have created opportunities to involve more stakeholders in agricultural research—involvement facilitated by an improved e-learning environment and networking capacity. Advances in data storage and sharing have improved the ability to exchange information—for instance, between departments and levels of government—and avoid costs associated with data transmission charges.

Improvements in data storage and sharing have underlying causes. The capacity of hard drives and the speed of microprocessors have continued to rise, making it dramatically cheaper to store data. Cloud computing offers access to numerous shared computing resources through the Internet, including sharable tools, applications, and intelligently linked content and data. These advances address some of the information and communication constraints of agricultural research institutions, government offices, cooperatives, and development organizations. Benefits of enhanced data capacity range from more accurate targeting of agricultural development programs to better preparation for handling surpluses or scarcities at the farm level.

4. USING ICT'S IN AGRICULTURAL ENTREPRENEURSHIP (OR AGRIPRENEURSHIP)

To start an ICT venture in agriculture, it is important to understand the agricultural value chain. An entrepreneur can provide services to various customer segments and stakeholders besides farmers. An ICT solution could be created to improve the efficiency of input suppliers, cooperatives, processors, exporters or point-of-retail-sales, yet many entrepreneurs do not consider all of these existing gaps. Young entrepreneurs who wish to venture into e-agriculture service provision should carefully consider specific areas and value-chain and stakeholder segments that they could target in order to offer unique value propositions. Entrepreneurs generally develop ideas by either connecting with a problem they have encountered or by identifying existing needs in a given community. Ideas are then generated in response to the needs observed. An initial solution is conceived in order to respond to the demand or need identified. Market analysis is then conducted to gather information about the demographic composition (age, sex, education level, civic associations, profession/job etc.) and trends in the community to determine the target market and its nuances. Funds would

then be sought from investors, the government or other stakeholders. Further customer development can be done. These steps are not necessarily chronological.

Once the target market has been defined, the product or service is developed and pretested with the target group. Pretesting involves the entrepreneur trying to gauge the reaction of potential buyers and users of the product and/or service. Pretesting is very important for obtaining feedback and making adjustments based on concrete customer feedback, which can boost profitability potentials and avoid costly mistakes. When the product is deemed to be ready for its targeted market, it is then officially introduced.

Apart from using pre-existing knowledge of the agricultural makeup of a country or region the start-up wants to serve, the best approach is to search for recent publications, for example, by the country's Ministry of Agriculture and international institutions such as the Food and Agriculture Organization of the United Nations (FAO). Information to seek includes a government's priority cash and food crops, and livestock and/or fishery data. This information should also point to the region in which the agriculture activity is taking place. In addition, knowledgeable agricultural experts could be consulted. Similarly, in a quickly developing telecommunications market, one must identify what level of connectivity and models of ICT use exist in the country/region and, more specifically, for the potential target audiences of the proposed service.

ICTs can be leveraged across the agricultural value chain to improve areas including research and development, access to inputs, production, marketing, wholesale distribution, retail and traceability. Therefore, firms need to identify which part of the value or service chain they seek to serve. Dalberg (2013) noted three areas with the highest perceived ICT need within the agriculture sector: supply-chain management; communication, awareness and marketing; and information management. Two ancillary cross-cutting segments that also present opportunities are agricultural finance and risk mitigation (notably through insurance schemes). Start-ups should identify gaps in services offered along the value chain and avoid, if possible, areas where competition is very strong. For example, many apps are developed to improve general access to markets, but most of them struggle to generate revenue. Other areas for which (social) entrepreneurship can be ventured into are agriculture-related sectors such as livestock or fisheries, or issues and segments such as consumption of agricultural products, drone uses, etc. The determining factor, however, should be the existence of actual

needs and the ability to address customer values. Using ICTs in emerging markets requires a broad view of what technology will be used, its availability and whether there are adequate devices within the target population. Table 1 lays out a number of options for mobile-based services.

Table 1: Options for Mobile-based Services

Minimum Delivery Method Requirements	Minimum Device Requirements
Basic: sms	Basic: Basic mobile phone
Intermediate: Interactive Voice Response (IVR)	Intermediate: Basic mobile phone
Advanced: Mobile and web-based applications	Advanced: Feature phone, Smart phone, Tablet

Source: *Woodard et al (2014)*

When determining the likelihood of success in a particular agriprenurship venture, there are three major investigative steps the entrepreneur has to follow: big picture (knowledge of the host country's business environment and macro trends for crop consumption); middle view (identifying what portion of the value chain to focus on and what ICT platform to use); and a start-up-based SWOT analysis.

5. RECENT DEVELOPMENTS IN ICT APPLICATION

Of late, young people are using ICTs as a launching pad for initiation of range of entrepreneurial activities. With ICTs, it is possible to explore low-income generation opportunities; involving telephony and the use of mobile phones, role of young people as information intermediaries, e-commerce and establishment of telecasters. Many of such paradigm shifts have been observed for last one decade and have potential to be generalized for overall entrepreneurship development. Some of the examples worth mentioning are as follows:

Pondicherry-Information Village Research Project: The project was implemented by the M.S Swaminathan Research Foundation, for Pondicherry fisherman. Computers were placed in the village center and connected to the Internet, through which regular weather reports of the Indian astronomical office could be accessed. The weather report is broadcast by loudspeakers and through VHF radios which enabled fisherman to determine low and high tide before sailing off to the sea to fish. This created a lot of agriprenurship development in Pondicherry.

The Farmers Information and Technology Service (FITS-Techno-Pinoy): It is a web-based information service initiative in the Philippines.

FITS aims to contribute to the empowerment of farmers, processors, entrepreneurs and traders and provides information and technology service that facilitate decision-making by rural communities. This leads to improved production, processing, trading and marketing. The initiative intends to link with organizations, networks and technology services and existing resources into a centre near the farmers and uses the Internet, traditional media, and face-to-face information delivery and access at local level. This has opened a new path for rural development in Philippines.

The Mango Information Network (MIN): MIN is a web-based information service that provides information on market outlook, pest management, directory of players in the mango industry, a virtual meeting place and extension research. MIN is relevant to farmers, farmer organizations, co-operatives, frontline agents and entrepreneurs and offers a question and answer service. Simple “fact sheets” are also available in print or accessed on the web. This network has created a lot of entrepreneurship development especially in the field of agriculture and allied fields in Philippines.

The Potato Extension and Training Information System (PETIS): The Faculty of Agriculture of the University of Mauritius has developed this computer based information system. PETIS uses the internet and will test whether rural communities can use the web to access information. The system, destined principally for the small-scale potato growers, is equipped with audio file that provides information in English. Illiterate users have an option that reads the summary of the contents in Creole and Bhojpuri, and icons and pictures that enable most rural users to navigate easily the basic levels on the site. The system has been rated very successful and the research team is now exploring touch screens (Lukeeram et al 2000). This has ushered the path for agriprenurship development especially in the field of potato marketing and cultivation.

In Bangladesh, ICTs have transformed the lives of rural people and village women. The women have started small-scale enterprises, through small loans from the Grameen Bank to buy mobile cell phones that have been used for telephone services and earn them good income. Much of the voice traffic over the cell phones is commerce directed — access to agricultural market prices, access to agriculture trade information, facilitation of remittances from foreign workers, information on work opportunities, using the phone to reduce substantial travel costs (Don Richardson, personal communication 1999).

The Grameen Bank (Bangladesh) has been so successful in

providing jobs to rural poor entrepreneurs and connecting the community to the world, and is being replicated in dozens of other countries. Most buyers are women, and meet weekly to discuss loan payment and other health and development issues. This has created a new group of women entrepreneurs in Bangladesh.

Samaikya Agritech P. Ltd. in Hyderabad, Andhra Pradesh operates 18 “Agritech Centres”, which provide agricultural support services to farmers on a commercial basis. They are permanently operated by qualified agricultural graduates called Agriculture Technical Officers (ATO) and are equipped with computers linked to the head office in Hyderabad through a modem-to-modem telephone connection. Through these centres Samaikya provides technical assistance to member farmers; inputs such as seeds, fertilizers and pesticide, machinery hire, tools and spares for sale; soil and water analyses; weather monitoring; field mapping; weekly field inspections and field visits by specialists. Farmers register with centres and pay per growing season (two or three seasons per year) a fee of Rs.150 (about US\$3) per acre/crop. A farmer registers by the field and receives support services that are specific to the fields registered. On registration, the farmer provides detailed information concerning his farming activities; the information is kept in the centre’s database, providing the basis for the technical support provided.

The centre in the village of Choutkur has 53 registered farmers, covering 110 acres of registered land. This is out of a total of around 1,000 farmers within the centre’s catchment area. Major crops include sugar cane, padi and pulses. Advice from the centres is based on data generated from pre-validated crop cultivation practices adopted in the State and provided by government agricultural services and local institutions. Farming information is up-linked from headquarters to the computers at the centres. If farmers have specific needs for information that cannot be satisfied immediately by the ATO at the centre, then the technician completes an on-line enquiry form on the computer and transmits this via modem to the headquarters. At the headquarters, specialists with more experience and qualifications organize and coordinate replies, which are typically transmitted back to the centre within 24 hours. The database and information systems are operated in the English language. Information is interpreted for the farmer by the ATO. Because some farmers are illiterate, the technicians have to spend time with explanations and descriptions. There is no standard for a computerized Telegu script. Prior to setting up a centre, Samaikya performs a survey of local farming and cultivation practices and ascertains the political and cultural context of the potential centre. It conducts a pre-

launch programme to familiarize farmers with the services. One centre closed down within three months of opening as no farmers registered for the service. This was due to the pressure placed on them by local marketeers, financiers and suppliers of inputs who perceived a threat to their livelihoods from the competing Samaikya services. Farmers were told that anyone who registered with the centre would not receive credit or essential supplies.

7. USE OF MOBILE APPS

Spreading agricultural related information to farmers in the poorest communities are made easier by proliferation of mobile phones. Today, mobile apps and services are being designed and released in different parts of the world. Mobile apps help to fulfill the larger objective of farmers' empowerment and facilitates in extension services which can address the global food security issues. Few mobile apps developed for farmers are:

Kisan Suvidha mobile app provides information on five critical parameters—weather, input dealers, market price, plant protection and expert advisories. An additional tab directly connects the farmer with the Kisan Call Centre where agriculture experts answer their queries. Unique features like extreme weather alerts and market prices of commodity in nearest area and the maximum price in state as well as India have been added to empower farmers in the best possible manner.

Pusa Krishi app helps farmers to get information about latest technologies developed in research labs. This app is actually transferring the technologies from “LAB to LAND”. **Agrimarket** mobile App can be used to get the market price of crops in market within 50 km of the devices location. This app automatically captures the location of person using mobile **GPS** and fetches the market price. **Crop Insurance** mobile app can be used to calculate the Insurance Premium for notified crops based on area, coverage amount and loan amount in case of loanee farmer.

8. CONCLUSION

Strong partnerships must be built with local media stations and organisations to spread awareness and, eventually, garner support. Agriculture is still viewed as a largely subsistence and unprofitable activity. This view affects how innovative pitches, plans and requests for finance are treated. Changing the perception of agriculture from a merely manual, low return, strenuous and purely on-farm activity is a crucial step in altering the fortunes of the sector. The negative perception of the sector is deeply entrenched and is manifested most evidently in terms of the availability of capital and finance in general. The issue of capital and finance for agriculture operates

at both private sector and government level (where already limited youth-oriented finance schemes that spur entrepreneurial ventures do not consider the specific nature of the agriculture sector). In the private sector, agriculture is conceived as a high-risk enterprise and so loan requirements (collateral) and terms (interest, repayment period and general conditions) are onerous (beyond the means of both young and older farmers).

Uptake of technologies at market prices in a sector that has traditionally been heavily subsidized remains challenging, but farmers are prompt to identify what works in their interest and are ready to pay for it. Digital technologies offer the potential to achieve the necessary conditions for scale, with distributed low cost and customized delivery, creating a unique opportunity for private enterprise and innovation to thrive. The challenge before India lies in balancing high growth with inclusive growth; leveraging technology to achieve these twin goals will be a fascinating journey to track.

On the whole, it can be concluded that ICT may be used effectively for a plethora of activities ranging from creation of entrepreneurial skills to successful rural development. The use of ICT and Knowledge Management in the context of rural development has taken a great start from the last one decade and the time is not very far when it will serve as a light house for agriprenurship and rural development in the entire world.

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DEVELOPMENT OF EXPORT ORIENTED ENTREPRENEURSHIP THROUGH BASMATI RICE

Ritesh Sharma and Pramod Kumar Tomar

1. INTRODUCTION

Indian economy is based on agriculture where more than 60 percent population depends on agriculture direct or indirectly. Total agricultural export from India was Rs. 236402/- Crore and Basmati rice and non Basmati rice export share was Rs. 27598/- Crore and Rs. 20336/- Crore, respectively, during 2014-15. The size of the global food trade is about USD 650 billion and India's agricultural export is about USD 10 billion only (1.50% sharing). India has one tenth of world's arable land with diverse agro climatic zone with more 50 major crops, one fifth of world's irrigated land, 3rd largest producer of agri. commodities. India is No. one producer of Tea, Mango, Banana, Cashew, Cauliflower, Okra, Pulses, and Milk etc. India is largest producer, consumer and exporter of spices also and in horticulture products, India has certain competitive advantages. Therefore, India has more opportunities to increase own agriculture export through development of entrepreneurship in agriculture sector and also play a vital role to increase the farmer income and target may come true for **“Doubling the Farmer Income by 2020”**.

WTO regime provides great opportunity for exports and India's entrepreneur can avail more benefit from export of high value products like Basmati rice. Our volume of Basmati export is increasing year by year and crossed 4.0 Million MT. Presently Basmati rice got *GI Tag* and the competition is not too much globally. Only Pakistan which has 14 districts of Punjab is the competitor and the demand of Basmati is from all over the

world. Therefore, Indian farmers and young youth who develop their own business in Basmati GI areas, they have great opportunity in this field.

2. THINGS TO KNOW FOR BECOMING AN EXPORTER

2.1 Type of exporters

- **Merchant Exporter:**

Merchant exporter does not have own manufacturing unit/ processing unit.

- **Manufacture:**

Procure and process raw material at his factory and exports finished products

- **Service Provider:**

One who provides export service like health care, consultancy, software, hotels etc.

In India, anyone can be registered as exporter; it is a very simple procedure for registration with Directorate General of Foreign Trade (DGFT) based on Import Export Code (IEC) issued by DGFT.

2.1.1 DGFT (Directorate General of Foreign Trade)

DGFT is an organization under ministry of commerce & industries, first and foremost work is to formulate foreign trade policy and its implementation. DGFT also organize training of entrepreneur through “**Niryat Bandhu Scheme**” and runs various incentivize schemes for the exporters also issues IEC (Import Export Code) which is PAN Based 10 digit code IEC is the basic requirement for commercial trade. For IEC form ANF2 can be filled both offline and online at webpage of dgft.gov.in.

2.2 Starting export

For starting as an export company, you need to name your company with logo and website. After issuing IEC you may become an exporter and may export any goods but for agricultural export, the registration with APEDA, Ministry of Commerce & Industries, Government. of India is mandatory. APEDA is established by an Act of Parliament in 1986 having head quarter at New Delhi and 5 Regional offices at Mumbai, Bangalore, Hyderabad, Kolkata and Guwahati. The mandate of APEDA is promotion of export oriented quality production; facilitate Market Access, development of Infrastructure, market development and promotion and financial

assistance to exporters. The registration with APEDA, which called RCMC is also a very simple process. It is based on IEC, application can be done online or offline for RCMC.

2.3 Data mining

Data mining is important to know the Size of world market of export product, trend of market, competitors, tariff barriers, sanitary phytosanitary issues for particular country and to get suitable buyer and country.

2.4 Buyer management

It is most important aspect in international trade and known about below points.

- ☐ Identify buyer and procure order.
- ☐ Sign the contract with clear pricing, freight charges, payment terms etc.
- ☐ Production and supply management
- ☐ Realization of payment.
- ☐ Delivery of goods and follow up.

2.5 INCO Terms

The Incoterms or International Commercial Terms are a series of pre-defined commercial terms published by the International Chamber of Commerce relating to international commercial law. You have to negotiate a sale contract with buyer before any trade happen. There are some terms likes FOB (Free on Board), CIF (Cost insurance & freight) etc. Inco terms were published by international chamber of commerce in 1936 and from time to time. They are widely accepted terms in domestic and international trade. These terms defines task, responsibility, cost, risk including cost and insurance. Inco terms significantly reduces misunderstanding among traders hence minimize the litigation.


INCO TERMS EXAMPLE

Free on Board ... (Named part of shipment)

Seller/ Exporter Premises	Export document formalities	Dispatch at named place of destinatio n frontier terminal /quay	Loading part of shipment	Onload ship rail ship rail	Discha rging part of arrival	Delivery at named place of destination frontier terminal / quay	Import document formalities	Buyer / importer premises
Seller's Risk				Buyer's Risk				
Seller's Cost				Buyer's Cost				

2.6 Payment Terms

Payment is the base of any trade. Best scenario is your payment before supply of goods. Ensure that your payment is safe as delay or default payment can disturb your trade cycle, so make clear payment terms in sale contract. Type of payment terms are described with risk factor as below:

E	100		Consignment
X	.		Payment will be made after goods being sold in import country
P	.		
O	.		Open Account
R	.		Delivery first before payment
T	.		
E	.		Collection
R	.		Delivery first before payment (through Bank)
R	.		Letter of credit
I	.		A guarantee for payment by Bank
S	.		Advance payment
K	0		Pay first before delivery

2.7 Status holder

Status holders are business leaders who have excelled in international trade and have successfully contributed to country's foreign trade. Exporters have to achieve exporter performance during current and previous two financial years. The exporter performance will be counted on the basis of FOB value of exporter earnings free foreign exchange; Double weightage for MSME, manufacturing units having ISI, BIS, one star exporter house.

Category	Export performance
One star export house	US\$ 3 million
Two star export house	US\$ 25 million
Three star export house	US\$ 100 million
Four star export house	US\$ 500 million
Five star export house	US\$ 2000 million

2.7.1 Privileges of status holder

- SION norms may be fixed on priority within 60 days by the norms committee.
- Exemption from furnishing of bank guarantee for schemes under FTP, unless specified otherwise.
- Two star and above export house shall be permitted to establish Export warehouse as per DOR guidelines
- Three star and above export house shall be entitled to get benefit of Accredited Clients programme as per CBEC guidelines.
- Manufacturers who are also status holders (3 to 5 star) will be enable to certify their manufactured goods as originating from India with a view to quality for preferential trading under FTAS, PTAS etc.

3. STATUS AND PROSPECTS OF BASMATI RICE EXPORT

Basmati rice is long grain aromatic rice grown from many centuries in the specific geographical area of the Himalayan foot hills of Indian sub-continent, blessed with extra-long slender grains that elongate at least twice of their original size with a characteristics soft and fluffy texture upon cooking, delicious taste, superior aroma and distinct flavour. Basmati owes its origin to confined pockets of low land rice fields of North West India and adjoining area of Pakistan because of its high photo-thermal sensitivity where it has been existing as a specialised ecotype. It drives its literary meaning from Dogri/Punjabi (Basana= aroma and Mati= More) a rice, rich in aroma. The earliest mention of Basmati rice is available in the epic Heer and Ranjha composed by Punjabi poet Varish Shah in 1766. The Basmati rice is defined as

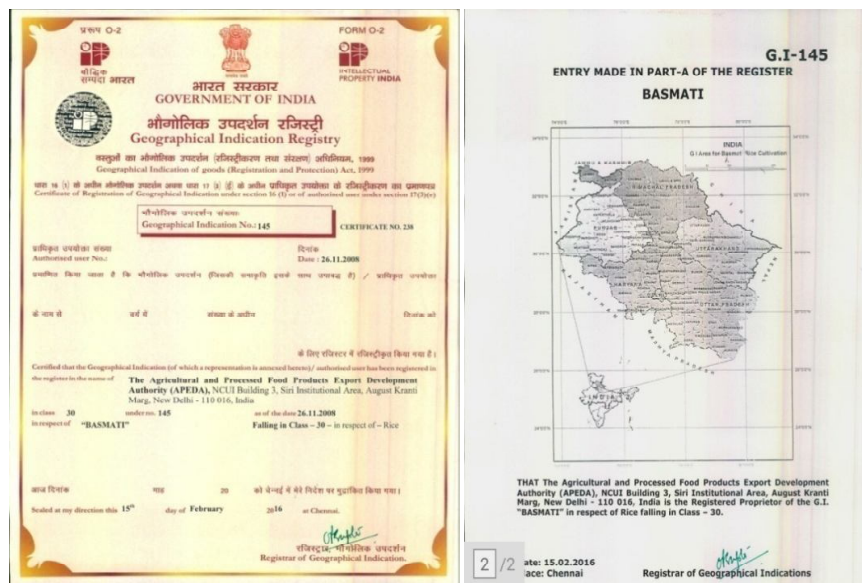
“ All aromatic rice are not Basmati but all Basmati rice are aromatic”

OR

“ Basmati is a small group of aromatic rice, traditionally grown in certain geographic regions at foot hills of Himalaya”.

Basmati rice has delicious taste, aroma and distinct flavour. This quality pulled to consumers and consumer's number increase day by day in whole universe. India has got GI certificate in February 15, 2016 for Basmati rice. The Geographical Indication registration No. is 145. For Basmati rice cultivation only two countries Pakistan and India has GI Certificate, Pakistan

has 14 districts only and India has 93 districts in GI area for Basmati rice production. These 93 districts belong to seven states; J&K, Himachal Pradesh, Punjab, Haryana, Delhi, Uttarakhand and West Uttar Pradesh. India is the leading exporter of the Basmati rice to global market. From India, Basmati is exported to Saudi Arabia, UAE, European Union countries,



USA, Canada, UK, Germany, Australia, Austria, Russia, Singapore, Iran, Kuwait, Bahrain, Spain, Italy, France and Denmark. .

3.1 Characteristics of Basmati rice

Characteristics	Standards
Minimum average pre cooked milled rice Length	6.60
Average precooked milled rice breadth (mm)	< 2.00
Minimum L/B ratio of precooked milled rice	3.50
Minimum average cooked rice length (mm)	12.00
Minimum elongation ratio	1.70
Average volume expansion ratio	>3.5
Aroma	Present
Amylose content	20-25%
Alkali spreading value (ASV)	4.0-7.0
Minimum brown rice recovery	76%

Minimum milled rice recovery	65%
Minimum head rice recovery	45%

3.2 Status and comparison of Export of Basmati and non Basmati rice

India ranks first in rice export and second in production after China (first producer). Basmati rice is growing only in India and Pakistan in whole world. India produces more than 80% of total production of Basmati rice and export in more than 145 countries in world. It is good luck of Indian farmers that only two countries produce to Basmati rice and rest all are consumers. Basmati rice gained per unit more foreign money compared to non Basmati rice 136.71%, 126.40% and 149.45% more than non Basmati rice during 2015-16, 2016-17 and 2017-18, respectively.

3.3 Comparison of Non Basmati rice and Basmati rice export quantity & value

Year	Non Basmati rice			Basmati rice		
	Quantity (Million MT)	Value (Lakh Rs)	Price (per kg)	Quantity (Million MT)	Value (Lakh Rs)	Price (per kg)
2015-16	6291109	1492874	23.73	4031168	2264584	56.18
2016-17	6672755	1592450	23.86	3984176	2152182	54.02
2017-18	8648488	2296782	26.56	4056758	2687017	66.24

4. Varieties of Basmati rice

Basmati rice from the Indian sub-continent is highly priced in the International and domestic markets for its unique quality. The traditional Basmati varieties are tall, prone to lodging, photoperiod and thermo sensitive and low yielding. Now a number of Basmati varieties are available for cultivation as a result of breeding programme initiated at various SAUs and ICAR institutions. At present 30 varieties of Basmati rice have been developed, released and notified for commercial cultivation (Table 1).

Table 1. Basmati rice varieties

S. No.	Varieties	Name of the institutions
1.	Basmati 370	Rice Farm, Kala Shah Kaku (Now in Pakistan)
2.	Type -3 (Dehraduni Basmati rice)	Rice Research Station, Nagina, UP
3.	Taraori Basmati (HBC -19 or karnal Local)	Rice Research Station, (CCS-HAU), Kaul, Haryana

4.	Basmati 217	Punjab Agriculture University, Ludhiana, Punjab
5.	Ranbir basmati	Shere-e-Kashmir University, Regional Agriculture Station, R S Pura, Jammu
6.	Basmati 386	Rice Research Station, Kapurthal, Punjab Agricultural University, Ludhiana, Punjab
7.	Punjab Basmati 1	Punjab Agricultural University, Ludhiana, Punjab
8.	Pusa Basmati -1	IARI, New Delhi
9.	Kasturi	Directorate of Rice Research Hyderabad, AP
10.	Haryana Basmati	Rice Research Station, (CCS-HAU), Kaul, Haryana
11.	Mahi Sugandha	Rice Research Station, RAU, Baswara, Rajasthan
12.	Pusa Basmati 1121	IARI, New Delhi
13.	Improved Pusa Basmati 1	IARI, New Delhi
14.	Vallabh basmati 22	Sardar Vallabh Bhai Patel University of Agriculture and Tech., Modipuram, Meerut,
15.	Pusa Basmati 6	IARI, New Delhi
16.	Punjab basmati 2	Punjab Agricultural University, Ludhiana, Punjab
17.	Basmati CSR 30	CSSRI, Karnal, Haryana
18.	Malviya Basmati Dhan	BHU, Varansi, UP
19.	Pusa Basmati 1509	IARI, New Delhi
20.	Vallabh basmati 21	SVPUAT, Modipuram, Meerut, UP
21.	Vallabh basmati 23	SVPUAT, Modipuram, Meerut, UP
22.	Vallabh basmati 24	SVPUAT, Modipuram, Meerut, UP
23.	Basmati 564	SKUAST, Jammu
24.	Pusa Basmati 1609	IARI, New Delhi
25.	Pant Basmati 1	G B Pant University of Agriculture and Technology, Pantnagar, U S Nagar, Uttarakhand
26.	Pant Basmati 2	GBPUA&T, U S Nagar, Uttarakhand
27.	Punjab Basmati 3	PAU, Ludhiana, Punjab
28.	Pusa Basmati 1637	IARI, New Delhi

29.	Pusa Basmati 1728	IARI, New Delhi
30.	Pusa Basmati 1718	IARI, New Delhi

5. COMPARATIVE ECONOMICS OF CULTIVATION OF BASMATI AND NON-BASMATI RICE

The detailed cost of cultivation of Basmati and Non Basmati rice is given in Table 2.

Table 2. Economics of Basmati and Non-Basmati Rice Production

S. No.	Particulars	No/Qty.	Basmati rice	No/Qty.	Non-basmati rice
1	Nursery Preparation				
A	Seed	20Kg.	1500	30 kg	1500
B	Fungicide	100 gr.	60	100 gr.	60
C	N:P:K	15Kg	300	15Kg	300
D	Urea	10 Kg	80	10 Kg	80
E	Zinc	2Kg	110	2Kg	110
F	Other(preparation of nursery area)		1000		1000
2	Land Preparation				
A	Land rent		32000		32000
B	Ploughing	2	1600		1600
C		2	1600		1600
D	Puddling	1	2400		2400
E	N:P:K	150Kg	3000		3000
F	Bunding	-	600		600
3	Transplanting	1Time	8000		6250
4	Fertilizer				
A	Urea(Twice)	150Kg	1200	250Kg	2000
B	Zinc	20Kg	1100	20Kg	1100
C	Zyme	20Kg	800	20Kg	800
5	Pesticide				
A	Weedicide charges		2000		2000

B	Insecticides		2820		2820
C	Fungicides		2140		600
D	Spray charges	10	3000	10	2000
E	Field cleaning	10	3000	5	1500
6	Harvesting & Threshing	-	8000		6000
7	Winnowing & Packing	-	3600		3600
8	Water Charge	6 Month	6000	6 Month	4000
9	Transport Charge	45 Qtls	2250	60 Qtls	3000
10	Total Cost		88160		79920
11	Cost of production (Rs./Qtl)		1959		1332
12	Total Income	45 Qtls @3000/-	135000	60 Qtls @1550/-	93000
13	Benefit		46840		13080
14	Benefit per qtl		1040		218

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PROSPECTS OF SEED ENTREPRENEURSHIP IN INDIA: AN OVERVIEW

Arun Kumar MB and Sherry Rachel Jacob

1. INTRODUCTION

Agricultural entrepreneurship is a dynamic sector which flourished with the liberalization movement, in both developed and developing countries. India too has gained significantly from the entrepreneurship opportunities created up by the open global market, in the past few decades. With more than 60% of the population dependent on agriculture sector, the emergence of agricultural entrepreneurs and related ventures were inevitable and our country currently has a commendable number of such enterprises. Within the agricultural sector, seed industry serves as a major catalyst for boosting agricultural production and productivity. The Indian seed sector is today valued at around Rs 20, 000 crores, with significant contribution from both public and private organizations. The major public sector organizations that are involved are the National Seed Corporation, State Farms Corporation of India and the 13 State Seed Corporations (SSC). They mainly deal with high yielding varieties of food crops that define the national production targets. The major players in the private sector are the Indian subsidiaries of 15 multinational companies, but the largest number belongs to unregistered small firms that function locally. The fact that both public and private sectors have prioritized and established themselves in separate components of the seed industry (Public sector gives thrust on high volume crops whereas, the private industry dominates the low-volume, high-value seed sector), has also facilitated a no-conflict modus-operandi in this industry, due to which there is a positive entrepreneurial environment.

2. SCOPE OF SEED ENTREPRENEURSHIP IN THE CURRENT INDIAN SCENARIO

Though the seed network in India is comparatively well established and strengthened by reputed institutions that provide scientific support, there has always been a persistent gap in the availability of quality seeds in all major crops. Since seed is the key input that triggers enhancement of agricultural productivity, it is imperative to focus and promote the seed scenario, in order to address the existing concern of feeding the ever increasing population of our country. A primary factor that holds down our crop production potential is the very low seed replacement rate (SRR) that is practiced in all crops, across all states. Though there have been consistent efforts to enhance the SRR in major crops, through the national seed network, by making available quality seed material, it has become quite evident that a single window approach is not sufficient to tackle this chronic problem that is overshadowing our agricultural progress. The small and marginal farming section that occupies the major share of our agricultural landscape has not been able to avail most of the facilities or resources that have been offered as an attempt to boost our agricultural productivity. Either the information dissemination had failed, or quality seeds have not reached all corners of our country or many times, the price was not affordable to the small or marginal farmer. But it is also a known fact that the farmers are willing to invest in quality seed material, if they are assured of proportionate returns. It is because of this reason that these small scale farmers have been victims of spurious trade and dealers of spurious seeds are now a common occurrence in local markets. Such negative experiences inhibit many in the farming community from adopting new varieties and seed materials and they safely opt for the farm saved seeds, thereby, hampering the SRR and subsequently, our crop productivity.

This major gap in seed availability is hence, the ideal opportunity for entry and establishment of seed entrepreneurs. The entrepreneurship need not be restricted to seed production *per se*, since seed sector involves diverse components with equal investment strengths.

3. POTENTIAL ENTREPRENEURIAL AREAS WITHIN SEED SECTOR

Seed production of promising hybrids/ parental lines/ varieties:

The hybrid seed market is an ever-expanding market in India, especially in the case of horticultural crops. The vegetable seed market is valued at Rs 4000 crore and is reported to grow at the rate of five per cent.

Hence, it offers a most viable arena for entrepreneurial ventures. The diverse requirement of varieties in every locality helps in accommodating any level of competition.

Seed processing:

The post harvest handling of seed material is the most crucial stage for maintenance of seed quality. It requires knowledge, skill and suitable infrastructure, which is specific to the geographic location and the crops that are to be processed. This step is also important in the context of value addition. A proper scientific support and liaison with research organizations will help in incorporating technologies for enhancing the quality of the seeds and thereby fetching premium price in the market. For example, by including techniques like seed coating, seed priming, polymer film coating etc., the entrepreneur can create a brand value for the product and thereby occupy a niche market space.

Seed storage cum marketing hub:

Our tropical climatic conditions do not permit safe storage of seeds under ambient conditions and it is important to have regulated temperature and humidity conditions for storing the seed material. Such facilities are currently inaccessible for the small and marginal farmers, whose produce is channelized in a very fragmented manner, in the market. A regional seed storage facility, which is linked to the local market, is the need of the hour. It can serve the two-way- purpose of storing the produce of contract seed production ventures in that region and also, serve as a safe storage for processed products that are mobilized from different sources. In this era of cloud based technologies, such seed storage enterprises can adopt strategies, maybe on a smaller scale, from the likes of Amazon, Flipkart etc and convert the storage facility into a warehousing venture that can deliver seeds to farmers' door-step, based on demands placed over phone.

Seed information hub:

All seed related activities require an efficient knowledge-support system which is not easily available to the farmers in every corner of our country. Timely dissemination of information has been mostly hindered due to the insufficient number of extension personnel who can effectively convey technical information to farmers in each locality or due to lack of availability of proper scientific information. All these drawbacks can be compensated by using latest technologies where communication in any regional language can be done from a centralized location. The farmers may just have to give a missed phone call and they can obtain the required information over a

returned phone call. A tie up with the private telephone service providers is essential in this case.

Input delivery enterprise:

As in the case of seed storage warehouse, a more extensive input delivery service can also be a promising venture. It can include seeds, pesticides, minor farm machinery, packaging material etc. Many of such essential items are generally not available in every local market and hence small and marginal farmers compromise by using low-grade inputs. By utilizing cloud based technologies, the entrepreneurs can establish and operate from any place and yet, ensure a wide market, by accepting demands made online or through phone calls.

Community seed banks:

This venture is more of an ethical responsibility, rather than a commercial enterprise. With the entry of high yielding varieties, there is a sharp decline in the crop diversity and varietal diversity in every agro-ecological zone. Local landraces, traditional varieties and farmers varieties are no longer available in the fields. These resources are very important in the context of breeding for pest and disease resilience. Several minor crops like minor millets, pseudo-cereals and unique indigenous legumes which are highly nutritious have vanished from fields and from our cuisine. A targeted effort need to be made to sensitize farmers in re-introducing these crops in their farms and such community seed banks will be the ideal hub for supply of seeds and maintenance of seed stocks. Since only a nominal charge can be taken from farmers, there need to be a tie-up with a proper funding source. Since firms like ITC, Infosys etc have forayed into rural ventures; there is a high probability of finding potential collaborators. By incorporating an organic production system, there will be an added possibility of an export tie-up.

4. WHO CAN BE THE SEED ENTREPRENEUR?

In India, the agricultural universities produce a large number of professionally qualified graduates, who find it difficult to get employed in their skilled areas. Only a minor percentage of this huge manpower pursues higher education or gets absorbed by the state agricultural department. The rest of these trained human resources are currently spread out in diverse career areas, where their knowledge and skills are mostly underutilized. These agricultural graduates are the most potential candidates for such entrepreneurial ventures. They can form groups where they can involve people with experience in specific seed sector areas by virtue of their

temporary work experience in private firms. Moreover, this is the era of business startups and the policy environment too is favorable. If the individual has the right attitude to face the challenge and also form a team that has a good knowledge base, the entrepreneurial venture would surely be successful. Once the entrepreneurial management team is set up, then both skilled and unskilled manpower will be required for its execution.

5. BASIC REQUIREMENTS FOR INITIATING A SEED ENTREPRENEURIAL VENTURE

1. *Field survey*: The success of entrepreneurial ventures depends on the decision making ability of the team, which should be based on their knowledge and experience. Though seed sector is ubiquitous in its presence, each locality zone has a specific requirement that is primarily based on the agro-climatic conditions and cultivator's subjective choices. Therefore, the first step in any seed venture should be an elaborate field survey, which should focus on collecting local information about-

- a. Cultivar preferences in each crop
- b. Acreage under each crop/variety
- c. Existing SRR for crops
- d. Demand- supply dynamics of quality seed material and their local sources
- e. Areas where there is need for scientific intervention
- f. Financial status of the farmers
- g. Marketing information

Based on this survey, a demand forecasting strategy should be developed because for a successful seed enterprise, the output should be in sync with the demand for the product/service

2. *Manpower*: As discussed above, there is no dearth of professionally trained manpower, in the agricultural sector. A strong team with individuals having knowledge/expertise or traditional experience (in both skilled and unskilled components) is essential for the success of the venture.
3. *Networking with institutions*: The success of any agricultural enterprise will depend on the extent of scientific and precision technologies that were employed by the enterprise, as compared

to the already existing ones. Such scientific intervention cannot be achieved in isolation. Efforts should be made to create a liaison with agricultural research organizations, state agricultural universities and Krishi Vigyan Kendras and their field-tested technologies that are relevant for the enterprise should be adopted and implemented. For eg., a seed processing unit can adopt a seed film coating technique that guarantees better field emergence, which has been validated by a public sector organization, since there won't be any patent issues involved.

4. *Financial investment*: This is the most crucial component in initiating an enterprise. But due to the positive policy environment, currently funding is available from several sources like the NABARD, Ministry of Small Scale Industries, National Horticultural Mission and National Food Security Mission. Several commercial banks are also providing lucrative loan schemes for such investment ventures.
5. *Marketing strategy*: Based on the information gathered during the survey, a well laid-out plan should be developed for marketing, if the enterprise involves production of seed for sale or of any seed related services. The success of Gujarat's Dairy Co-operative and Maharashtra's Sugar Co-operative lay in its marketing strength. Cloud-based technologies, internet and the extensive mobile phone connectivity should be fully exploited for the best marketing coverage, even from remote locations.

There are several upcoming seed entrepreneurs who have even made entry in the export market. The risks and challenges of any business enterprise, exists in this case as well. But one should always remember that 'Nothing can withstand the power of the human will'.

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MUSHROOM PRODUCTION FOR SUCCESSFUL ENTERPRISE DEVELOPMENT

Chandra Bhanu and Veena Yadav

1. INTRODUCTION

Mushrooms have been recognized as valuable health food and contain almost all essential components of a balanced diet. They are rich in highly digestible lysine rich protein (12-37% on dry wt. basis), vitamins and minerals, dietary fibers, lacking fat and low in carbohydrates (low calorie food). The mushroom protein contains almost all essential amino acids in balanced proportions as denoted in FAO reference proteins (Chaube, 1995). Mushrooms are rich in vitamin B (folic acid, thiamine, riboflavin, niacin, biotin, pantothenic acid etc.), C, D and K. Their alkaline nature and presence of dietary fibers protect from digestive ailments and strengthening the human immune system. Some mushroom species contain complex polysaccharides (β -1,6 glucan etc.) which provide anti-tumor and immune-modulating properties. Mushrooms are also used for several medicinal purposes right from tonic food to anti-cancerous and anti-aids medicines (Bhanu *et al.*, 2001).

Mushrooms are very fit food supplement for resource poor peoples as a high protein food and also for rich peoples as a low calorie, cholesterol free food. The incorporation of mushrooms in the diet will be very helpful in overcoming protein malnutrition in the developing countries like India, where nutritional security is still a big challenge particularly among small farmers and other resource poor peoples. As the increasing population imposes more and more pressure on pulses, milk, fishery and meat sectors for fulfilling its protein requirements, the mushrooms have very great potential to bridge

the protein gap in Indian diet. This high protein production potential of mushrooms lies in the fact that, by utilizing vertical space, one can produce 100 times more protein in the form of mushrooms than the conventional agriculture or animal husbandry (Singh, 2011).

2. NATIONAL AND INTERNATIONAL SCENARIO OF MUSHROOM PRODUCTION

The world production of mushrooms was 3.41 million metric tons in 2007 and China being the highest producer accounting 46% (1.57 million metric tons) of total world mushroom production. Other leading countries were USA, Netherlands, Poland, Spain, France, Italy, Ireland, Canada, UK and Japan. The major mushroom species include *Agaricus* spp., the button mushroom (31.8%), *Lentinula* (25.4%), *Pleurotus* spp., the *Dhingri* mushroom (14.2%), *Auricularia* spp. (7.9%), *Flammulina* sp. (4.6%) and *Volvariella* spp., the straw mushroom (3.0%). A India which was producing about 40,000 metric tons of mushrooms in 1996-97 is now showing a great jump with more than 1 lakh metric tons mushroom production per year (Wakchaure, 2011; Tewari and Sharma, 2010). However, the majority of mushroom production in India is contributed by the export oriented industrial scale units. These units perform forced cultivation mainly of white button mushroom with temperature and humidity control at very high production cost. Only three species *Agaricus* spp. (100683 Metric tons), *Pleurotus* spp. (6399 Metric tons) and Milky mushroom, *Calocybe indica* (920 Metric tons) are grown at commercial scale in the country. There is tremendous scope for boosting the mushroom production in the country by involving marginal and small farmers with location specific mushroom species and production technologies on the line of China. Looking for the diverse Agroclimatic conditions in the country, there is tremendous scope for increasing mushroom production by diversifying mushroom species especially the specialty mushrooms as prevalent in China.

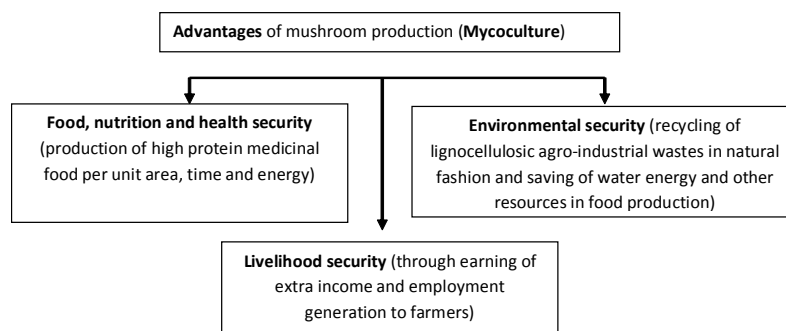


Fig.1. Advantages of mushroom production (Mycoculture)

3. MUSHROOM PRODUCTION SYSTEMS IN INDIA

The mycocluture history in India is about five decades old. The mushroom cultivation systems in the country are summarizes as under:

3.1. Marginal Grower's cropping system

The mushroom cultivation is strictly a seasonal activity and farmers are taking 1-3 crops per season as per the availability of desired temperatures. Locally available agrowastes and other raw materials are used as substrate. Cropping rooms are made-up of local tree/grass materials like bamboo, sugarcane leaves and rice straw etc. The shelves or racks are constructed using bamboo, plywood, twigs, *sarkanda* etc. Mainly button mushroom is grown which is followed by dhingri, milky and paddy straw mushrooms at some locations. Long method of composting is common with 14-16kg mushroom yield per quintal of compost in 8-10 weeks of cropping in case of button mushroom. Seed is purchased from commercial spawn production units. The produce is sold in surrounding markets and nearby cities. Small cropping rooms (40'x20'x12-14' to 30'x17'x10-12') with 3-4 tiers of racks and 5-6 tons of compost are generally used. Casing is prepared using FYM and local soil with formaldehyde treatment. The yield potential of this system is very low and farmers are growing mushroom as a source of additional income along with their usual farming. The cleanliness and hygiene are not maintained properly, hence the attack of diseases and pests are common.

3.2 Small Grower's cropping system

A large number of mushroom growers are taking seasonal crops of mushroom by converting their older buildings into mushroom crop rooms or inside specially constructed crop rooms (40'x20'x12') for the purpose. Depending upon prevailing temperatures, 1-3 crops are taken per season. Long method of composting is generally followed or compost is purchased from big industrial units. Wooden trays or metallic racks were earlier common, but are being replaced now by polythene bags. Seed is purchased from commercial spawn production units. An average yield of 16-18 kg per quintal compost is generally obtained. The produce is generally sold in local markets of big cities. The cleanliness and hygiene are better than the marginal growers hence; better yield is obtained in this case.

3.3 Big Grower's or Industrial scale cropping system

In this case mushroom (mainly button mushroom) is grown inside controlled crop rooms with temperature and humidity controls. The size of crop room varies from 35'x35'x12' to 83'x17'x12'. Compost is prepared in

bulk pasteurization tunnels with short method. Metallic wire racks with 4-5 tiers are used for polythene cropping bags. Around 20 tons of compost is accommodated in each crop room. The yield varies from 18-20kg per quintal of compost within a harvesting period of 40-42 days. This system is harvesting maximum yield potential of mushroom with high degree of cleanliness and hygiene and very less pest and disease attack. Big growers are mainly export oriented units with their own canning or processing and spawn production units.

The marginal and small growing systems have great potential for diversification of farming system through increased emphasis on specialty mushrooms (species other than button mushroom) along with button mushroom. Since button mushroom cultivation is fit only to Northern parts of the country during winter season, the inclusion of specialty mushrooms (with high bioconversion efficiencies: 100-150%) will give a round year production system for entire agro-ecological zones of the country. The location specific technological interventions for growing specialty mushrooms will be very helpful in increasing the income of farmers, generating round the year employment and finally livelihood security which are main concerns with resource poor small and marginal farmers. The plenty of labour force with these systems can be utilized for myciculture at a cottage level along with their traditional farming systems.

4. THE POTENTIAL OF MUSHROOM CULTIVATION IN INDIA

India has vast potential for mushroom production due to abundant availability of lignocellulosic agrowastes, cheaper manpower and input resources and diversified agroclimatic conditions which is flexible for growing a variety of mushroom species. The potential of mushrooms in the country can be emphasized under following heads:

4.1 Recycling of agro-wastes

India produces about 600 million tons of lignocellulosic agricultural wastes annually and majority of it is either decomposes naturally or used for fuel wood for cooking or burnt *in situ* (Table1). These activities also pose the problems of environmental pollution. On the utilization of only 1% of these agro-industrial-wastes India can produce about 3.0 million tons of mushrooms annually which will be a major share to the total world production of mushrooms. An additional 15 million tons of compost will also be produced which can complement the crop production through improved manuring.

Table 1: The agro-wastes production in India, their major uses and potential for mushroom cultivation

Crop	Grain-straw ratio	Annual production (million tons)	Major uses	Potential as substrate for mushroom species
Rice	1:1.5	85	Animal feed, thatching	Button, Dhingri, paddy straw, milky, wood's ear mushrooms
Wheat	1:1.5	130	Animal feed	Button, Dhingri, wood's ear, milky, reishi mushrooms
Maize	1:1.0	30	Animal feed, thatching	Dhingri, wood's ear mushrooms
Pulses	1:1.0	13.14	Animal feed, thatching, fuel wood	Dhingri, wood's ear mushrooms
Sugarcane	1:0.2	186 (bagasse)	Fuel wood	Button, Dhingri, wood's ear mushrooms
Oil seeds	1:2.0	25.58	Fuel wood, thatching	Dhingri, wood's ear mushrooms

Other agrowastes include millets straw, cotton waste, wastes of coconut and jute, tea wastes, saw dust, forest woods and other agro-industrial wastes which are suitable for production of various mushroom species

(From Bhanu, 2000; Tarafdar and Yadav, 2009; Tewari and Sharma, 2010)

4.2 Use of vertical space for cropping and suitability for landless and marginal farmers

Mushroom cultivation is highly economical on land, area and time. It does not need arable land, since it is not cultivated in soil and hence non productive lands can be efficiently utilized for its cropping. Cultivation of mushrooms is done in tiers, utilizing vertical space, thus it is a fit component for small and marginal systems and particularly in hilly, tribal, plateau and other unproductive areas. The production per unit area of mushrooms is many times higher than the field crops. Due to shorter cropping duration of most of mushroom species, it highly productive per unit time and economical in terms of water, labour and energy requirements. Obviously, this enterprise is an ideal activity for landless, marginal and small systems.

4.3 As an economic activity for livelihood security

Mushroom production is an economically viable enterprise in the

farming system. It can be adopted by landless, marginal, small, medium and big farmers by investing few thousands to lakhs or even crores of rupees depending upon their investing capacity. Besides high profit, mushroom production starts giving returns within very short time. Marginal farmers of the mountain region, tribals of the forestlands, and even landless labourers may also take up mushroom production at a small scale to earn for their livelihood and nutritious food for their families. Mushroom cultivation is labour intensive and generates employment. Various activities of this enterprise like spawn production, crop production, processing and marketing can be carried out by women-folk and the farmers may involve their family members to augment their income. Thus, mushroom production is a highly profitable

4.4 As an eco-friendly activity

Mushroom cultivation is basically a recycling process which produces highly nutritious food from agricultural, horticultural, forest, animal residues/wastes and other agro-industrial wastes. In addition, the spent substrate left over after the crop harvest is also invaluable, since it ameliorate the exhausted soil by improving its texture, water holding capacity and nutrient status. The spent compost of button mushroom is comparable to FYM in terms of nutrient. It can be utilized for reclamation of soil, as a good manure in horticultural crops, bioremediation of contaminated soil and water, management of some diseases of crops, regrowing of mushrooms, animal feed, biogas production and other uses (Ahlawat, 2011). As per one estimate, 5% and 25% spent compost of button mushroom by volume, are sufficient to meet the P, K, and N requirement of crops respectively (Verma, 2007). Hence the spent mushroom substrate can potentially replace the inorganic fertilizers with organic one and promote the organic agriculture.

4.5 Round-the-year cropping

In contrast to field crops, mushroom production can be done round the year, since they do not require sunlight and are cultivated indoors under controlled conditions and not exposed to climatic variations outdoors. There are different species of mushrooms fitted to different climatic conditions of various locations of India and can be scheduled in production module in year-round-fashion (Table 2) without investing on climate control facilities. Hence, this enterprise can provide year-round employment to farmers.

Table 2: Suitability of various mushroom species to different temperature range

S.No.	Mushroom species	Common names	Temperature range (°C)	
			For spawn run	For cropping
1.	<i>Agaricus bisporus</i>	Button mushroom	23-25	14-16
2.	<i>A. bitorquis</i>	Summer white button mushroom	28-30	25
3.	<i>Pleurotus</i> spp.	Dhingri mushroom	25-30	22-26
4.	<i>Calocybe indica</i>	Milky mushroom	25-30	30-35
5.	<i>Volvariella</i> spp.	Paddy straw mushroom	32-34	28-32
6.	<i>Lentinula edodes</i>	Shiitake mushroom	22-28	12-20
7.	<i>Auricularia</i> spp.	Wood ear mushroom	20-30	20-30

4.6. Mushroom cropping vs. natural calamities

Most of agricultural crops are prone to the destruction caused by various natural calamities like heavy precipitation, drought, cold, floods etc. leading to medium to complete losses of farmer's livelihood depending upon the intensity. Mushrooms being the indoor and short duration crop have an advantage in such situations also, either it escapes such damage or even if it is damaged, a fresh mushroom crop as an emergency source of food and income can be re-started within a short time.

5. MUSHROOM PRODUCTION MODULES

Mushroom cultivation involves a number of operations. While, some big growers undertake all the required operations, others are involved in only one operation or one step of the entire production cycle. Some culture collection units provide culture only, spawn (seed) production units involved only in mass production of spawn, and some units produce compost (substrate) only. Some of the prevalent and possible modules are may be as follows:

1. Culture producers → Spawn producers → Compost/substrate producers
Crop growers → mushroom sellers
2. Culture and spawn units → composting, growing and marketing units
3. Spawn producers → compost producers → growing and marketing
4. Spawn and substrate producers → individual/co-operative grower and seller

Further each of above activities of mushroom production has the full time employment and income generation potential (Fig.2).

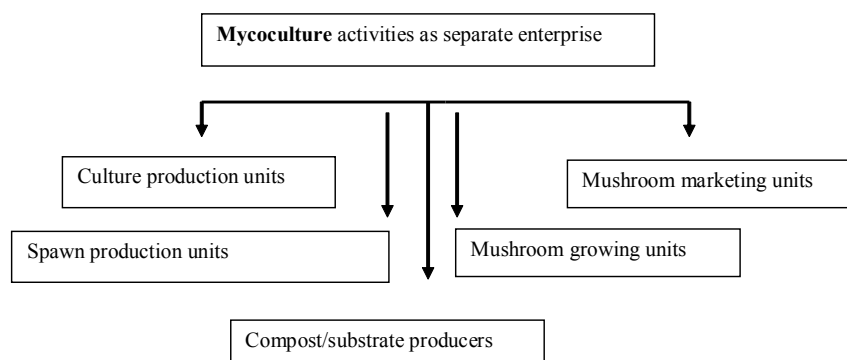


Fig.2. Mycoculture activities as separate enterprise

5.1 Mushroom production systems for India

In India the possible agri-systems which include mushroom production may be the followings:

1. **Agri-mycoculture system:** involves field crops+ mushroom production (for most of farmers)
2. **Agri-horti-mycoculture system:** involves field crops+ fruit crops+ mushroom production (for most of farmers)
3. **Silvi-mycoculture system:** involves forest crops+ mushroom production (for tribal areas)
4. **Agri-horti-silvi-mycoculture system:** involves field crops+ fruit crops+ forest crop+mushroom production (for technically skilled farmers having agri-horti-silviculture and organic production system)
5. **Agri-horti-silvi-myco-vermiculture system:** involves field crops+ fruit crops+ forest crop+mushrooms+vermicompost production (for organic farmers)

6. COST-BENEFIT STATUS OF DIFFERENT MUSHROOMS

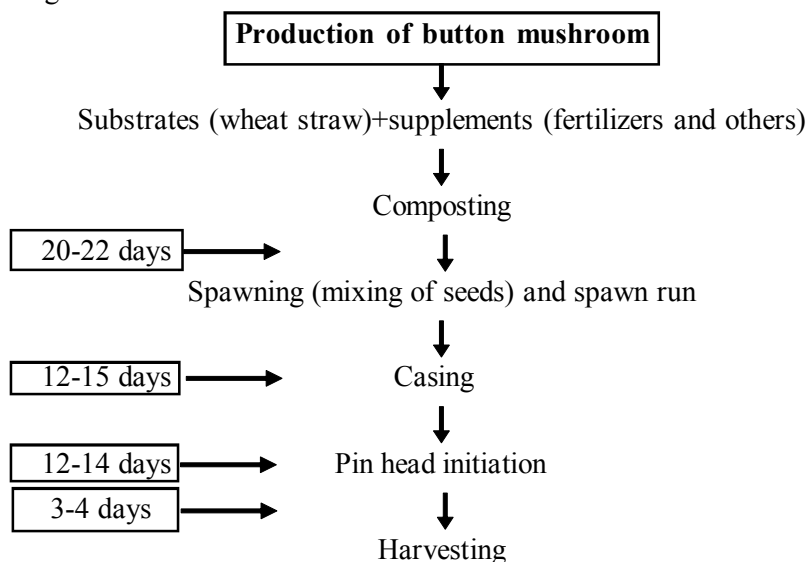
Mushroom production is a profitable agricultural enterprise being indoor crop, it does not require arable land. The cost of production and net gain in the production of various mushroom species is given in Table 3.

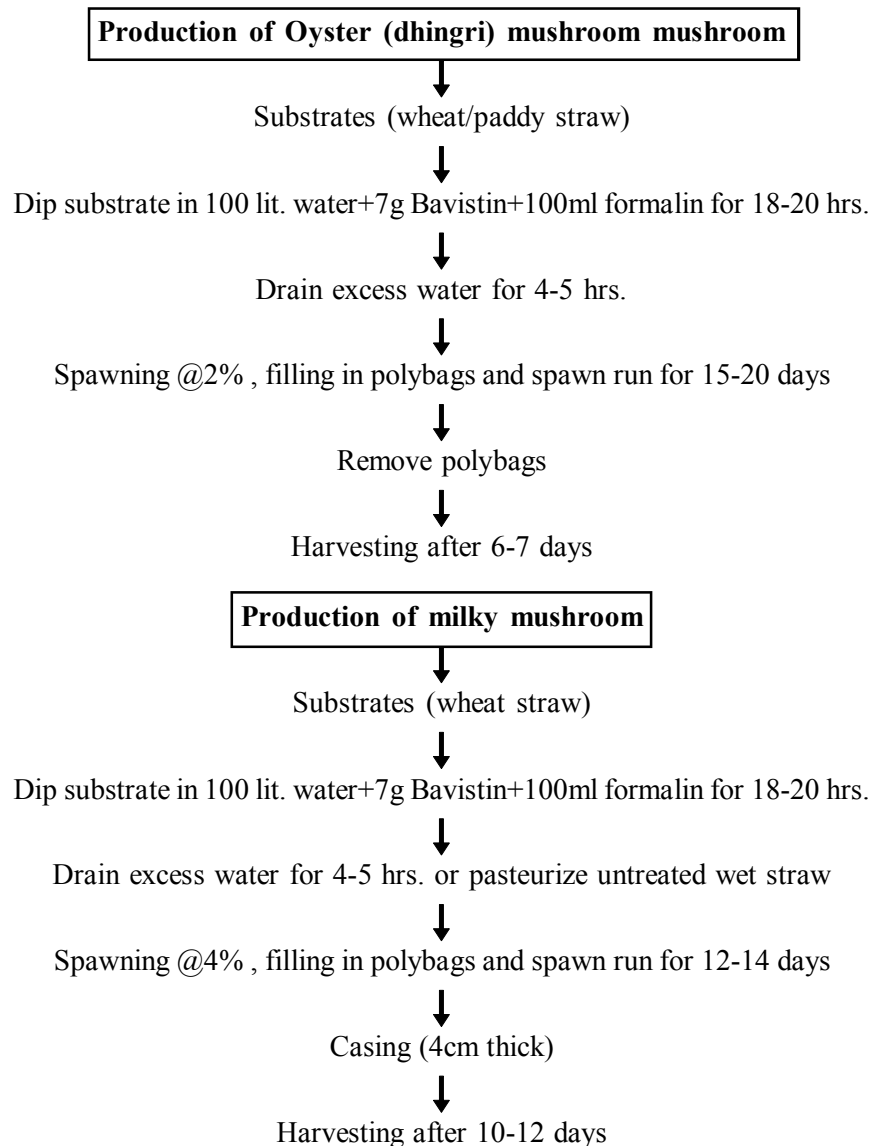
Table 3: Cost benefit status of different mushrooms

S.No.	Mushroom species	Yield	Cost of production (Rs./kg)	Market rate (Rs./kg)	Net gain (Rs./kg)
1.	<i>Agaricus bisporus/ bitorquis</i> Button mushroom	15-16% of compost wt.	28-35	50-60	22-35
2.	<i>Pleurotus</i> spp. Dhingri mushroom	50-60% of substrate wt.	20-25	35-45	15-20
3.	<i>Calocybe indica</i> Milky mushroom	40-50% of substrate wt.	22-28	40-50	18-22
4.	<i>Lentinula edodes</i> Shiitake mushroom	15-20% of substrate wt.	25-30	60-80	35-50

7. PRODUCTION TECHNOLOGY OF MAJOR MUSHROOM SPECIES

The production technology of many mushroom species is undergoing dynamic changes and varies slightly from region to region depending upon the availability of various resources and cultivation technologies. The major events in the cultivation of some common mushrooms are given in flow diagrams as below:





In view of the challenges faced by Indian farmers in general and small/marginal, mountain and tribal farmers in particular, and considering the advantages of mushroom production for food, nutrition, health, economic, livelihood and environment security, it can be safely concluded that mushroom based composite integrated farming system might be an ideal enterprise. It will prove a highly sustainable in a few years as and when full advantages

of mushroom based organic recycling with multi-crop, multi-enterprise, and eco-farming are realized and the soil productivity, rural economy as well as employment and health status are restored. In fact, this type of integrated farming systems, based on eco-regional planning needs to be popularized as early as possible.

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ENTREPRENEURSHIP DEVELOPMENT THROUGH PROTECTED HORTICULTURE

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1. INTRODUCTION

The horticulture has gained importance in recent years as a significant component of agriculture in India. It is distinguished from agriculture by scale of production, specialization, and commercialization. Horticulture sector which includes a wide variety of crops such as fruits, vegetables, spices, plantation crops, floriculture, medicinal and aromatic plants, cashew etc. is at present, recognised as an important sector for potential diversification and value addition in agriculture. The new momentum towards the development of the horticulture, particularly for growing fruits and vegetables is getting upcoming demand of the demand and supply chain in Indian market. Horticulture is a mother for many axillary industries like canning industries and processing industries etc. Several agro industries, based on horticultural products are being established there by solving the unemployment problem to some extent, for example-rubber, coir (Coconut) and sago (Tapioca) industries. It has been recognised that growing horticulture crops is now an ideal option to improve livelihood security, enhance employment generation, accomplish income and food security, and increase income through value addition.

In the present situation, farmers are required to develop themselves as entrepreneurs for deriving greater benefits from their agriculture. Horticulture sector, thus, provides an immense scope in improving the present situation of unemployment. The marketed surplus will remains small, keeping

in view the holdings acquired by the farmers in the state. Small farmers having small surplus, appeared to be reluctant in marketing their produce, as the net returns, they could attain would not cover even the cost of marketing. The new generation of educated farmers and unemployed rural youth has an opportunity to become entrepreneur and adopt horticulture as a business enterprise. A farmer does not become an entrepreneur only by adopting new agricultural technology but he becomes an entrepreneur only when he comes to be an operator of farm business. The marketing cost of fruits and vegetables is almost 50% of the total cost of production which tends to be increased further with more wastage and loss of produce. 'Assembling' is a marketing function that can solve this problem in horticultural marketing, but we need entrepreneurs who can manage and save the resources for themselves and for the country. Infrastructure like roads and markets are building in a phased manner and will surely complement the horticultural marketing. Wastage of produce on farmers' fields should be minimized for promoting horticulture in becoming an important source of gainful employment. There is a long term need to remove the distortions in the present supply chain and create better integration between different links of the supply chain. Entrepreneurship development among farmers is an important way of achieving that integration for bringing net gain to producers, consumers and to the nation. Entrepreneurship contributes to development of a country in several ways, viz., assembling and harnessing the various inputs, bearing the risks, innovating and imitating the techniques of production to reduce the cost and increase its quality and quantity, expanding the horizons of the market and co-ordinating and managing the manufacturing unit at various levels. During the Eleventh Plan period, 16.7 lakh ha of land was brought under horticultural crops in India (Boruah et al., 2015). Production of vegetables and flowers is significantly influenced by the seasonality and weather conditions. The extents of abundance and deficiency in production cause considerable fluctuations in the prices and quality of vegetables and flowers. Vegetable production, at present, is also characterized by a strong dependence on chemical plant protection with its all-inherent environmental and health hazards, both, for the grower and the consumer. Striking a balance between all-season availability of high-quality vegetables with minimum environmental impact, and still to remain economically competitive in this time of globalization, is a major challenge for the modern technology of crop production.

The crop productivity is influenced by the genetic characteristics of the cultivar, growing environment and management practices. Under

open field cultivation, while the other factors could be taken care of, it is not possible to effect control on the environment around the plant. The plant's environment can be specified by five basic factors, namely, light, temperature, humidity, carbon dioxide and nutrients. The main purpose of protected cultivation is to create a favourable environment for the sustained growth of plant so as to realize its maximum potential even in adverse climatic conditions. Greenhouses, rain shelters, plastic tunnels, mulches, insect-proof net houses, shade nets etc. are used as protective structures and means depending on the requirements and cost-effectiveness. Besides modifying the plant's environment, these protective structures provide protection against wind, rain and insects. Protected cultivation offers several advantages to produce vegetables and flowers of high quality and yields, thus using the land and other resources more efficiently. This becomes relevant to growers in India who have small land holding, say less than one hectare. They would be interested in a technology, which helps them to produce more crops each year from their land, particularly during off-season when prices are higher. However, growing vegetables under protected conditions requires comparatively high input cost and good management practices, which have direct bearing on the economic viability of the production system. Even if the protective structures are cost effective, proper planning, management and attention to details are needed to achieve maximum benefits. Growing vegetables and flowers under location-specific suitable structures may accumulate substantial benefits even to small growers.

2. PROTECTED CULTIVATION

Protected cultivation is the technique of providing favourable micro-climate surrounding the plant body and is controlled partially or fully as per the requirement of the horticulture crops grown during their period of growth. In short, it is the modification of the natural environment to achieve optimum plant growth. Protected cultivation may also indicate comprehensive system of controlled Environmental agriculture in which all aspects of the natural environment are modified for maximum plant growth and economic return.

There are many challenges in open field condition:

- Rising of healthy seedling
- Isolation management
- Seed production of parental line
- Promotion of hybrid seed production

- Short growing period
- Poor seed yield and seed quality
- Reduced storability

So, why we go for protected cultivation? Now in days population is increasing sharply and due to modernization or infrastructure work is increasing day to day, agricultural land is becoming less and less. Greenhouses have proven to be a reliable solution to achieve these goals; however, protected agriculture has the potential to lead to serious problems. Therefore, the main benefit of protected cultivation is Environmental conditions can be controlled e.g. lighting, temperature, humidity. Plants can be grown in places where plants cannot normally grow. Plants can be grown out of season or allows a longer growing season. The inability of people to predict the weather and control the climate persists. This is accompanied by a rising population with increasing numbers of affluent and demanding people who insist on improved diets. Above all, there are limitations of land, water, energy, mineral nutrients, and the need for improved management of all resources. Thus, we will likely see a continuing increase in the extent and dispersion of protected cultivation throughout the world (Wittwer and Castilla, 1995).

Crops can be grown at greater densities leading to higher yields. Harvesting does not depend on weather. Control of crop disease may be more effective as infection may be restricted to a single glasshouse/polytunnel. Recently there was a technical shift towards the production of high quality hybrid seeds in protected structures such as net houses, low cost net cum polytunnels for production of hybrid seeds of cucurbits and solanaceous vegetables where as fan and pad cooled greenhouses for the production of hybrid seed of high value vegetables like sweet pepper, hot pepper, indeterminate tomato, melon and cucumbers.

Advantages of Protected Cultivation:

- It moderates light, temperature and humidity within the structure.
- The plant propagation is effective.
- It helps in improving production in terms of quality and quantity.
- It reduces infestation of pests and diseases.
- It ensures weed free cultivation.
- It helps in saving water and fertilizer requirements as compared to

open field cultivation.

- It reduces development period of the crop with better quality.
- It facilitates off-season production.

Constraints of Protected Cultivation:

- Cost of basic and infrastructure development is very high.
- Regular electric power supply is indispensable.
- Technical knowledge and expertise is decisive.
- Lack of suitable varieties / hybrids for greenhouse cultivation

3. STRUCTURES/ METHODS USED FOR PROTECTED CULTIVATION

There is a wide scope in protected cultivation as an entrepreneur. But before starting entrepreneurship in protected cultivation, we need to know about various structures and methods generally used for protected cultivation. Some of protective structures for crop production range from simple provisions such as rain shelters, shade houses, mulches, row covers, low tunnels, cloches to greenhouse structures with passive or active climate control are mentioned below in brief.

3.1. Rainout Shelters

Rainout shelters are specifically designed to protect the required land area against receiving precipitations so that the drought stress experiments can be formulated under controlled condition. There are many types of rainout shelters which are designed and used, with better or lesser results by emphasizing on important issues in designing, constructing and operating rainout shelters.



a) Static design of rainout shelter

b) Movable design of rainout shelter

Fig. 1. Rainout shelter with automatic version alongwith sensors and sprinkler facility

There are two main designs for rainout shelter- static and movable (Fig.1). Within the moveable design there are automatic/motorized and manual versions. The automatic version is signalled to move over the protected plot by a rain sensor and an electric drive system. The manual version is moved either by manually switching the drive on (manually driven) or by manually pushing it (manually pushed) over the protected plot. The 'manually pushed' must be lightweight and hence it is cheaper and can cover a limited land area.

The manual version is moved from its parking spot onto the protected plot whenever a rain is expected and not when the rain begins. It is moved into the parking space whenever rain is expected to cease completely. Good weather forecasting service is therefore important. If forecasting is unreliable, better have the shelter over the protected plot more time than expected. Therefore, the shelter construction must allow sufficient light inside as well as some ventilation. The direction of the protected plot and the parking place of the shelter should be designed so that the parked shelter will not shade the plot in the morning or the evening and that the direction of the wind would not allow rain to blow under the shelter. The shelter parking place cannot be used for growing experimental plots. Hence, many automatic rainout shelters have become more popular even if it is little costlier than manual one. Automatic rainout shelter has installed with rain sensors, and therefore, the shelter moves to the experimental site automatically once the signals receive from rain sensors. It overcomes the problem of better weather forecasting.

3.2 Shade Houses

A shade house is a structure which usually consists of a metal frame that supports shade cloth - a type of screen that provides some passive environmental control e.g. shading the plants from excessive sunlight and wind. In warmer climates shade houses are useful for growing a range of plants that grow well in cool to temperate regions but do not cope with the amount of hot direct sun. In a cold snap, more elaborate shade houses can be heated to prevent frost damage to the plants. A shade house is important in plant production for gaining maximum growth, allowing plants time to acclimatize to outdoor conditions and "harden off". There are a number of benefits in using a shade house:

- Protect plants from wind, hail and pests
- Protect plants from extreme hot weather
- Protect plants which are cold or frost sensitive over winter

- Propagate new plants
- Grow tropical plants in cooler climates
- Improve space: Using multi-tier/layer shelves in a shade house
- Grow vegetables, cut flowers or berry fruits in off-season, faster than might be achieved outside.
- Considerable savings in operation costs (energy, irrigation, spraying, misting etc.)
- Labour cost: Better work environment increases work efficiency
- Avoid workers exposed to severe weather conditions

3.3 Row Cover

Row cover are also known as garden fabric, floating row cover or garden netting, is any transparent or semi-transparent, flexible material, like fabric or plastic sheeting, used as a protective covering to shield plants, usually vegetables, primarily from the undesirable effects of cold and wind, and also from insect damage (Hochmuth *et al.*, 1987). Another form of lightweight row cover is made from high-density polyethylene (HDPE) and is a knitted fabric. It is strong, with an claimed life of eight years. It has a low shading effect (16%) and allows natural air flow and rain and water penetration. It also protects from light frosts, strong winds and hail. It is used on low tunnels. It comes in a variety of widths and lengths. A protective tunnel formed with row cover is sometimes called a cloche, although a cloche, or bell jar, commonly refers to a distinct type of protective covering, made of glass or plastic, usually placed over individual plants. No longer in general use, a type of cloche employed in Europe involved panes of glass attached with wire to form continuous tunnels to protect rows of crops.

3.4 Low Tunnels

Low tunnels are essentially miniature versions of high tunnels, usually two to four feet tall at their peak and four to six feet wide. Low tunnels are generally made from PVC pipe as a main frame with dome shape structure. It is covered with plastic ploy film sheet which is weighted down to the ground or buried rather than attached to the structure. It provides a low cost, cost effective investment option for those seeking an entry point to poly tunnel production or for those wishing to enhance their current poly tunnel production capacity. It offers an alternative form of crop protection and season extension that may work even better than a high tunnel for some growers and in certain situations. These low cost structures can be

dissembled, move throughout the farm and work with the contour of the land. Plastic covered low tunnels provide crops with several degrees of protection against outer atmosphere. There are many advantages of low tunnels:

- It is made up of light structure
- Cost is less
- Installation is quite easy
- It is easy to uninstall and rebuilt to other places.

3.5 Greenhouse

A greenhouse is a structure with a glass or plastic roof and frequently glass or plastic walls. Its roof and sides have to allow light to penetrate. The greenhouse heats up because incoming solar radiation from the sun warms plants, soil, and other things inside the building faster than heat can escape the structure. Greenhouses can also protect plants from wind, rain and animals. There are different types of greenhouse structures:

a) Ground to ground

Free-standing greenhouse (ground to ground greenhouses), because of their cost, are one of the most popular styles of greenhouse structures. The free-standing greenhouse, ground to ground greenhouse can be designed as a high tunnel or as an environmentally controlled greenhouse. Free-standing greenhouses come in a wide variety of lengths and widths; most popular is the 30 ft wide ground to ground greenhouse. The ground to ground greenhouse often is the built with short sidewalls. It is a free-standing greenhouse structure popular in reforestation for over-wintering; ground to ground greenhouse can also be designed with environmental controls and can be purchased with a number of different coverings. Moreover, ground to ground, free-standing greenhouses are popular in every climate.

b) Gable

A gable attached greenhouse is designed to look like an original part of your architecture. Pick your favorite greenhouse design, glazing and color and we will remove the gable wall to attach to your location. We can place doors in the sidewalls or the gable end and increase sidewall height to maximize available floor space. Convenient access to water and power is great for those wanting to extend the season and enjoy the view into the garden.

c) Quonset

The Quonset, arch, clear span greenhouse is the most popular greenhouse style for gutter connected poly or polycarbonate structures in the world. They are available in many different widths and lengths. They are available in roll form, round or square galvanized pipe, designed to meet many loads. This Quonset style greenhouse is the one that is efficiently made from virtually indestructible Kee-Klump fittings is the one that you need to put your money, and your trust, into building right for the very first and very last time. The main advantage of Quonset style greenhouses are their freestanding architecture, which lets in the greatest amount of sunlight of any greenhouse design, including ridge and furrow greenhouses, ground-to-ground greenhouses, and gutter-connected, arch greenhouses. This extremely high amount of solar radiation is the best for cultivating your crops from seedlings into full-grown, mature plants.

d) Tunnels

High tunnels are an increasingly popular trend for growers and a proven technology for crop production. The term “high tunnel” is a loosely defined phrase for growing fruits and vegetables in greenhouses, although some high tunnels are used for cut flower production. High tunnels may be used to extend the growing season by providing protection for early- or late-season production, or they may be used for year-round growing. High tunnels are becoming increasingly popular due to the low start-up cost and quick rate of return on investment. High tunnels were originally greenhouses with high sidewalls to enable tractors and tillers to easily enter and exit greenhouses from either end. These greenhouses were simple in design, with usually just one layer of poly, roll-up curtains and no electricity. Some of these greenhouses only had poly on them for a few weeks before the warmer weather allowed the cover to be removed safely without any damage to the crops. High tunnel greenhouses enabled local growers to produce crops during all four seasons and helped combat the forces of unpredictable weather, particularly in the early spring.

e) Lath house/ Seran house

A lath house is a valuable asset in raising seedlings, rooted cuttings, and young rhododendron plants prior to setting them out in the garden. Properly used, it will modify the environment in which they are growing by offering protection from hot, drying summer winds, reducing the intensity of the sunlight, lowering temperatures, and by maintaining a higher humidity.

f) Lean to greenhouse

A lean-to greenhouse is a type of greenhouse that is built against the side of another structure. Therefore, it has only one sloping roof and shares a wall with another building with a different intended use. It is considered as traditional structures, dating back to the Victorian period. They are extremely tough and wind resistant. Lean-to greenhouses can also be considered sun rooms when they are built against a residential property, and can be used for both edible crops and ornamentals. There are several factors to take into account with the lean-to greenhouses. The height must be carefully checked, along with any metal base plinth, to make sure that the ridge does not clash with any obstacles such as windows or drain pipes. If the lean-to greenhouse is going over a door on the house, it must be glazed with toughened safety glass. Another crucial point to remember is that if there is a flue from a boiler exiting the wall, it must not be discharged into the greenhouse. Majority of lean-to greenhouses are built on a solid brick or concrete stem wall. They are often made with a stone veneer that helps to retain heat as night sets in. Leaning against a wall, which generally stores heat through the day and slowly releases it at night, helps reduce the range of temperature fluctuations inside the greenhouse, leading to a steadier overall temperature.

Cladding materials used for greenhouses:

There are wide varieties of materials that can be used and available for greenhouse construction at present. With the current explosion of interest from both commercial farmers and backyard gardeners, the options for materials are constantly expanding. Some of the common selections by farmers/ entrepreneurs are:

- Glass
- Fiberglass
- FRP (Fibre Reinforced Plastic)
- Polythene (Poly Vinyl Chloride)
- Polycarbonate sheets
- Silpauline sheets

3.5.1 GREENHOUSE CLIMATE AND REQUIRED PLANT ENVIRONMENT

A plant grows best when exposed to an environment that is optimal

for that particular plant species. The aerial environment for the plant growth can be specified by the following four factors: i) Heat or temperature; ii) Light; iii) Relative humidity; and iv) Carbon-di-oxide (Malik and Sehrawat, 2015). While plants have precise optimum environmental conditions for best growth, most are tolerant to variations in these conditions within some limits. However, permanent damage would occur when they are exposed to conditions outside these limits. At the same time, plants are subject to attack by pests and diseases. Greenhouse crop production provides protection against adverse environmental conditions and allows pests and diseases to be excluded or controlled. Besides providing a protective enclosure, a greenhouse also acts as a 'heat trap'. It admits solar radiation and converts this energy into heat by raising the temperature of the greenhouse air. While this is the basis of the greenhouse's ability to perform its tasks, it also affects other environmental factors (Malik and Sehrawat, 2015). Environmental conditions inside the greenhouse can be modified suiting to the potential growth of plants. The extent of climate modification will, however, depend on the design of greenhouse and is generally related with its cost. Higher the capability of greenhouse to modify its climate, higher is the cost of its construction.

4. FACTORS AFFECTING THE SELECTION OF STRUCTURES

The selection of structures to be utilized for seed production depends on the type of seed crop and local environmental conditions like sunlight, maximum and minimum temperature, wind speed, humidity, rainfall, snowfall etc. Simple plastic covered net houses may be enough to produce hybrid seeds in rainy or winter seasons in many parts of south India. But it is difficult to raise sweet pepper seed crop in summer months in such net house because of very high temperature and very low humidity inside the net house. In case of fan and pad cooled green house sweet pepper seed production can be taken up throughout the year. Plastic houses with top ventilation can be used for seed production of temperate vegetable crops in the hills of north India. Computer controlled European type high tech glass house are very expensive and economically not viable for seed production under north Indian conditions (Tomar, 2015).

The cultivation of fruits plants per unit area of land provides a comparatively larger volume of employment opportunities to the people than the cultivation of field crops. A significant level of increase in the labour absorption in fruit cultivation over the few years also reflects the importance of horticulture for the overall development of the area (Nain *et al.*, 2013). The wealth may be created by individuals who take the major

risks in terms of equity, time and career commitment of providing value to some product or services (Kuratko and Hodgetts, 2001). The product or service itself may or may not be new or unique but value must somehow be infused by the entrepreneur by securing and allocating the necessary skill and resources.

5. LOCATION OF GREENHOUSE AND DESIGN CRITERIA

For locating the greenhouse, a piece of land larger than the grower's immediate need should be acquired. The ultimate size of the greenhouse range should be estimated. Area should then be added to this estimated figure to accommodate service buildings, storage, access drives and a parking lot (Singh, 2015). The floor area of service buildings required for small firms is about 13% of the greenhouse floor area, and it decreases with the increase in size of the firm. On an average, service buildings occupy 10% of the growing area. The service building is centrally located in a nearly square design of the firm, which minimizes distance of movement of plants and materials. Doors between the service buildings and the greenhouse should be wide enough to facilitate full use of the corridor width. Doors at least 3.1 m wide and 2.7 m high are common (Singh, 2015). It is good to have the greenhouse gutter at least 3.7 m above the floor to accommodate automation and thermal blanket and still leave the room for future innovations.

6. PROTECTED CULTIVATION AND ENTREPRENEURSHIP

Majority of entrepreneurs are similar and an imperative query from their side that how this protected cultivation helps in entrepreneurship to enhance their income. As we all aware that the horticulture production in India has achieved considerable progress during last three decades; whereas the average productivity of different horticultural crops is quite low as compared to the best yields at national and world level, indicating the scope to enhance the yield in different horticultural crops by many folds along with its quality. This is due to potential yield and the actual yield of various horticultural crops is fluctuating with pleasing space, some vegetable crops are realized even less than 50% of their potential yield. Sometime the farmers who grow their horticultural crops during main season are even not getting back their cost of production, but the prices of the same horticulture produce are very high during off season. During rainy and post rainy seasons, many horticultural crops are the major limiting factor for their outdoor production especially for vegetables as they are highly influenced by various biotic and abiotic stresses. The demand of off-season and high quality fruits and vegetables is increasing significantly under present

market scenario of big cities, and therefore, it has the right time to call the attention of the vegetable growers for diversification from traditional way of vegetable production to protected cultivation. Protected cultivation has great potential in augmenting production and quality of vegetables, flowers and in some fruit crops in main and off season and maximizing water and nutrient use efficiency, under varied agro- climatic conditions of the country. Since, it can be profitably used for growing high value vegetable crops like, tomato, cheery tomato, colored peppers, parthenocarpic cucumbers, flowers like cut flowers, chrysanthemum, liliun fruits like strawberry, grapes etc. and for off season cultivation of vegetables and their healthy and virus free seedlings, this technology has great potential especially in peri-urban agriculture in near future (Malik, 2015). Protected cultivation in partially modified environment structure is useful in combating both biotic and abiotic stresses directly affect the productivity and quality of horticultural crops. Therefore, protected cultivation needs proper precaution with an effective planning and attention including timing of production and harvest so that the entrepreneurs get higher market prices and choice of varieties adopted to the off season environment. All the farmers who are living in urban adjacent areas of the country can successfully diversify their traditional cultivation practices by adopting or using various levels of protected cultivation technologies for production of horticultural crops looking to their resources, availability of emerging market of usual and unusual off season horticultural produce, year round demand of high value vegetables like slicing tomatoes, coloured peppers and parthenocarpic cucumbers etc. High quality nursery raising in vegetables is the other area, where complete diversification in the traditional system of nursery raising is required. All kind of protected technologies may not be economical and useful to the farmers in India, because of their very high initial, running and maintenance cost, but some protected technologies are simple and highly profitable under Indian conditions and more specifically for peri-urban areas, which can be adopted by Indian farmers for production of different horticultural crops in the following manners.

The improved high-quality seedlings through good quality seeds at right time and at appropriate place is one of the cheapest but most important ways to ensure high productivity and high quality of the produce. Traditionally, most of the Indian farmers raise the seedlings of vegetables, flowers and fruits like papaya seedlings under open field conditions. The raised seedling through such types of traditional methods are always the problem of inferior quality, as the seedlings are infected with virus when raised in open during rainy and post rainy season. On one side soil borne

fungus and nematodes create severe problem for raising the seedlings in soil media in open fields during hot summers and rainy season but on the other hand the very high cost of hybrid seeds in vegetables has also warranted the farmers to improve or change their traditional nursery raising method to increase the productivity and quality of vegetables (Malik, 2015). A large number of virus free healthy seedlings of different vegetables can be raised in a small area of green house in plastic pro-trays by using soil-less media for growing vegetables either for main season or for their off season cultivation. With the use of this technology it is now almost possible to raise healthy vigorous seedlings of different cucurbits, otherwise it was not possible in the traditional system of nursery raising. The farmers or unemployed agriculture graduate youths of our country can very successfully start nursery raising as a small scale industry in major vegetable growing pockets of the country. By this way the vegetable growers will get the virus free or off-season healthy nursery as per their requirement and it will also generate some employment in agriculture sector. Therefore, this is the foremost to encourage the new generation entrepreneurs to help in diversification in horticulture through protected cultivation with proper guidance by providing the awareness of determine potentially successful crops for each area based on climate, crop requirements, technology level required, and market price potential. It is also essential to work out and identify niche markets, domestic and export, that could generate sufficient revenue to recover the upfront costs of protected cultivation.

7. ENCOURAGEMENT FOR ENTREPRENEURSHIP DEVELOPMENT

Any attempt to promote the farmers perceptions towards fruit cultivation could improve their practice. Rural farmers including their family members are in fact soldiers who implement and improve sustainable agriculture, so promoting their knowledge, improving their perceptions and also increasing their practice are all the important prerequisite of sustainable fruit production (Nain *et al.*, 2013). Strategy emphasizes much on long-term decision making with regard to the future of the farm. Strategies for keeping up with business demands is related to the entrepreneur's focus on commercial relations, the branch and direct business relations (customers and suppliers) and on informal contacts with fellow entrepreneurs. These contacts are important in retrieving relevant information that will help to keep up with business demands (Bosma *et al.*, 2000). Proper use of the knowledge infrastructure helps the entrepreneur to react effectively to any new developments (Schilden and Verhaar, 2000). Nain *et al.* (2012) emphasized that researcher need to be active participant in the early adoption

process to nurture the technology until market selection begins to work. Strategies are affected by the farm feature, by the environmental feature, region and by the personal feature of the entrepreneur. As such indicative measures can be enlisted for the policy makers, how, and if, agricultural entrepreneurs must be dealt in the era of the radical changes in agriculture (Nain *et al.*, 2013). Strategies at policy level and at field extension level can bring measurable improvement in entrepreneurial knowledge, skills, abilities and aspirations of farmers.

8. FUTURE THRUST AREAS / RESEARCHABLE ISSUES IN INDIA

- Standardization of region-specific designs of both Low / Hi-tech protected structures and production technologies for Hi-value vegetable and ornamental crops
- Standardization and validation of region and crop-specific IPM and GAP strategies
- Standardization and adoption of modern techniques like grafting in vegetable seedlings to manage the soil-borne pathogens
- Development of indigenous varieties suitable for protected cultivation
- On-farm value addition and cool-chain management
- Human resource development keeping in view the entrepreneurial skill development especially for export oriented production

9. CONCLUSION

Horticulture has emerged as an engine for economic growth and prosperity of Indian farmers. Strengthening Horticulture sector will have positive impact on removing poverty and improving income of farmers. Protective cultivation generates immense employment with wide boost to horticultural production and helps the betterment of entrepreneurs. Farmers grow up as entrepreneurs through protected cultivation and calibre to introduce innovative techniques in protected cultivation. Thus, protected cultivation helps to generate employment as well as proliferating income of farmers and in turn contribute for economic development of the country.

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ENTREPRENEURSHIP DEVELOPMENT THROUGH FRUIT AND VEGETABLE PROCESSING

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Jalgaonkar, Vijay Singh Meena and Bharat Bhushan**

1. INTRODUCTION

Agro-industries are those enterprises that process agricultural raw materials into edible or consumable form. In that process, agro-processing wastes may also be utilized for extraction of natural bioactive compounds so as to be used in pharmaceutical and other industries. An agro-processing plant can open up new opportunities to the farmers facilitating income and employment generation. However, the industries dealing with fruit or vegetable processing are characterized by seasonality, perishability and variability of raw materials. In such industries, the raw materials can only be procured in particular season while processing operations may continue for the off season. For the processing of raw materials by the agro-industries, greater speed in handling, storage and distribution is required. The raw materials obtained for processing vary in their quality as well and hence the emphasis must also be given towards post-processing management also. Such characteristics make the procurement rather restrictive and the industries are amenable and move viable to the locations nearer to the source of raw material.

India is known as fruit and vegetable basket of the world. It is the second largest producer of overall fruits and vegetables production in the world, after China and one of the centers of origin of fruits and vegetables with the total production of 81.285 million metric tonnes of fruits and 162.187

million tonnes of vegetables till the year end 2013 (NHB, 2013). It has the potential to be the world's largest food producer which is bestowed with one of the best natural resources in the world and several factors like Increasing urbanization, nuclear families, working women, disposable income and changing lifestyles are gearing up the Indian food supply chains for a better future. Organized retail and Private label penetration, demand for functional food, and increased spend on health food are major drivers for the growth of this sector (Viswanadham, 2007). As the population is increasing, the demand for such food is also increasing.

India has a strong raw material base for the food processing industry. India is one of the largest producers of certain fruits, vegetables, pulses, cereals and dairy products such as mangoes, papaya, potatoes, onions, ginger, chick peas, rice, wheat, groundnuts, milk and eggs among others. Over time, there has been a continuous increase in the production of food processing industry. The total value addition of the food processing sector as a share of GDP manufacturing was 9.8 percent in 2012-13. Yet in India the sector suffers from several bottlenecks leading to an estimated wastage of 25-30 percent of agriculture produce (Chari and Raghavan 2012). India lacks agricultural raw materials of processable quality. Only 7 percent of the total Indian perishable produce is processed, which is extremely low compared to countries such as the US (65 percent), Philippines (78 percent) and China (23 percent).

Food and grocery is the largest segment in India's retail sector, with a share of more than 60 percent in India's total retail market in 2014. The vast production base offers India tremendous opportunities for export. During 2015-16, India exported fruits and vegetables worth Rs. 8,391.41 crores which comprised of fruits worth Rs. 3,524.50 crores and vegetables worth Rs. 4,866.91 crores.

The food-processing sector employs about 13 million persons directly and about 35 million persons indirectly. India's agricultural production base is quite strong but at the same time wastage of agricultural produce is massive. Processing is very low at around 2.20% in fruits and vegetables, 35% in milk, 21% in meat and 6% in poultry. Value addition is only to the tune of 20% Food processing sector contributed about 14% of manufacturing Gross Domestic Product. India's share in world trade in respect of processed foods is only 1.6 percent and India was ranked 27th in 2006 in terms of trade performance of Processed Food Products. (APEDA, 2015)

2. RECENT TRENDS IN FOOD PROCESSING

In India, a substantial portion of net value added from agro industries is derived from unregistered and cottage small units and the contribution of registered units is very meagre. Generally in food processing industries, about 90% of total value added comes only from primary processing while secondary tertiary processing account for a small proportion.

In addition, by-product processing of major fruits and vegetables has huge potential for industrial growth in rural areas as well.

Organizational problems of fruit/vegetable based industries and the basic characteristics are as follows:

1. Industries based on fruit and vegetables depend upon the seasonality of the raw material. This factor compels such industries to procure most of their raw material requirements during the peak harvesting season and a little after that so that they can process them during and after the season. This enables the industries to market their processed products round the year as per the existing demand.
2. Owing to the perishable nature of F & V's, additional care in handling, transportation, storage and processing is required.
3. The location also acts as a key feature for establishment of such industries, as the raw materials are highly perishable and hence these units should be in a close proximity to the availability of raw materials. It also reduces the expenditure towards transportation cost.
4. Another technical feature of this industry is that unlike other industries, such unit's faces variability in the quality and quantity of their raw materials.
5. In addition, the price of raw material also does not remain steady throughout the year which makes difficult the task of fixing the prices of processed products.
6. The domestic demand for processed foods is very low as most of the Indians have a habit of consuming fresh F & V's and moreover the prices of processed products are beyond the reach of common man.
7. Such industries also face many hurdles in developing the domestic market due to lack of infrastructural facilities including cold storage, suitable transport facilities and adequate food testing laboratories.

8. Besides, the owners of such industries do not have strong information network for marketing of their products.
9. Another characteristic of this industry is that government play supplementary role in fruit processing by providing facilities to the people at certain agricultural centers at very nominal cost for consumers. However, such facilities are very limited and are confined to only one or two products. Such services rendered at subsidies price create competition for the private enterprises.
10. The raw material represents a large investment. It is therefore important that strict orderliness and method are employed to ensure accuracy in preservation and safety at all stages of raw materials movement and custody.
11. Owing to the perishable nature, the F & V's required to be preserved in cold storage to avoid wastage and decay. But the entrepreneurs of the local units with their limited capital neither could afford to have their own cold storage nor has the government come forward to help them in this regard. Moreover, though most of the units are started by the entrepreneurs at their own residential houses with sufficient space for production yet they are carried on in an unorganized way.
12. Since most of such processing units are being operated through household and hence are having a small scale of operation. And as the space available is very limited, the minimum space requirement as per FSSAI license/standards could not be fulfilled. As a result, their product though of good quality is deprived of getting FSSAI license.
13. In certain rare instance, there is also a capability of foreign uneatable particles found in the processed foods. This is because the items are often prepared in an unhygienic manner.

2.1 Production of an industry

For the success of any industry, production should be carried on in a smooth and uninterrupted way. It can be only possible when the purchasing of the raw materials, machines and other equipment required for production is done in an effective manner. In addition to this, the brought materials need to be stored in an adequate manner to avoid wastage and decay. Moreover, the production department has to see whether an efficient quality control process is adopted to test the quality of finished products. The production activities comprises of following:

- **Purchase:** The requirement of proper materials, machines and other accessories are must for any industry. Before going for large scale production, sufficient quantity and assurance of continuing supply to meet production needs and schedules must be managed. The material quality must be adequate for the intended purpose and suitable for the process and the equipment used. Procurement of raw materials at consistently lower cost with quality is desired. Efficient inventory management is also a contributory factor for economic and successful operation.
- **Storage:** It is the function of receiving, storing and issuing of materials. The raw material represents a very large investment and hence strict orderliness and method are employed to ensure accuracy in preservation and safety at all stages of material movement throughout the production line.
- **Quality control:** The quality awareness must begin at the very conception of a product and continue during the various stages of its manufacturing till consumption. The quality cycle begins and ends with the user. It starts when the users need is analyzed and ends when the final product is accepted for consumption.
- **Transportation:** It plays a vital role both in production and marketing of products. Bringing the raw materials from distant places and inadequate cold storage facility may become the reason of deterioration inevitably increasing the transportation cost.
- **Preservation:** Necessary steps need to be adopted for increasing the keeping life of processed products. It can be achieved using physical methods (heating, refrigeration, freezing, drying, dehydration, and concentration), chemical methods (sugar, salt, vinegar, potassium meta- bisulphate and sodium benzoate) and fermentation.
- **Finance:** It is the most essential criterion for initial establishment and further modernization of any business. Both the central as well as state government has many financial schemes for establishment of such processing ventures.
- **Personnel:** An industrial or commercial organization comes into existence when a number of persons come together and work in coordination. These people work together to achieve organizational objectives. Human resource is of paramount importance for the success of any organization. The management must deals with

maintaining a satisfactory workforce.

- Labour: It is always and everywhere the largest critical factor for any industry. It represents people employed or capable of being employed in a productive activity. The manpower can be divided into three main categories: skilled, semi-skilled and unskilled. However, most of the times, there is a dearth of skilled manpower in and around the established industry. In addition, there must be uniformity in the standard rate of wages and timely payment of wages must also be ensured.
- Training: It involves the transfer of defined and standard procedures to the workforce to cope up with the future challenges in the industry. The various institutes under Indian Council of Agricultural Research (ICAR), State Agricultural Universities (SAU's) and Krishi Vigyan Kendra's (KVK) must conduct training on processing and value addition of F & V's and train the manpower.
- Marketing: It is the aggregation of all those activities that are related to the free flow of goods from the points of production to the points of consumption. The pertinent marketing problem faced by the units seems to be the most vital one.
- Packaging and labeling: Ordinary and simple type of labeling is mostly preferred by the local units.
- Advertisement: The level of advertising the products must be rigorously increased in order to compare with the commercially available materials.
- Market research: It is among the most prominent step before initiation of any industrial setup. A survey/study must be carried out in order to understand the probable market behaviour before launching of the products. In addition, few persons must be employed for door to door sales and to bring feedback information regarding the acceptance/ limitations of the product for further improvement.

3. METHODOLOGY TO TAKE UP FOR DEVELOPMENT OF ENTREPRENEURSHIP

Indian agriculture is severely suffering with unacceptable level of wastages and failed to provide remunerative prices to farmers. This problem could be curtailed if appropriate strategies can be adopted for processing of agricultural commodities (especially fruits and vegetables) at their production catchments. In a study conducted by Nanda et al. (2012), the

estimated losses are 5.8 to 18% for fruits and 7.5 to 13% for vegetables, respectively. The food processing sector surrounds with plentiful opportunities for the entrepreneurs, nevertheless the industry is forced to revamp the overall value and speed of its innovations. Significant progress of entrepreneurship in food processing segment will create work opportunities for rural youth and thereby augmenting the living standard of the people across the country (Negi, 2013).

3.1 Role of government

The government must create conducive business environment and promote financial help via venture capitals, investors and business houses. The ideal role for the government to be the enabler and provide adequate infrastructure, ease in taxation, raising of fund, attract investments etc. The MSME sector has taken few initiatives in this regard,

- Udyog Aadhar Memorandum- to promote ease of doing business
- Employment exchange for industries
- ASPIRE (Promoting innovation and rural entrepreneurs)- setting up a network of technology to promote startups for innovation and entrepreneurship in rural and agriculture based industry

3.2 Agricultural and Processed Food Products Export Development Authority (APEDA)

This agency was established in December 1985 with its head quarter at New Delhi. The main objective of the organization is to promote and develop the exports of various processed products including the fruits and vegetables. It plays a very important role in promotions of agricultural commodities export from the country. APEDA has established cold storage facilities at metropolitan cities of the country. It has also developed standards of marketing for processed products. APEDA acts as a platform to take the products to various national and international fairs and exhibitions. It also arranges many seminars and conferences where experts are invited to address the entrepreneurs regarding the different aspects of processing of F & V's and their export (Choudhury and Barua, 2006).

3.3 Indian Institute of Entrepreneurship (IIE)

This was established in the year 1993 by the Ministry of Industry with its head quarter at Guwahati (Assam). The institute undertakes training, research and consultancy activities in the field of small scale industry and entrepreneurship. The institute also acts as catalyst for entrepreneurship

development by creating suitable environment in a way by organizing seminars and workshops for sharing experience on implementation of programs of self-employment. The institute conducts various training programs related to processing of fruit and vegetables which help them for developing their technology, marketing, quality improvement etc (Choudhury and Barua, 2006).

3.4 Ministry of skill development and entrepreneurship (MSDE)

The prime focus of this ministry is to focus on enhancing employability of the youth through skill development. The proposed schemes on Entrepreneurship Development by the government are:

1. Educate and equip potential and early stage entrepreneurs across India
2. Connect entrepreneurs to peers, mentors, incubators
3. Support entrepreneurs through Entrepreneurship Hubs (E-Hubs)
4. Catalyze a culture shift to encourage entrepreneurship
5. Encourage entrepreneurship among underrepresented groups
6. Promote Entrepreneurship amongst Women
7. Foster social entrepreneurship and grassroots innovations

3.5 National Horticultural Board (NHB)

It was set up by the Government of India in 1984 as an autonomous society with a mandate to promote integrated development of horticulture to help in coordinating, stimulating and sustaining the production and processing of F & V's and to establish a sound infrastructure in the field of production, processing and marketing with a focus on post-harvest losses. The HQ's is at *Gurugram* and total 33 offices are functioning throughout the country. Developing post-harvest management infrastructure, provide training and as well as education to farmers and processing industry personnel for improving agronomic practices and promote consumption of F & V's in fresh as well as processed form are among the major objectives of this board (Choudhury and Barua, 2006).

3.6 Small Industries Development Bank of India (SIDBI)

It was set up as an apex institution for promotion, financing and development of industries in the small scale sector.

4. FOCUS ON ENTREPRENEURIAL OPPORTUNITIES AND RESOURCES

According to GEDI (Global Entrepreneurship Development Index) 2018, India ranked 68th out of 137 countries in the world and ranked 14th out of 28 countries among Asia Pacific region a “middling” performance. India performed above its overall score and its strength areas where are in product and process innovation, start-up opportunities, risk acceptance, internationalization, opportunity perception and robust competition in the marketplace. Its accomplishment on human capital is broadly at par with its overall performance. The entrepreneurial potential in India is on rise as per the latest Global Entrepreneurship Monitor (GEM) Report on India for the financial year 2016-17. According to the report rate of entrepreneurial intention stood 14.9% compared to 9% in 2015-16. Whereas, the fear of failure rate has decreased from 44% in 2015-16 to 37.5% in subsequent year. It is also noted that India with its peers in BRICS economies suggests that perceived opportunity is the highest and perceived capability is the second highest among all. Thus, Entrepreneurship positive performance leads to development of a country in several ways, *viz.*, wealth creation and distribution, employment opportunities, balanced regional development, GDP and Per capita income, exports and community development at various levels. Education, entertainment, retails, transportation, manufacturing, e-commerce are some of the sectors in India which have been revolutionized by entrepreneurship.

Agriculture and allied sectors are known to be the mainstay of the Indian economy, which provides food and nutrition to 1.3 billion people and creates forward and backward opportunities to support 60% of Indian population contributing about 16% of Gross Domestic Product (GDP) of India. Every individual, communities, corporate industries, etc., are directly or indirectly dependent on agriculture either for raw material, farm labour, marketing etc. to run their business smoothly. But, Indian agriculture is still seen low in tech-industry with limiting the individual business towards quantity oriented business rather than quality oriented profit. Over the last decade, this situation has changed drastically due to economic liberalization, government policies, a reduced shelter of agricultural markets and fast changing, individual awareness and more decisiveness society.

Thus Agriculture and allied oriented entrepreneurship are moving progressively more to adapt to the vagaries of the market, changing consumer lifestyle, enhanced sustainable approach, improved ecological regulations, new requirement for product quality, chain management, food safety and

security so on. These changes have paved the way for new participator, innovation, and portfolio entrepreneurship in agriculture and its allied segments such as horticulture and its allied sectors (including fruits and vegetables, plantation crops, flowers, spices, aromatic and medicinal plants).


India bestowed with a varied agro-climate and is highly favorable for growing a large number of horticultural crops which includes fruits and vegetables. It is the second largest producer of fruits and vegetables. Entrepreneurial development through the fruits and vegetable mainly lies in the rural India, where development agencies look into rural entrepreneurship as an enormous employment potential, farmers take it as an instrument for improving farm earnings and women see it as an employment possibilities.




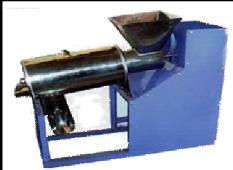

With respect to fruits and vegetables, there are plenty of opportunities in processing and value addition sector. Processing of commodities (F & V's) which are cheaper along with abundant availability, results in higher profit margin for entrepreneurs. A brief description of such fruits and vegetables with relevant information on number of valorized products that can be prepared is described below:

4.1 Aonla

Aonla is amid such category of fruits which is available at a very low price during its peak production season and a variety of value added products can also be prepared. It has been in use for jam, jelly, segments, pickle, preserve, *chavanprash*, candy, juice, squash, mouth fresher etc. There are established machineries for different unit operations of aonla processing with variable capacity and efficiency. The major unit operations include grading, pricking, shredding, juice extraction and drying. There are machineries available for each of the unit operation. Few tools/machineries were fabricated and few were procured and arranged sequentially under pilot plant facility at ICAR-CIPHET Abohar (Punjab). Description of the machineries is as follows:

Table 1: Machineries to be used for aonla processing

S	Machine	Specifications	Picture
1.	Aonla harvester	<ul style="list-style-type: none"> Consists of a stainless steel pipe with a hook type structure and a net structure composed in such a way that it surrounds the tree system The hook on the top of harvester is mired to the branch and shaken vigorously 	

	<ul style="list-style-type: none"> The fruits are collected by the surrounded net. Capacity: 5-6 trees/h or 6 kg/min aonla 	
2. Aonla size grader	<ul style="list-style-type: none"> Based on size grading of aonla fruits and has a capacity of around 350-400 kg/h It consists of 10 cylindrical rollers made of PVC plastic which are placed at an inclination of 3-10° from horizontal Machine grades Aonla into three sizes i.e. below 20 mm; 20-40 mm and 40-60 mm Grading efficiency was 75%. 	
3. Aonla pricking machine	<ul style="list-style-type: none"> The machine consists of a feed hopper, pricking part and outlet. About 50-70 holes are made on each fruit before it comes out of the machine Capacity to prick: 100 kg/h 	
4. Aonla shredding machine	<ul style="list-style-type: none"> Power operated machine is designed for extracting whole stone from Aonla Aonla gets scraped continuously by the rotating blades, against the concave and shreds are obtained Capacity: 250-300 kg/h 	
5. Aonla pulper	<ul style="list-style-type: none"> Fruits are first heated in water for about 10-15 min to separate the segments from the stone Pulp is extracted by addition of water equal to the weight of segments and passing through pulping machine. 	
6. Heating kettle	<ul style="list-style-type: none"> Can be used for concentration of fruit juice/pulp. Capacity: 100 kg 	

7. Tray dryer	<ul style="list-style-type: none"> For dehydration of aonla shreds or stones to make value added products like mouth freshener and powder etc. 	
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Establishment of Aonla processing plant

Government institutes like ICAR, SAU's etc. have given consultancy to establish aonla processing plant in the production catchments of some progressive farmers/entrepreneurs. Such type of technical guidance was given to Mr. Kailash Chaudhary, by ICAR-CIPHET Ludhiana and the established firm is named as Chaudhary Agro Bio- Tech, Keeratpura, Kotputali, Dist. Jaipur (Rajasthan). At present, this industry is involved in making value added products from aonla like juice, powder, candy, squashes, pickles, sweets and exporting to countries like USA, UK, UAE and Japan under brand name of KS BIO FOODS besides the domestic sale.

4.2 Kinnow

Kinnow is a high yielding hybrid mandarin in Punjab (India) having 48182 ha area under this fruit with production about 1.11 million tonnes in 2014 -15. It is also grown to some extent in Rajasthan, Haryana, Himachal Pradesh, Jammu and Kashmir, Maharashtra, Tamil Nadu and Karnataka also. Kinnow is grown in all the districts of Punjab but Fazilka and Hoshiarpur are the main kinnow growing districts followed by Firozepur, Faridkot and Amritsar. In Punjab, Kinnow occupies 55% of the area under citrus. The overall post-harvest losses in kinnow were earlier about 25-30%, however, subsequent the establishment of waxing and grading plants in Punjab and Rajasthan, the losses are reduced to below 15%.

Harvesting and post-harvest handling operations of kinnow in pack houses.

With respect to Kinnow, the general pack house operations after fruit harvest include washing, waxing and grading. The sequential operations by means of a pictorial flowchart are shown below (Fig 1).

Machines used for kinnow waxing, grading and packaging

- Feeding cum sorting conveyor
- Washing, sponging and waxing machines
- Waxing unit
- Drying section

- Grader
 - Rotary cylinder Grader (Reel grader)
 - Roller Grader
- Packaging
 - Regular slotted corrugated board box:\
 - Telescopic corrugated board box
- Accessories:
 - Plastic crates: (18-20 kg capacity)
 - Labeling and sealing equipment
 - Quality inspection tables
 - Fork lift: used for lifting of crates, bags or packed kinnow boxes
 - Conveyors

Sponging

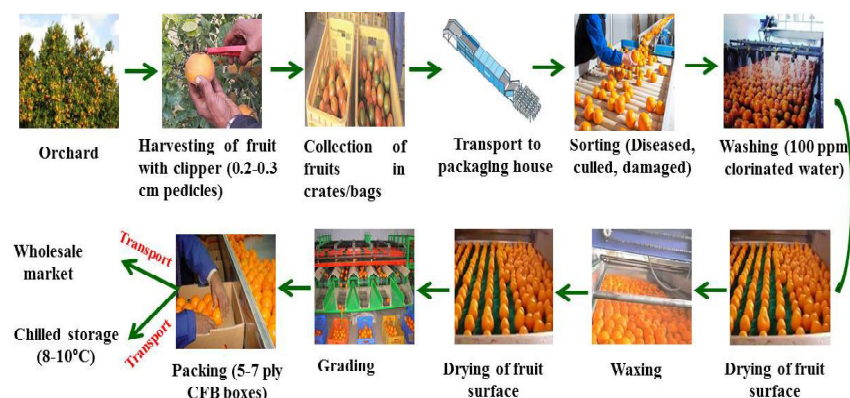


Fig. 1. Pictorial view of pack house operations of Kinnow fruit

Fruit and Vegetable pilot plant established at ICAR-CIPHET Abohar

A pilot plant for processing and value addition of Aonla has also been established at ICAR-CIPHET Abohar. This facility holds the purpose of demonstration and providing hands on training for the upcoming entrepreneurs who wish to have such type of facility at their vicinity for Aonla processing and product development. The fruit processing plant established at ICAR-CIPHET Abohar comprises of following machineries-

Table 2: Machineries available in fruit and vegetable processing pilot plant

S. No.	Machine	Capacity	Operation of machine
1.	Fruit washer	100-200 kg/h	Washing of fruits
2.	Fruit crusher	40-50 kg/h	Crushing of fruits into pulp
3.	Juice extractor	80-100 kg/h	Juice extraction from fruits
4.	Juice pasteurizer	100 l/h	Pasteurization of fruit juice
5.	Storage tank	100kg	Handling of product
6.	Steam jacketed kettle	100 liters	Concentration of product
7.	Vacuum bottle filling machine	0-1000 ml, Filling speed: 20-30 bottles/ min	Bottle filling of products
8.	Bottle Crowning Machine	100-150 bottles/h	Placing of crown over bottles
9.	Blancher Container	50kg	Blanching of fruits

Common utilities available in plant are listed below:

- a) Baby boiler
- b) Tray dryer
- c) Sealing or packaging machine
- d) Vacuum packaging machine
- e) Weighing machine
- f) Material handling devices and utilities
- g) Volume measuring devices

The facilities of established pilot plant are being used by the entrepreneurs for preparation of several value added products from fruits like Aonla, Mango, Guava, Kinnow, Sapota, Plum etc. Further the value added products that can be prepared using the established pilot plant from different fruits is given below:

Table 3: Value added products that can be prepared from listed fruits

Commodities	Value added products
Aonla	Whole aonla/ segment based products: Preserve (Murabba), aonla candy, aonla pickle Juice based products: Aonla juice, squash, Ready

	to Serve (RTS) beverage Aonla powder based products: Aonla shred powder, mouth freshner, churan Other products: Laddu, dry shreds, jam, sauce, chutney
Mango	Pulp based products: Slices/ amchur, leather/ aampapad/ slab/ amawat, jam, preserve chutney, toffee Segment based products: preserve (Murabba), candy, pickle Juice based products: juice, squash, nectar, Ready to Serve (RTS) beverage
Pomegranate	<i>Anardana</i> , frozen arils, seed oil, juice, squash, RTS, nectar, jam, jelly, peel powder
Guava	Pulp, squash, juice, RTS, nectar, jam, jelly, leather, cheese, toffee
Sapota	Pulp, squash, RTS, nectar, jam, jelly, leather, dried shreds, powder
Plum	Squash, jam, jelly, chutney, sauce
Kinnow	Juice, squash, syrup, marmalade, candied peels
Tomato	Puree, ketchup, sauce, soup, peel powder, dried slices, lycopene
Potato	Chips, shreds
Onion and Garlic	Dried flakes, powder, paste
Okra	Dried slices
Chilli	Paste, powder, puree, pickle, <i>chutney</i>

5. ENTREPRENERIAL OPPORTUNITIES IN FRUITS AND VEGETABLES AND THEIR RESOURCES

Overcoming challenges can be a game changer in augmenting opportunities to setup entrepreneurship in fruits and vegetable business. Some of the challenges and opportunities are been discussed here under

1. Post-harvest loss and their preventive measure

The fruit and vegetable segment has grown vigorously both in volume and in variety of outputs which are traded globally. Improved and precise technology, falling transportation costs, improved channelized marketing and evolving international markets, have all contributed towards robust growth. This increased level of fruit and vegetable output has, unfortunately, mismatched by processing, value addition, preservation and certainly developments in supply chain management. While minimal and traditional processing technologies present considerable opportunities for innovation and vertical diversification in the fruit and vegetable sector, relatively few small and medium enterprises (SMEs) are able to tap into and benefit from these opportunities.

Foreign Direct Investment (FDI) of 100% in food industry and streamlining the norms to set up business unit has increased the number of processing unit in India. Further, 100% FDI under Government route for retail trading through e-commerce, is permitted in respect of food products manufactured and/or produced in India. Establishment of 42 mega food parks, a primary processing center for grading, sorting, packing and collection center various producers. Agro-Processing Cluster (APC) enables to facilitate modern infrastructure, common facilities and encourages group of entrepreneurs to set up food processing units based on cluster approach by linking groups of processors with farmers/ producers and markets through well-equipped supply chain.

2. Challenges and avenues in cold chain

The estimated annual production of fruits and vegetables in the country is about 130 million tones. This accounts for 18% of our agricultural output. Due to diverse agro climatic conditions and better availability of package of practices, the production is gradually rising. Although, there is a vast scope for increasing the production, the lack of cold storage and cold chain facilities are becoming major bottlenecks in tapping the potential. The cold storage facilities now available are mostly for a single commodity like potato, orange, apple, grapes, pomegranates, flowers, etc. which results in poor capacity utilization.

As per National Centre for Cold-chain Development (NCCD), the Current gap in cold storage infrastructure estimated to be 40 million metric tons. The investment is expected to grow rapidly in India's cold chain in next 5 to 10 years. For instance, refrigerated transport, it is required 3 times the present infrastructure to handle full service in storage capacity i.e the current estimate of refrigerated transport shows that the available on road capacity is of 3.6 million MT only. The other opportunities lays in testing cum certification labs, research and framework development centers, training centers, IT network, handling and packaging equipment. Moreover, service tax has been exempted for various project erections pertaining to cold storage.

3. Fruits and vegetable exports

With production base of fruits and vegetable, India has tremendous opportunities for export. During 2017-18, India has exported fruits and vegetables worth Rs. 9,400 crores. But, India's share in the

global market is still nearly 1% only, but there is an increasing acceptance of fruits and vegetables from the country especially for Pomegranates , Mangoes, Grapes, Bananas, Walnuts in fruits and Onions, Mushrooms, Bitter Gourd, Okra, Chilles and Potatoes from vegetables . This may be due to concurrent developments in the post-harvest management such as quality assurance, packaging, strict regulation, standard operating procedures, cold chain infrastructure etc. Even large investment pumped in by public sector as well as initiatives of private sector with APEDA's assistance integrated post-harvest handling facilities and several centers for perishable cargoes and have been set up in the country. Initiatives to build capacity building at the farmers, processors and exporters' levels have also contributed towards this effort. These are some of the key factors have placed the food processing industry on a high growth track as reflected by the increase in food processing from 11 per cent in 2009 to 17 per cent in 2017.

4. **Technology delivery systems**

- a. Farm level intervention: Enabling farmers to cultivate multiple superior varieties with higher juice and brix content with distributed production. A distributed time for yielding varieties prevents glut and ensures stabilized prices, making lesser market risk for farmers. Development of clusters at different places for same agriculture commodity can create forward and backward linkage with better logistics and marketing channels. Consultancy on farm extension and sustainability are the fast and thrust area to grow entrepreneurs at full scale.
- b. Industry level intervention: Processor level interventions in citrus and apple fruits may get tax exemptions and financial subsidies for capacity expansion and improving the financial viability of existing units. The government is keen in looking at subsidizing the integrated units to setup for by-product processing.
- c. Corporate level interventions: Fragmented lands are often considered the biggest challenge for Indian agriculture; however, there has been success of a cooperative system in the fragmented dairy sector. There could be projects to address all aspects of fruit juice concentrate processing thus leading to a Fruit Circular Economy. These projects can be new venture in terms of developing new varieties, , farm extension services and providing e-marketing, digital market linkage to the farmers.

6. RESOURCES FOR AUGMENTING HORTI-ENTREPRENEURIAL OPPORTUNITIES

- Agro processing clusters set up by Project Execution Agency (PEA)/ Organization such as Govt/PSUs/ Joint Ventures/ NGOs/ Cooperatives/ SHGs/ FPOs/ Private Sector/ individuals etc. and are eligible for financial assistance.
- Under central governments scheme SAMPADA, financial assistance in setting up integrated cold chain, preservation and value addition infrastructure facilities are provided with an objective to arrest post-harvest losses of horticulture produce by providing infrastructure from farm gate to the consumer
- Under PMKSY Scheme for Infrastructure for Agro Processing Clusters, which aims at development of modern infrastructure to encourage entrepreneurs to set up food processing units based on cluster approach
- Technical Agencies (TA) of Ministry of Food Processing Industry (MoFPI) will be organizing capacity building workshops, training for Board of Directors (BoDs), business planning and other key members of the FGs on entrepreneurship and management related to food processing.
- Scheme under APEDA which provides financial assistance for development of an adequate infrastructure for export of agricultural products. The scheme covers fresh produce and processed food products. Its primary role is on setting up of post-harvest handling facilities to entrepreneurs.
- Indian Institute of Horticultural Research (IIHR) provides on-site incubation facility in order to encourage start-ups in fruit and vegetable processing
- Food Processing Training centres (FPTC) established under various institutes recognized by MoFPI imparts training on various areas such as cluster creations, processing of fruits and vegetables, framework and export regulations, analysis procedure, startups to producers, entrepreneurs etc.

7. ECONOMICS INVOLVED TO TAKE UP THE VENTURE FOR ENTREPRENEURSHIP DEVELOPMENT

Indian Council of Agricultural Research (ICAR) in its Consortium

Research Platform (CRP) project scheme has directed the respective institutes for establishment of pilot plants with respect to processing and value addition of fruits, vegetables, spices, oilseeds, grains etc. These established are serving as training cum incubation center for the local farmers/entrepreneurs. They can process their raw material under the guidance of trained professionals of the institute. The operating cost is also very minimal so as to encourage the local community for processing of raw produce. Utilizing the incubation facilities will not only ease the whole process for the farmers but also the collaboration with institutes will help them in gaining authenticity of their processed produce. ICAR-CIPHET is actively engaged in conducting entrepreneurship development programs (EDP's) on different aspects of processing of cereals, oilseeds, horticultural produce etc. The duration of such trainings will vary from 3-5 days and the fee structure also varies with technology/product.

Suggestions for further improvement in EDP (Dixit et al. 2014)

- The nomination of participants to the training must be based on certain criteria based on need assessment, willingness, socio-economic status, occupation, resources availability and market accessibility etc.
- There must be a continuous monitoring system of trained entrepreneurs so as to keep them updated with changing technological and market environment.
- Awareness on marketing aspects and funding source are vital and guidance should be given to the participants.
- The basic information about the 'Food safety and standards' and procedural guidelines for acquiring license from Government or any other authorized body.
- The fees should be waived off so as to increase the number of interested participants.

8. CONCLUSION

India abides to its agro climatic condition is a place suitable for growing wide range of fruit and vegetables. The post-harvest losses while handling and marketing are substantial and processing of these horticultural produce into various kinds of value added products not only stabilizes the market, it also creates opportunity for employment of rural youth which in turn will help in increasing the farmers income. The role of entrepreneurship in agro-processing in developing countries like India is very significant.

Entrepreneurship development programs conducted by ICAR-CIPHET have impacted well in terms of motivation and adoption of post-harvest technology. The establishment of processing units has resulted into economic benefits to the intended beneficiaries besides generating direct and indirect employment to the society. Finally, need based EDP's considering the socio-economic conditions, willingness, resources availability, geographical dimensions and market for final product are to be promoted so as to encourage processing in production catchments.

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COMMERCIALIZATION OF FLORICULTURE FOR ENTREPRENEURSHIP

**Mukesh Kumar, Madhu Bala, Kiran Bhagat and
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1. INTRODUCTION

Floriculture is the segment of horticulture concerned with commercial production, marketing, and sale of bedding plants, cut flowers, potted flowering plants, foliage plants, flower arrangements, and noncommercial home gardening. Floriculture crops include bedding plants, flowering plants, foliage plants or house plants, cut cultivated greens, and cut flowers. As distinguished from nursery crops, floriculture crops are generally herbaceous. Bedding and garden plants consist of young flowering plants (annuals and perennials) and vegetable plants. They are grown in cell packs (in flats or trays), in pots, or in hanging baskets, usually inside a controlled environment, and sold largely for gardens and landscaping. Geraniums, impatiens, and petunias are the best-selling bedding plants. Floriculture is an ancient farm activity with immense potential for generating remunerative self-employment among small and marginal farmers. Flowers are being cultivated in India from time immemorial. Since ancient times ornamental plants have been an integral part of life with gardens, flowers, and ornamental horticulture being noted in most of our historical references.

Now a day's floriculture is one of the commercial businesses which not only provides a handsome profit but also provides ample employment opportunity. In order to encourage floriculture business both central and state government has accorded export-oriented status. In India floriculture is considered as an industrial activity comprises flower trade, production of

nursery plants, potted plants, seed and bulb production. Flowers were cultivated for aesthetic purposes as also for their fragrance, perfumes and medicines. Changing life style of people has led to the commercialization of flower cultivation. The huge demand for flowers coinciding with various occasions has led to growth of market for flowers. Though, India has controlled climatic condition for floriculture states like Maharashtra, Karnataka, Andhra Pradesh, West Bengal is leading state on flower production. Hence floriculture business is one of the profitable entrepreneurial opportunities of our country.

2. WORLD FLORICULTURE MARKET

Floriculture as an industry began in the late 1800s in England, where flowers were grown on a large scale on the vast estates (Wikipedia, 2009). The industry continues to advance since that period. It is a profitable agribusiness throughout the world. The present day floriculture industry is very dynamic and fast growing. In the 1950s, the global flower trade was less than US \$3 billion (The flower expert, 2008). It has been reported that the world production of floriculture products was valued at US \$40 billion (Getu, 2009). The Netherlands, Japan, and United States of America (USA) account for nearly half of the world flower trade. In the 1990s, a niche market was developing for field-grown cut flowers, perhaps because many specialty cut flowers can be field-grown (Armitage and Laushman, 2003; Starman et al., 1995). The increasing interest in the production of specialty, field-grown cut flowers (Kelly, 1991) and their developing market (Starman et al., 1995) helped create the new niche for U.S. growers. Niches are specialized markets. Starman et al. (1995) identified specialty cut flower species that can be field-grown and profitable, provided a niche market exists. Floriculture is a lucrative industry in many parts of the world. The advancement of scientific techniques in flower cultivation has given a tremendous impetus to the growth of this industry. India has yet to cash-in on the production, marketing and export potentials in this field. Both domestic market and export potentials are prodigious. Floriculture sector, all over the world is experiencing rapid changes. Growing of flowers and ornamental crops is rapidly expanding dynamic global enterprise in to-day's world (Bhattacharjee, 2006).

Floriculture, a \$40 billion global business, is engaged in the struggle to transform something "natural and unspoiled" into a mass produced, transportable product, says Amy Stewart, bestselling author of *Flower Confidential: The Good, the Bad, and the Beautiful in the Business of Flowers*. This transformation relies on an extensive network of breeders,

field workers, auction houses, sales representatives, shippers, and florists to offer consumers a variety of choices well beyond those found in backyard gardens. Flower growers don't wait for nature to introduce the genetic mutation that will make them millionaires; in the lab, they painstakingly cross-pollinate promising varieties to develop new plants with marketable characteristics, creating hundreds of new varieties every year.

3. PRODUCTION AND CONSUMPTION

Globally more than 145 countries are involved in floriculture industry and the global floriculture trade is estimated to be at US\$ 70 billion at present (ICAR Vision, 2050). According to The International Association of Horticultural Producers (AIPH, 2010), 702,383 ha area was under flower production in different countries of the world, of which the total area in Europe was 48,705 ha, North America was 21,067 ha, Asia was 523,829 ha, the middle East was 4,026, Africa was 7,604 ha, North America was 21,067 and Central and South America was 97,152 ha. According to Indian Horticulture Database, India occupied a floriculture area of 183,000 ha, which was 26% of the global area. The global floriculture industry is experiencing rapid changes due to globalization and its effect on financial development in the different regions of the world. At the same time, competition is increasing worldwide. The Netherlands, USA, Columbia, Japan and Italy are well known as traditional growers of flowers. Some Asian countries like India, China, Bangladesh, Thailand, Vietnam, etc., are also steadily improving horticultural production. Also in Latin America and Africa, production is increasing very rapidly. Major flower consuming countries in the world concentrate in the Western Europe and North America. Germany, USA, UK, the Netherlands, France and Switzerland together consume around 80 percent of the total flower production (Global Horticulture, 2014 -2018). Of the world's ten largest domestic markets for cut flowers, six are in Europe, namely Germany, the UK, France, Italy, the Netherlands and Spain. Other important markets are the US and Japan, accounting for around 20 percent each. Recently, Russia and the Middle East have also become important markets demonstrating rapid market growth. In the earlier years, Netherlands (Euro 3901 million), the United States (Euro 2992 million), Japan (Euro 2987 million), Italy (Euro 1627 million), Germany (Euro 1289 million) and Canada (Euro 1067 million) are the largest producers of cut flowers and plants. However, due to stagnation in production in these traditionally recognized centers, developing countries have emerged as large production centers in the past few decades. This is further supported by low production cost and seasonal advantages in the developing countries, which ensures supply of floriculture products

throughout the year. Some of the major developing country producers and exporters of cut flowers and plants are Colombia, South Korea, Kenya, Israel, Ecuador, Poland, Ethiopia, Costa Rica, Thailand, India, China, Zimbabwe, and Mexico. The economies of some of these countries are even dependent on floriculture industry, such as Colombia and Kenya, China (286,068 ha) and India (161,000 ha) having the majority of the world acreage under cut flowers and plants production, the Asia-Pacific region has the major share (75 percent) of the total world area under floriculture production. Europe has a 10 percent share in the world area under floriculture. The acreage under flower cultivation in Africa is very small (1.5 percent). With around 2200 ha, Kenya is the largest producer of flowers and plants in Africa, followed by South Africa and Zimbabwe both growing over 1000 ha of flowers. Latin America has an 8 percent share in the world area under floriculture, with Mexico having the largest area under flower production (21,129 ha).

4. GLOBAL PROFILE OF FLOWER PRODUCTION AND EXPORT POTENTIAL

It is seen that the Netherlands is the world leader. Total world export of floriculture products stands at USD 9,784,525,000 and Netherlands claims 47.7% of total world exports. The other major countries are Colombia, Ecuador, Kenya, Ethiopia and Belgium. India is in 14 position in exporting floricultural products (Fig-1). In the year, 2007, worldwide export value of cut flowers and foliage amounted to US\$ 8.41 billion. Europe still maintains its position as the leading exporter in the world with a share of over 60 percent of total exports of cut flowers and foliage. However, European exports of cut flowers and foliage (US\$ 5.06 billion) are largely intra-European in nature with only about 11 percent exported to other non-European countries. The share of non-European countries in the worldwide export value of cut flowers was about 25 percent in 1994, which has gone up to around 30 percent in 2007. Re-exports are very common from some of the leading European exporting countries such as the Netherlands and Italy. The world exports of live plants, bulbs and cuttings are estimated to be about US\$ 8.58 billion in 2007. This is more than the three times the value of flowers exported in 1994 (US\$ 2.8 billion). As in the case of cut flowers, Europe is the leading exporter of live plants, bulbs and cuttings, supplying predominantly to the European countries.

During the year 2003-2007, The Netherlands was the largest cut flower producer in Europe. The production value of flowers and pot plants in the Netherlands increased by 10 percent annually, amounting to Euro

3,901 million in 2007. In USA, the total production area under floriculture crops declined by 2.5 percent in 2007 compared to 2006. The flower industry in the United States is undergoing a period of consolidation. The large operations account for 96 percent of the total value of floriculture crops. Annuals and perennials are the largest selling items accounting for 32 percent of the total floricultural sales in 2007. The wholesale value of sales of floricultural products in 2007 was estimated at US\$ 3.9 billion, registering an increase of 2 percent over the year 2006. In Canada, the area under cultivation increased by 10 percent over the five years between 2001 to 2006. Total number of operations, both farms and nurseries, declined to 11 percent and 16 percent respectively between 1981 to 2006. The flower industry in Canada is generally concentrated in Ontario, British Columbia, and Quebec, which together account for about 85 percent of total production. Japan is one of the largest flower growing countries in the world. Around 47 percent of land area under flower cultivation is currently, under protected cultivation such as greenhouses and covered structures. Chrysanthemums are the most important flowers cultivated in Japan. Japan is one of the largest consumers of cut flowers and potted plants. Japanese cut flower retail market is estimated to be worth US\$ 9.3 billion. Japan is the tenth largest flower importer in the world. Only 7 percent of the cut flower consumption in volume terms is imported by Japan. The country Ecuador has around 3,500 ha under floriculture, of which, 2,500 ha is under rose cultivation. Other flowers grown in Ecuador are Chrysanthemum and Carnation. The sector employs around 60,000 people directly and over 100,000 people indirectly. Israel's cut-flower industry is regarded as one of the most advanced flower industries in the world by virtue of the technologies used in production of large varieties of flowers in the desert-like conditions. Flowers and ornamental plants account for 8.0 percent of Israel's total agricultural production. Israel's flower sector is relatively small by international standards, but is highly profitable. Flowers are Israel's leading agricultural export item (29 percent). Israel ranked 12th amongst world exporters of floriculture products and its share in world exports was around 1.5 percent (US\$ 259 million) in 2007. In Kenya, the flower industry employs around 100,000 people directly and around 2 million people indirectly. Kenya is currently, the world's seventh largest exporters of flowers accounting for 2.6 percent share in world exports. Kenya has the largest market share in European flower imports (51 percent) compared to other Sub Saharan African country exporters. The Ethiopian flower industry took-off in 2005, and currently, ranks 22nd amongst world exporters of floriculture products, with a share in world exports of around 0.51 percent. There are over 70 flower farms in Ethiopia. Ethiopia grows Roses, Carnations, Chrysanthemum

and Statice. The sector generated employment for over 50,000 persons (permanent and temporary), and has become one of top five foreign exchange earning products of the country. In Ethiopia, about 40 percent of the farms are fully foreign owned, 23 percent are joint ventures, and 36 percent are fully domestic owned. China's ornamental plants growing area was only about 3,000 ha in 1985; which has currently crossed over 700,000 ha. In 2007, China ranked 17th amongst world exporters of floriculture products with a share in world exports of around 0.76 percent. It is the third largest supplier of floriculture products to Japan. Thailand covers about 6,000 acres, mainly in Bangkok and nearby provinces, namely Nakhon Pathom, Samut Sakhon, Ratchaburi, Pathum Thani, Ayutthaya, Suphan Buri, and Chon Buri. The flowering season in Thailand usually takes place during the rainy season, from July to October. There are more than 1,000 species of Orchids in the country. Besides Orchids; over 30 types of flowers are commercially cultivated in the country, which include Roses, Carnations and Chrysanthemums.

5. INDIAN SCENARIO

India's, commercial floriculture has gained momentum in the 1990's. The development of Indian commercial floriculture has centered around the production of rose, marigold, gerbera, chrysanthemum, gladiolous, anthurium, carnation, orchid, tuberose, lilium, alstroemeria etc. In India, the area under flower cultivation has more than doubled from 53,000 hectares (1993-94) to 1,61,000 hectares (2007-08) and has been growing at a CAGR of 8.26 per cent. Out of which, 500 ha of production is in greenhouse; around 5 percent of greenhouse production is domestically consumed and the remainder is exported. In 2007-08, flower production in the country was estimated at 870,000 MT of loose flowers and 4,342 million (numbers) of cut flowers. It is seen that the growth rate has drastically changed during the year 1995-96, 2003-04, 2011-12 and it is decreased in the year 2012-2013 and again increased in 2013-14 (Fig-2). Indian floricultural products have been attaining to the world floriculture trade by increasing the productivity. The Agricultural and Processed Food Products Export Development Authority (APEDA) manages for developing and promoting agri-exports including flowers. India's exports of floricultural products in the year 2007-08 decreased by 48 percent to US\$84.5 million (Rs. 340 crores), from US\$ 144 million (Rs. 653 crores) in 2006-07, which further decreased by 5.18 percent in the year 2008-09 to US\$ 80.31 million. However, in rupee terms there was a marginal increase of 8.4 percent from Rs. 340 crores in 2007-08 to Rs. 368.8 crores in 2008-09. It is also observed that from 2006-07 production quantity as well as value slowly

decreases up to 2009-10. It is evident from the (Fig -3) that there is a gradual rise of

flowers production in the following years. Loose flowers production almost keeps uniformity in its incremental rate. From the graph, it is clear that the cultivation of cut flowers is in the process of accelerating the floriculture development in India. Since at present cut flowers are highly demanding particularly for export purpose and India has been shifting from traditional flowers to cut flowers production. In the time periods 2009-10 to 2014-15 though the quantity of the total exported products varies slightly, export value has significantly increased. It has happened due to the increasing trend of global market price. Thus, India has an opportunity to increase the export potential by increasing the productivity of commercial flower (Fig-4). The country's share in the world trade of fresh flowers is 0.40 per cent to 0.50 per cent as compared to Netherlands 65 per cent, Columbia 12 per cent, Italy 6 per cent, Israel 4 per cent, Kenya 1 per cent and other countries 20 per cent. Recently, It is observed that the export to the different countries is quite uneven. In the year 2014-15 the floricultural products have been exported to 105 countries, of which 86.3% are exported to the 18 countries shown in the figure. It is clearly seen that the biggest export market is the USA importing 5490 MT quantity by 98.13 crores. The USA imports 23.9% of the total exported quantity followed by UK, Germany, the Netherlands, UAE, Canada, Japan, Australia, Italy and Singapore. These ten countries together import more than 70% of the total exported quantity. The Netherlands, which is known as the leading exporter in the world trade of flowers, also imports a large amount of floricultural products from India (Fig-5). The area under floriculture although high compared to many countries, the area under protected cultivation is low compared to these countries. The proportion of area under protected to total area floricultural area is 99 per cent in Colombia, 70 per cent in Netherlands and 57.51 per cent Italy and in India it is 0.56 per cent. The investments in this sector and per capita consumption of flowers are also considerably low when compared to other developed countries like Western Europe, Japan and USA. In other words, the vast potential in the country does not seem to be fully tapped.

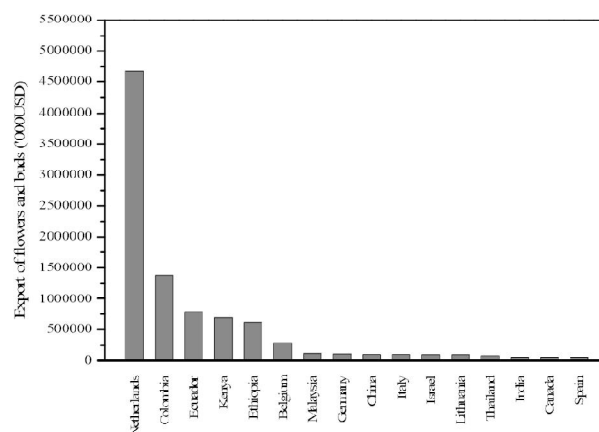


Fig- 1: World's leading cut flowers and buds exporting countries Source: ITC Trade Map- International Trade Statistics, 2014

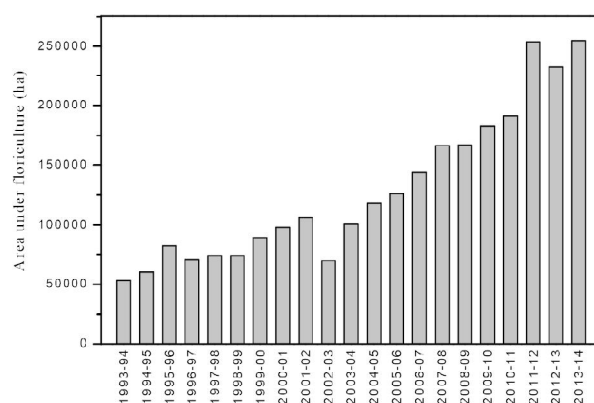


Fig- 2: Area under floriculture (ha) in India from 1993-94 to 2013-14
Source: Indian Horticulture Database, 2008 and 2014

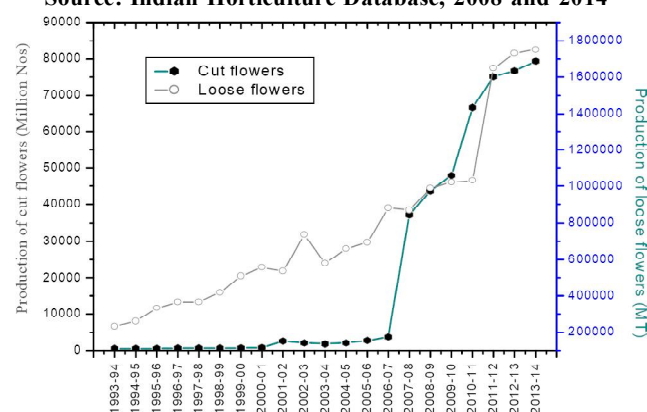


Fig- 3: Yearly production quantity of important Indian loose flowers (MT) and cut flowers (Million nos) Source: Indian Horticulture Database, 2008 and 2014

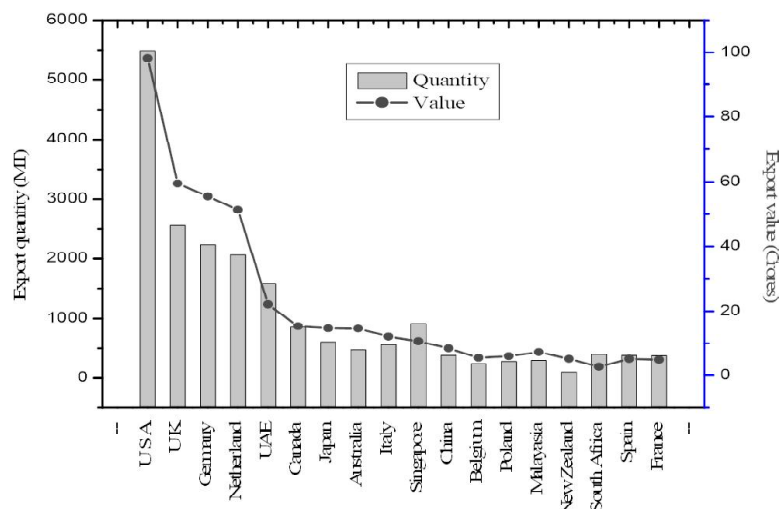


Fig-4: Export of the floricultural products from India in quantity (MT) and value (Crores)

Source: APEDA 2000-01 to 2014-15

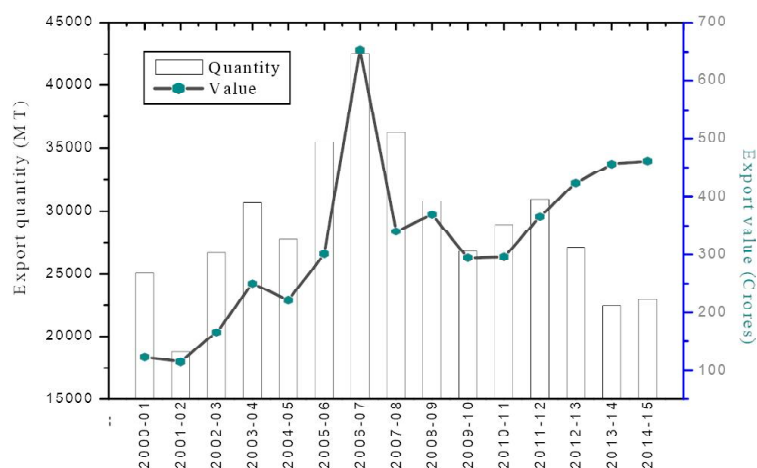


Fig- 5: Floricultural products export from India to major importing countries by quantity (MT) and value (Crores)

6. CONSUMPTION OF FLOWERS IN DIFFERENT COUNTRIES

Europe (Germany, UK, France and Italy), USA and Japan are the major consumers of floriculture products. Flower consumption in the United States is relatively low as compared to Western Europe; however, the industry has been consistently growing. The consumption in the developed markets in the Europe and Japan has been showing stagnancy or declining trends, in the recent years. In case of cut flowers, per capita consumption

in Japan is the highest, followed by Europe and USA. The European Union (EU) consumes over 50 percent of the world's flowers, and includes many countries, which have a relatively high per capita consumption of cut flowers. Germany is the major consumer, followed by the UK, France and Italy, in the order of importance (Fig- 6). In 2006, per capita consumption of floricultural products was highest in Switzerland followed by Norway, Denmark, The Netherlands, Sweden, Germany and Austria. Currently, the per capita expenditure in East European countries on flowers and plants amounts to approximately Euro 7 to Euro 8 per person per year. Flowers in EU are sold mostly in auctions at the Netherlands and also some through direct sales. The Netherlands auctions are generally considered as indicator for the best sold cut flower species in the EU. Rosa is the most important cut flower traded at the Netherlands auctions, followed by Dendranthema, Tulipa, Lilium and Gerbera.

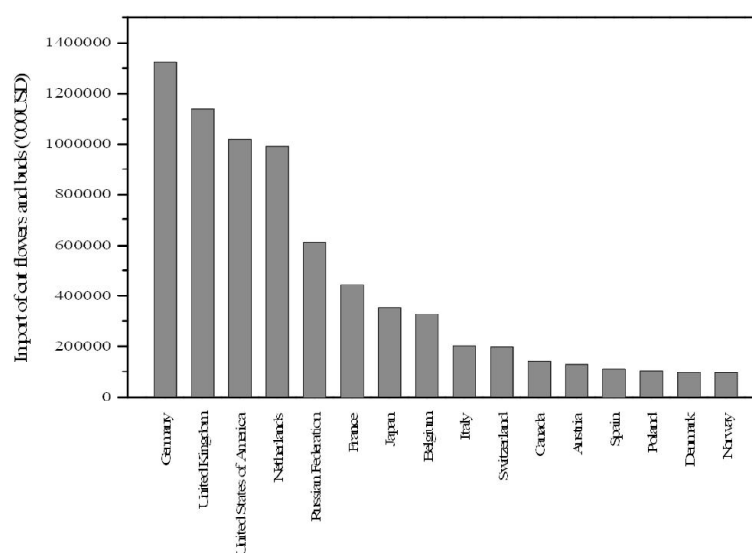


Fig- 6: World's leading cut flowers and buds importing countries

Source: ITC Trade Map- International Trade Statistics, 2014

7. Global leaders in cut flower exports (Top ten countries)

Netherlands continues to be the largest exporter of cut flowers in the world market, having a 52% share of the global market for cut flowers today. Columbia occupies 15% of the global market share in the cut flower export sector, generating revenue of around \$1 billion dollar. Ecuador occupying a 9% share of the global market in terms of cut flower export values. 7% of the global market share of cut flowers is held by the Kenyan

cut flower industry. Belgium is also cut flower producers in the world, holding 3% of the total global market share for cut flower exports. Ethiopia holds a 2% share in the global flower export market and it is predicted that by the end of 2016 the country will be earning \$550 million from annual exports of cut flowers. Malaysian cut flower exports account for 1% of the global market share of these products. 1% of the global market share of cut flowers today is held by Italy. Germany occupying 1% of the global market share in flower export and Israel is holding a 1% share of the global market in terms of cut flower exports (Fig. 7).

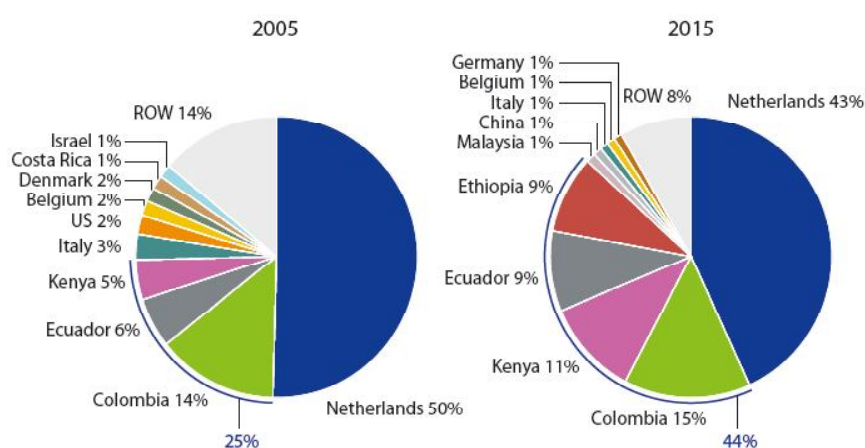


Fig- 7: World's largest cut flower export countries, 2005 vs. 2015

Sources: UN-Comtrade, Royal FloraHolland, Rabobank, 2016

8. FLOWER PRODUCTS FOR HIGHER ECONOMIC VALUE:

8.1 Dehydration of flowers and foliage and floral craft

Dehydration technology can also be exploited for dehydration of promising colourful cut flowers in its original colour and shape for long term enjoyment and for commercial utilization of unutilized/underutilized plant species. Dry flowers that are near natural, dried and preserved, have an everlasting value that can be cherished for longer periods and require little care. Dry flower market has grown exponentially as consumers become “eco-conscious” and choose dried flowers as the environmentally friendly and biodegradable alternative to fresh flowers. There is large potential to develop the dry flower industry in every country and to provide employment to house wives and rural women.

Methods of dehydration

Press Drying : The flowers and foliage are kept in blotting sheet/news paper and pressed dried with the help of “Plant Press”. The plant press has been specially designed in a very simple way. The plant press is made up of two wooden board fixed with nuts and bolts at four corners. The size of plant press may vary (6" X 12" to any desired size). Collected leaves and flowers are kept between blotting sheets and one type of leaves/flowers are always pressed in one sheet. All blotting sheets containing leaves/flowers are kept between two ply boards and tightened with nut and bolt. The materials may be kept at room temperature for dehydration. Blotting sheets are changed every 3rd and 5th day to avoid fungal effect/ contamination. This helps maintenance of original colour of flowers and leaves. For quick drying, the pressed materials may be kept in hot air oven at 60o C.

Embedding and Drying: Flowers are embedded either in sand or in silica gel in earthen/plastic/tin/glass pots and pots are kept for dehydration in hot air oven / micro wave oven / solar cooker. The hot air oven is thermostatically controlled.

Hot air oven : In hot air oven, the temperature is maintained 40 – 450C.

Microwave oven: Flowers are dehydrated within 5 – 10 minutes. Pots after taking out from micro wave oven are kept for two hours at room temperature for setting

Solar Cooker : Flowers can be directly embedded in the container of solar cooker and it can be dried under sun. The time of exposure vary according to day temperature. The solar cooker can also be operated electrically. Solar cooker will be most suitable for rural women. They can cook their food in solar cooker and rest of the time can utilize for dehydration work.

Suitable methods of drying and dehydration of flowers and foliage plants

Press drying: Candytuft, Chrysanthemum, *Euogirua keyciceogakam*, Lantana, Ixora, Mussaenda, *Galphimia nitida*, *Pentas carnea*, Grasses, Foliage of *cassica biflora*, Golden fern, Silver fern etc.

Hot Air Oven drying : *Helptenum roseum*, chrysanthemum, Candytuft, Gerbera, *Gomphrena globosa*, *Helochrysum bracteatum*, *Euphorbia leucocephala*, *Delphinium ajacis*, Rose, *Zinnai linearis*, Bougainvillea, Narcissus, Dahlia, Gladiolus, *Tagetes petula*, *Tagetes erecta*, *Nymphaea* sp.

Different flowers take different time to dehydrate in hot air oven like *Acroclinum*, Aster, Bougainvillea, Candytuft, Marigold (small), *Zinnia linearis* - 48 hours; *Ixora* – 36 hours; *Chrysanthemum*(small flower) – 45-48 hours; *Dahlia* (pompon), Marigold (large), *Narcissus*, *Zinnia liliput* – 72 hours; *Nymphaea* – 120 hours.

Microwave oven drying: *Antirrhinum majus*, *Callistephus chinensis*, *Chrysanthemum*, *Gerbera*, *Gladiolus*, *Legestromia indica*, *Narcissus sp.*, *Delphinium ajacis*, *Helichrysum bracteatum*, *Phlox*, *helipterum roseum*, *Ixora coccinea*, *Nymphaea sp*

A quantitative estimation has also been done i.e. fresh flowers approx. 8,000 of *Acroclinum*, 2,600 of *Helichrysum*, 2,700 of Aster, 350 of Rose, 800 of Marigold large, 550 of *Dahlia*, 1,17,500 of *Ixora* and 16,000 of Annual *Chrysanthemum* are required for preparation of one Kg. of dry flowers.

Techno-economics

Hot air oven is easily available in the market or it can be fabricated of any desired size. The price varies from Rs. 5,000/- to Rs. 40,000/-. Micro wave oven costs from Rs. 6,000/ to Rs. 20,000/ and the price of Solar Cooker varies from Rs. 2500/- to Rs. 3,500/-. Therefore, initial capital cost for starting dry flower business is not high. For press drying approx. Rs. 2000/- and for Hot Air Oven drying Rs. 10,000/- (along with other raw materials) initial investment required to start dry flower business. (Datta, 2011)

Production Cost and profit margin : Rs. 4,250/- are the production cost for 1600 Greeting Cards (9 x 25 cm size) and profit is Rs.3,744/-. Similarly for production of 100 pieces of three dimensional floral arrangements in sealed glass containers Rs. 3,515/- are the production cost and the profit is Rs. 2,485/-. (Datta, 2011)

8.2 Essential oils

Essential oils are a concentrated hydrophobic liquid containing volatile aroma compounds from plants. Essential oils are also known as volatile oils, ethereal oils or aetherolea, or simply as the “oil of the plant” from which they were extracted. Oil is “essential” in the sense that it carries a distinctive scent, or essence, of the plant and is therefore used in food flavouring, perfumery and therapeutically in aromatherapy.

Scenario of essential oils

Global: Estimated world production of perfume oils, for all applications

taken together is about 250,000 tons. The global export of these oils, perfumes and flavours increased from US \$ 2149 million in 1986 to US \$ 8254 million during 2002. Imports recorded an increase from US \$ 2008 to US \$ 5316 during the same period. On the production side, the total worldwide production of essential oils is estimated at about 1,00,000 to 1,10,000 tonnes. The production of geranium essential oil alone is estimated to be nearly 400 tonnes per annum, with a value of US \$ 20-30 million. The world's largest importer of aromatic materials is the USA followed by Japan (Verma *et al.*, 2012).

Indian: India ranks 26th in import & 14th in respect of export in world in the trade of essential oil. India holds around 0.7% of import & 1.1% of export. Jasmine and tuberose concentrate from South India have created a marks in world marked. The major buyers of Indian essential oil are Former USSR, USA, France, UK, Netherlands, UAE and Saudi Arabia. Growth in perfumery is higher i.e., 15% in India compared to 7% in America and 5% in Europe (Verma *et al.*, 2012).

Opportunities in the essential oil industry:

Manufacture of perfumes, creams, aftershave lotions, soaps, detergents, agarbattis, incense, shampoos, bath oils, hair oils, talcum powder and other cosmeceuticals. Flavouring all types of food products like candies, beverages, tobacco, soups, chewing gum, sauces, desserts, cake mixes, etc. As therapeutics, antiseptics, bactericides or germicides and are also used in making balms, tooth pastes, mouth washes, antiperspirants, deodorants, insecticides and aerosols. For protecting fur, wool, silk clothing and for making shoe polish, and also as solvents in the paint and varnish industry. Manufacture of paper, plastics, textiles, paints as well as synthetic odour and flavours.

Aromatherapy: It is a form of alternative medicine that uses volatile plant materials, known as essential oils, and other aromatic compounds for the purpose of altering a person's mind, mood, cognitive function or health.

Different oil extraction methods for flowers

There are six methods of extracting essential oil from flowers;

i. Distillation: There are three types of distillation used: Water or Hydro distillation; Water and steam or wet steam distillation; and Direct steam or dry steam distillation.

ii. Enfleurage: This process is useful to extract delicate floral scents from flowers that produce essential oils even after being picked (for example;

jasmine, tuberose, violets, etc.) or where the oil is affected by higher temperatures.

iii. Maceration: In this method, successive batches of chopped plant materials are digested with hot oil at 45-80°C for several hours. The filtrate is heated with successive batches of fresh flowers up to 20 times.

iv. Solvent extraction: When oil with natural flavor is required, direct extraction with solvents such as petroleum ether or benzene is practiced.

v. Mechanical expression: In this process, the fruits are compressed or squeezed in claw-shaped bowls where juice is sucked out of the fruit through a cannula inserted in the pulp, while the oil released from the oil cells is rinsed with water and then the two are separated by centrifugation or the fruits are placed in a revolving vessel fitted with spikes to release the oils.

vi. Adsorption: In this process, hot air or inert gas is passed over the aromatic plant material which is then led through the activated carbon from which the essential oils are recovered by solvents.

Flowers yielding essential oils:

Rosa sp oil: About 10 tonnes of rose oil is produced in the world out of which Bulgaria produces more than 5 tonnes. India produces a very small amount of rose oil, which does not exceed 10 kg. Important constituents of rose oil are : l-citronellol (40-65%), nerol, geraniol, linalool, eugenol etc. Recovery and Yield: In Bulgaria, *Rosa damascene* yielded 1 kg oil/4000 kg of flowers, when extracted in industrial still. *Rosa damascene* yields 0.05% oil, of highest quality which fetches highest price.

Jasminum sp oil: Next to rose, jasmine is the most important perfumery raw material used since the beginning of human civilization. The word 'jasmine' is derived from Persian word 'yasmyn' meaning 'fragrance'. Jasmines are cultivated throughout our country in an area of 8000 ha. Egypt is the largest producer (10-15 tonnes concrete/yr) followed by Morocco, France, Algeria, Italy and India. Main constituents of jasmine concrete are benzyl acetate, benzyl benzoate, geraniol, eugenol, benzaldehyde, indole, nerol, methyl jasmonate etc. *Jasminum auriculata* also known as 'Juhi' has highest oil recovery (0.29%). Important varieties are Parimullai, CO-1 Mullai, CO-2 Mullai, *Jasminum grandiflorum* or 'Chameli' has best Quality oil (0.25-0.30%). Other important varieties are JG 1, JG 2, JG 3, JG 4, JG 5, JG 6, CO1 Pitchi and CO2 Pitchi.

***Polianthes tuberosa* oil:** About 30,000 kg loose flowers give 27.5 kg of concrete and this concrete gives 5.50 kg absolute. Generally, 1 kg concrete is obtained from 1150 kg of flowers. Oil is used on heavier types of scents and also used in nonalcoholic beverages, ice cream, candy, baked goods etc.

***Lavandula angustifolia* oil:** The fragrant oils of its flowers are used in aromatherapy, baked goods, candles, cosmetics, detergents, jellies, massage oils, perfumes, powders, shampoo, soaps, and tea. Yield is 0.81% on steam distillation. Known chemical constituents of volatile oil: linalyl acetate, linalool, borneol.

***Pandanus fascicularia* oil:** It is distributed in tropical areas and in India, it is found growing in the coastal district of Orissa, Gujarat, Andhra Pradesh and Tamil Nadu. Male inflorescence exhales odour and it is an economically important part of the plant which is highly scented. Attar is used for flavouring hair oils, soaps, bouquets, cosmetics, snuff and incense.

***Tagetes* sp oil:** In India, four species *T. erecta*; *T. patula*; *T. signata*; *T. minuta* have been naturalized for processing of essential oil. The plant and essential oils have been found to be repellent to the common house fly, *Musca nebulosa*. The ethanolic extract of the entire herb showed antiviral activity against Ranikhet disease virus. Volatile oil isolated from *Tagetes minuta* exhibits Tranquillizing, Hypotensive, Spasmolytic, bronchodilatory and anti inflammatory properties.

***Achorus calamus* oil:** Its essential oil is extracted from the roots by steam distillation and has been used since ancient times as one of the ingredients of the holy anointing oil. Traditionally, this herb was smoked, eaten, or brewed into a tea, decoction, extract and syrup. The oil has the compound asarone which has tranquilizing and antibiotic activity but is also potentially toxic and can cause mild hallucinations. So it should be well diluted before use.

Other important essential oil-bearing ornamentals: The other ornamental plant which are used as essential oils i.e. *Michelia champaca*, *Narcissus*, *Magnolia* sp., *Cestrum nocturnum*, *Gardenia jasminoides*, *Iris* sp., *Dianthus caryophyllus*, *Michelia champaca*

Essential oils as therapeutics:

Shunying et al., (2005) evaluated the antimicrobial activity of essential oils from air-dried and processed flowers of *Chrysanthemum indicum* and found out that the oil of the processed flowers with higher percentage of camphor, exhibited greater bacteriostatic activity. Adamczak et al., (2011)

determined the variability in the content of oil and main fatty acids in hips of all native rose species of section *Caninae*. Katsukawa et al., (2011) identified geraniol and citronellol, the major chemical components of rose oil, as suppressors of COX-2 expression and activators of PPAR and this may be important in understanding the anti-inflammatory and antilifestyle-related disease properties of these chemicals.

Essential oils as food preservatives

Lodhia et al., (2009) tested the anti-bacterial activities of essential oils extracted from flower petals of palmarosa, evening primrose, lavender and tuberose against gram-positive and gram-negative bacteria. Palmarosa oil showed the highest activity against both bacteria among the tested essential oils.

9. FUTURE PROSPECTS OF FLORICULTURE IN INDIA

Today, a significant growth in Indian floriculture is observed and a significant increase in acceptability of Indian flowers in the global market is perceived. Indian floriculture is slowly progressing towards becoming globally competitive with the new global trade rules under the WTO regime. The growing urbanization and changing lifestyles have given a boost to the per capita consumption of flowers and plants and as a result flower retail shops and boutiques have mushroomed all over the cities and towns. Thus, Flora Industry in India is shining and holding great promise with immense investments and employment opportunities along with several challenges. Here, pockets in Maharashtra, West Bengal, South Gujarat, are fast approaching towards becoming 'A hub of Floriculture' in near future and soon may become a candle of inspiration for the entire India. Also, a large number of export-oriented units have created facilities of precooling chambers, cold stores and reefer vans and their produce coming for domestic market sales are also, thus, of good quality and have longer vase life, and fetch higher price. Further, research based on postharvest and transportation problems observed in cut flower trade need to be focused and innovative approach and ideas among growers need to be encouraged. Efforts are needed to popularize cut flower use among the high income group in the country and indigenous flowers outside the country. Further, nursery industry need to be given boost and should be considered as a major component of floriculture as it is being excluded so far. In view of the unorganized set up, it is difficult to estimate the size of flower trade, both in terms of volume and value. Realizing the importance of floriculture's contribution to national agricultural economy, the Government of India has introduced many developmental programmes through the schemes of

Ministry of Agriculture implemented under (National Horticulture Board), National Horticulture Mission, Ministry of Commerce and Industry, implemented by (APEDA) and Technology Mission for North Eastern States. All these have generated ample scope for the industry to expand in domestic and global sales. Today, flowers have become an integral part of ceremonies, they are yet to enter our homes and offices on regular basis and to explore at industrial level. There is a need to promote and explore the flower trade in addition with the other value addition techniques including pot plant trade along with infrastructural support and market intelligence study as major steps for strengthening the flower trade in India. Thus, potential for flower industry in India, including production for domestic and export sales of flowers and plants is unlimited, provided the challenges are converted into opportunities through strategic planning, creating awareness, infrastructural development and collaborative and cooperative approach.

10. CHALLENGES OF FLORICULTURE IN INDIA

As there is ample opportunity for flower cultivation in the state but its commercialization is a recent development by the horticulture department. The problems in this area are mentioned below.

10.1 Lack of infrastructural facility:-

Despite increasing demand of flowers day by day in the India, one of the major drawbacks is a requisite infrastructural facility. The scope of infrastructure like flower mandi, cold storage, facility of an auction sale, are some of the requirement which is not available plentifully in the state for development of floriculture.

10.2 Poor scientific knowledge:-

The traditional practice of plantation of the flower is one of the major problems for the farmers of the India. The farmers should be provided update scientific method of the plantation of the flower so that the flower production will increase both in quality and quantity.

10.3 Post harvesting situation:-

Marketing is one of the most important problem for floriculture business. Due to poor post harvesting situation in India there is no enough scope for marketing of flowers. At the time of harvesting, the farmers have to either depend on traditional sale or they have to depend on govt. agency to get the right price of the product. There is no formal agency either in govt. sector or in the private sector for selling of the product after harvesting.

10.4 Middle man exploitation: -

This is another problem which poses a serious challenge for the entrepreneurs of the flower. Most of the farmers fall into the trap of middle man as they have no idea or knowledge regarding the demand and the right price of the flower. In such a situation the middle man gets the opportunity to exploit the genuine farmer of the flower.

10.5 Inadequate institutional support:-

One of the major problem in floriculture business in the India is a lack of adequate financial support by the banks and other sources. The Govt/ Institutions/ Universities should ensure the supply of qualitative seed, proper marketing facility storage of flower during production season is some the support in order to promote floriculture in the state.

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AGRI-ENTREPRENEURSHIP DEVELOPMENT THROUGH BOVINES

Varij Nayan and Anuradha Bhardwaj

1. INTRODUCTION

Agriculture has been the mother of humanity. Agriculture including the animal agriculture has shaped the landscape of various civilizations for thousands of years and the world as we see it today, is unimaginable without it. In India, animal husbandry is not only complementary to agriculture but also plays an important role in its economy by providing livelihood to unemployed and rural youth and women. Agriculture and animal husbandry can be heralded as an opportunity for “cultivated thought”. No doubt, there has been a significant revolutionary development in small farm management in respect of all the sub-sectors, i.e., crops, animal husbandry and fisheries. This process needed to be encouraged to provide ‘the power of mass production to production done by the mass of small farmers’. The challenges that India’s agriculture faces in the coming years are also enormous. In fact, the agricultural setting has also transformed considerably in modern era and a second green revolution is needed in the ignored and lesser privileged parts of our country with radical and novel measures and technologies. The economic scenario in India is also undergoing a sea-change, with Indian economy slated to remain as the top three world economies by 2050 (Chateau et al., 2011; Hawksworth and Chan, 2013, Nayan, 2015).

In this context, it is important to realize that livestock sector is contributing more than 4 percent of the total Indian GDP since last three decades and is well set for bigger roles with inputs of right policy initiatives. The percentage contribution of agriculture in total gross value added (GVA

at constant prices-2011-12) is 9.3% (for 2015-16), whereas it is 4% to total GVA (for 2015-16) (Fig. 1). It clearly implies that the livestock sector is expanding much faster than any other agricultural sector. It will not be surprising if the livestock sector produces more than half of the total agricultural output in coming decade. This gigantic contribution of livestock sector can be largely owed to the bovines especially the domestic cattle and the river buffaloes.

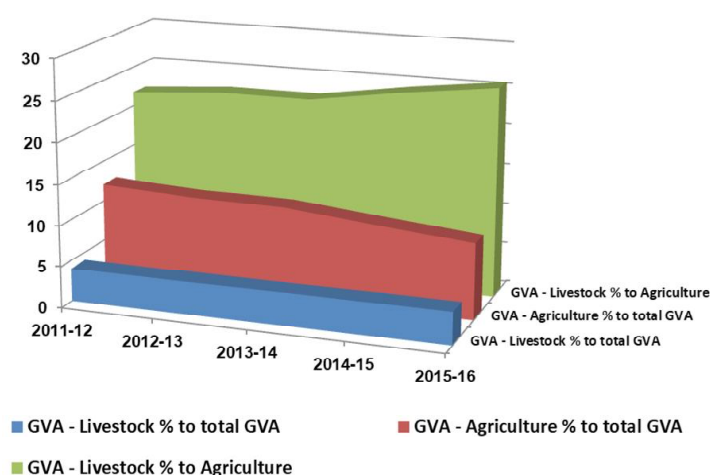


Figure 1: Recent trends in livestock sector's contribution to the agriculture sector of India

The contributions by other members of bovidae family are lesser though. The species-wise percentage contribution towards total milk-production during the period of 2016-2017 is exhibited in the Fig. 2. Similarly, Figure 3 depicts the all-India average milk productivity (Kg/day) of the popular bovines.

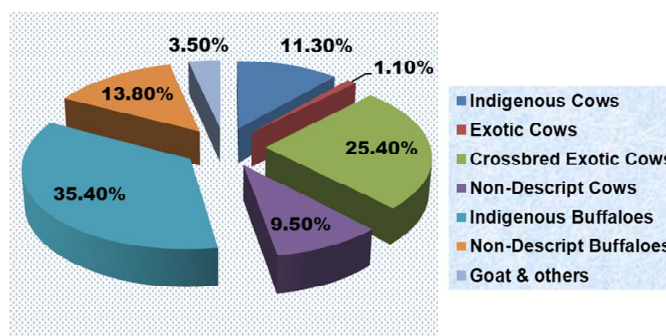


Figure 2: Contribution by different bovines and bovidae in the total milk-pool (2016-17) of India

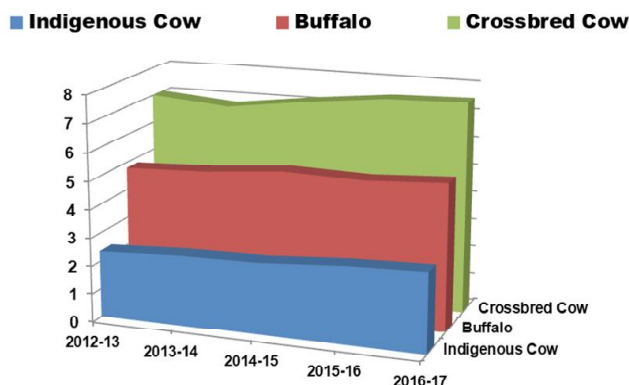


Figure 3: The all-India average milk productivity (Kg/day) (Y-axis) of popular bovines over time (X-axis)

2. TYPES OF PROMINENT BOVINES IN INDIA

The Bovidae are the biological family of cloven-hoofed, ruminant mammals that includes bison, African buffalo, water buffalo, antelopes, wildebeest, impala, gazelles, sheep, goats, muskoxen, and domestic cattle. A member of this family is called a bovid. With 143 extant species and 300 known extinct species, the family Bovidae consists of eight major subfamilies apart from the disputed Peleinae and Pantholopinae. The family evolved 20 million years ago, in the early Miocene. The biological subfamily Bovinae includes a diverse group of 10 genera of medium to large-sized ungulates, including domestic cattle, bison, African buffalo, the water buffalo, the yak, and the four-horned and spiral-horned antelopes. The general characteristics include cloven hoofs and usually at least one of the sexes of a species having true horns. The largest extant bovine is the gaur. In India, cattle and buffalo are prominently reared as livestock and the cow is considered sacred.

2.1 The Cattle

India is endowed with large cattle population which constitutes an integral part of majority of the livelihood of rural farmers since time immemorial. The cattle is considered as one of the important livestock species in the country, as it provides milk, draught, dung, hide etc. India owns the largest cattle population of 190.90 million (19th livestock census) which constitutes 37.28 per cent of the national livestock population and 13.00 per cent of world cattle population. The country has rich cattle genetic diversity composed of 41 acknowledged breeds classified according to their utility as draft (28), dual (9) and milch (4). The estimates of breed wise cattle population revealed that the crossbred cattle constitute 20.81 per

cent while the non-descript and defined cattle breeds constitute the rest of the population. Out of the 79.19 per cent, the non-descript cattle constitutes nearly 74.90 per cent of the total indigenous population while the rest 25.10 per cent covers the defined indigenous cattle breeds. The cattle breeds viz. Sahiwal, Gir, Red Sindhi, Tharparkar and Rathi, are known for their milking prowess. The Kankrej, Ongole and Hariana, belong to dual breeds that have both milch and draught qualities. The rest are pure draught breeds. Each of the breeds of cattle are important and needs attention based on their geo-climatic adaptation to a particular region. Though, the cattle population has decreased by 4.1 per cent from year 2007 to the year 2012 as per the 19th livestock census, the cattle breeds of India are playing a momentous role in meeting the national demand of milk and milk products due to the consumer preference. There has also been renewed consumer and academic interest in the sacred cow and the ancient ways and relationship between the *Bos indicus* and the *Homo sapiens*.

2.2 The Buffalo

The domestic water buffalo (*Bubalus bubalis*) has an important role in the agricultural economy of India and recognized as a triple purpose animal providing milk, meat and draught power. It is also used in some Mediterranean and Latin American countries as a source of milk and meat for specialized markets. Buffaloes are now very important in India's contribution to milk and meat. Buffaloes are emerging as the “**Black Gold**” or “**Black Platinum**” with great potential as the “**Bank on Hooves**” for Indian agrarian community and entrepreneurs. India is a breeding tract and home not only for the world famous Murrah and Nili-Ravi Buffaloes, but also for other buffalo breeds such as Bhadawari, Jaffarabadi, Surti, Pandharpuri and Mehsana, which are well known for their milk producing ability. There are 13 registered breeds of buffaloes (Figure 4 and Table 1). High productivity of Indian buffaloes is evident by their contribution to total milk pool, which is about 10% more than that contributed by cattle. Resultantly, India now occupies the pride position of being the highest milk producing country in the world. About 56% of milk and 16% of meat produced in India are from buffaloes. Owing to their multifaceted contribution, buffaloes are increasingly becoming a preference among Indian livestock entrepreneurs and farmers as indicated by a consistent increase in buffalo population from 84.21 million in 1992 to 105.34 million in 2007 (Taneja, 2012). As per 19th livestock census, the buffalo population has increased by 3.19 per cent in year 2012 from the year 2007. This particular livestock species has immense potential for poverty alleviation and rural entrepreneurship. It can be visualized with the fact that milch buffalo

population increased from the period 2003-07 to 2007-12 by 46 per cent in rural areas. The total milk production was about 165 million tonnes in 2016-17, in which Buffaloes share was 49%. The domestic water buffalo, being one of the most important livestock animals in India has an important role in the agrarian economy and will continue to have a bigger role in future as well.

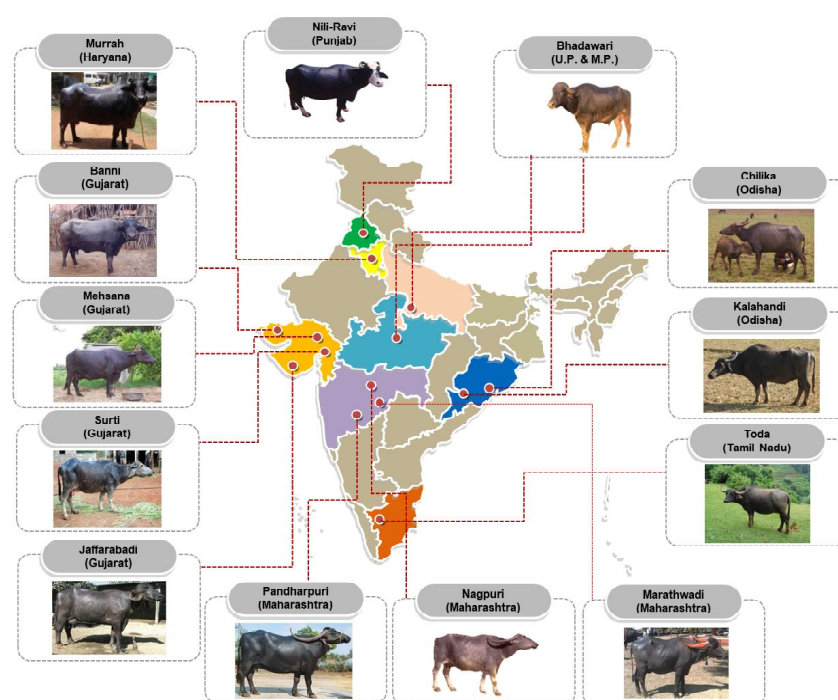


Figure 4: The Recognized and registered breeds of buffaloes mapped to the Indian map

Table 1: Recognized and registered breeds of buffalo

Sl. No.	Registered Breed of Buffalo	Home Tract
1.	Bhadawari	Uttar Pradesh and Madhya Pradesh
2.	Jaffarabadi	Gujrat
3.	Marathwadi	Maharashtra
4.	Mehsana	Gujarat
5.	Murrah	Haryana
6.	Nagpuri	Maharashtra
7.	Nili Ravi	Punjab

8.	Pandharpuri	Maharashtra
9.	Surti	Gujarat
10.	Toda	Tamilnadu
11.	Banni	Gujarat
12.	Chilika	Odisha
13.	Kalahandi	Odisha

3. AGRI-ENTREPRENEURSHIP DEVELOPMENT THROUGH THE BOVINES

The term “entrepreneur” is rooted in the French word, “Entreprendre” which means, “to undertake”. The term was first used as a technical economic term by the 18th century, French economist Richard Cantillon. He portrayed an “entrepreneur” as one discharging the function of direction and speculation. It was further stated that, “the entrepreneur was a person endowed with the qualities of judgment, perseverance and a knowledge of the world as well as of business. An entrepreneur is traditionally heralded as someone who produces for the market. An entrepreneur is a determined and creative leader, always looking for opportunities to improve and expand his business. An entrepreneur likes to take calculated risks, and assumes responsibility for both profits and losses. An entrepreneur is passionate about growing his business and is constantly looking for new opportunities. They always look for better and more efficient and profitable ways to do things. Being innovative is an important quality for a farmer-entrepreneur, especially when the business faces strong competition or operates in a rapidly changing environment.

The agri-entrepreneurs are the crucial elements for futuristic innovations which are essentially required for a low-tech industry such as the agriculture with limited dynamics dominated by numerous smallholder families and firms. They could also be instrumental in our fast and growing economy. The entrepreneurship development using bovines will be a key driver for promoting & sustaining the momentum of growth. Governments, Institutions and individuals have increasingly visualized entrepreneurship as a strategic intervention for accelerating the pace of development in any economy. Entrepreneurship development is essential for exploiting full potential of dairy and food industry on one hand and providing job opportunities to the teeming population of the country on the other. The scope for wage employment is not only limited but decreasing very fast. Even the nature of wage employment is undergoing drastic transformation

from the security-oriented job to performance based contractual assignment. Under such situation entrepreneurship development is a must. Entrepreneurial development is a systematic and a controlled development of a person to an entrepreneur. The development of an entrepreneur refers to inculcate the entrepreneurial skills into a common person, providing the desirable knowledge, getting higher the technical, financial, marketing and managerial expertise, and building the entrepreneurial approach. Entrepreneurial development programmes may be defined as a program designed to help an individual in strengthening his entrepreneurial motive and in acquiring skills and capabilities necessary for playing his entrepreneurial role effectively. This situation can be changed by generating employment opportunities for them in rural areas itself. Agro entrepreneurship can be used as paramount medicine for the solution of this complexity. Developing entrepreneurs through the bovines will solve the entire problem. (a) Trim down the burden of agriculture (b) Create employment opportunities for rural youth (c) Control migration from rural to urban areas (d) Increase national income (e) Sustain industrial development in rural areas (f) Cut down the pressure on urban cities etc. Moreover, the intended beneficiaries include the farmers, individual entrepreneurs, NGOs, companies, groups of organized and unorganized sectors, etc. Groups of organized sector include Self-help Groups (SHGs), dairy cooperative societies, milk unions, milk federations, etc.

3.1 Probable objectives for agri-entrepreneurship development through the bovines

- ✓ Promotion of the setting up of modern dairy farms for production of clean milk
- ✓ Encouraging heifer calf rearing, thereby conserving good breeding stock
- ✓ Bringing structural changes in the unorganized sector so that initial processing of milk can be taken up at the village level itself
- ✓ Up-gradation of the quality and traditional technology to handle milk on a commercial scale
- ✓ Generation of self-employment and provide infrastructure mainly for unorganized sector

3.2 What should be the the agri-entrepreneurial environment?

Being an entrepreneur is a way of life and a way of looking at the world. Entrepreneurs enjoy independence and freedom. They decide for

themselves what to do and when to do it. Entrepreneurs also face risks, work under pressure and are immediately accountable for the outcomes – good or bad – of their decisions. While farmer-entrepreneurs are free and independent, they do not work alone. They operate in a complex and dynamic environment. They are part of a larger collection of people including other farmers, suppliers, traders, transporters and processors, each of whom has a role to play in the value chain (Figure 5).

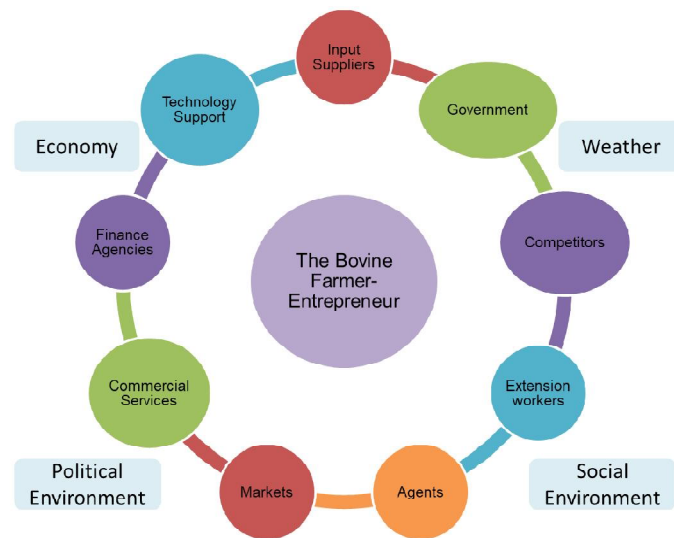


Figure 5: An entrepreneurial cattle and buffalo farmer makes farming decisions in a complex competitive and collaborative environment.

One should also understand that entrepreneurial environment is very much dependent on the regional preference for the bovines being utilized. The Figure 6 explains the latest population of buffaloes (in millions) state-wise. It can be well-understood that the buffalo is pre-dominant in states of Haryana, Punjab, Gujarat, UP and AP, where they contribute between 54-85 percent to total milk. Therefore, for any farming decision, the dairy entrepreneur has to balance his opinion in a dynamic, complex and collaborative setting.

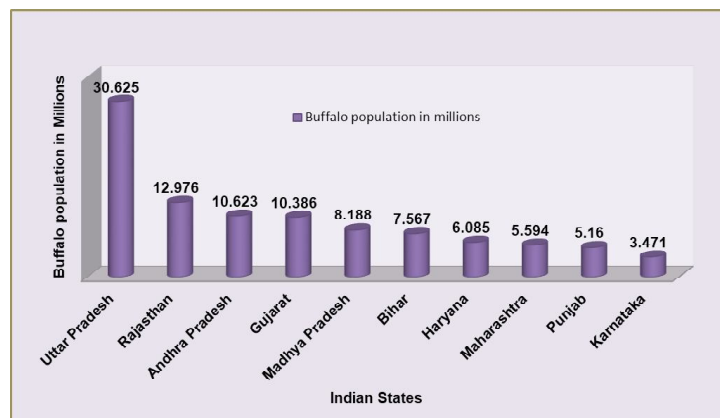


Figure 6: The Buffalo population in states of their prominence in India

3.4 Setting the agri-entrepreneurship development process using bovines:

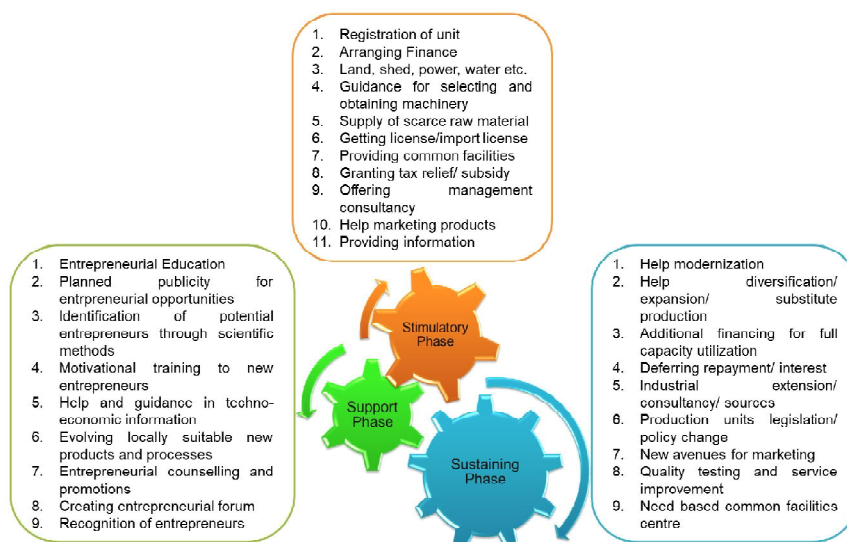


Figure 7: The agri-entrepreneurship development process

3.3 Possible areas of agri-entrepreneurship development through bovines

3.3.1 The milk and dairy products:

The dairy entrepreneur should be aware of “4 P” i.e. Procurement, Production, Processing and Promotion. The procurement covers milk collection from rural producers or contractors including setting up of chilling centers, provision of laboratory equipment and supplies, milking machines,

cattle welfare, including feed and fodder and last but not the least the transportation. Production includes activities of producing various types of liquid milks like the conventional whole, toned and standardized as well as innovative like milk with extra nutrition for children, pregnant mothers, the aged and the infirm and low fat milk for the calories-conscious. The key is to sale milk also as a fun product and not merely as something, which is good for health. Processing of products such as butter and cheese spread, pre-sliced butter and cheese, dairy whiteners, milk beverages (Plain and Carbonated), butter oil as a cooking medium, whip-and-serve milk shake powders, wet and dry kulfi and ice cream mix, high protein whey drinks for sports man, milk sweets, Shrikhand, dried condensed milk, dried khoa and many more can be added the list. The promotion covers activities like brand promotion, setting up of dairy parlours, buying milk in bulk and repacking to sell, distribution, devising attractive packaging and other such activities, which will result in building an image either nationally or even regionally and enhance the marketing of the products.

3.3.2 The meat, meat and livestock products:

Globally livestock products account one-fifth of global trade of agricultural products, however, India does not have significant presence in global livestock trade. It shares only 0.3% world exports and 0.4% imports. In India, bovine meat has been a major export commodity with around 70 per cent share in the total livestock exports value. Also, its value share has increased more than twice in 2016 than that in 2001. Buffalo meat export has lion share. In addition to fetching 4 billion US \$ foreign exchange, employment intensive meat sector provides job to about 14.44 million people. It also associates with development of sectors-such as leather sector (increased quantity of quality hide); poultry sector (with supply of quality protein and energy feed ingredients as meat and bone meal and tallow); and a number of other sectors such as soap, textile, which utilize different by-products. This sector also has great potential for agri-entrepreneurship development.

3.3.3 Businesses related to bovine farming:

The dairy farming is not just about cows, buffaloes, their milk and meat. There are several businesses related to dairy farming like selling fodder, transportation of milk, processing, selling cow-comforts like rubber mats and cubicles, selling medicines for the cattle and buffaloes, and the most profitable one –breeding of cattle and buffaloes. The agri-entrepreneur can breed the bovines and sell them when they start milking. Proper record keeping of their milk production potential including those of their parents

can also maximize the economic returns in terms of their selling prices. Understanding the whole value chain of the dairy Industry can provide great opportunities to the agri-entrepreneurs. The whole story can be enriched with incorporation of different feeding regimes including selling of green fodder, silage and area specific mineral mixture with the help of local NGOs, universities and research institutes. There is severe derth of semen availability too in most of the parts of our country. The agri-entrepreneurs can utilize the vast potential available in the area of frozen semen production by setting of their own semen station within the framework of extant rules and regulations. Apart from this, the services rendered as trained artificial inseminators are also the need of hour for livelihood generation and improved conception rate in their own farms and nearby areas.

4. CONCLUSION

It is heartening to see that the livestock sector especially the bovines, viz. cattle and buffaloes are contributing much in the domestic GDP and poised for great leap with right policy initiatives. Simultaneously, it also provides opportunities for development of agri-entrepreneurs utilizing the tenets of farming practices employing these bovines. Gone are the days where the farmers treated their livestock such as cattle and buffalo as a non-essential commodity of their livelihood. The era of the “Urban Dairy Farmer’s model” has come and with right vision, willingness and support of the policy-makers and funding agencies new breed of agri-entrepreneurs will willingly enter in this field. The entrepreneurship development through bovines has great potential in reducing migration of agrarian community to cities and also facilitating the reverse-migration too.

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AGRI-ENTREPRENEURSHIP DEVELOPMENT THROUGH EQUINES

**Yash Pal, Parvati Sharma, Anuradha Bhardwaj, RA Legha and
BN Tripathi**

1. INTRODUCTION

Approximately, 98% equine in India contributes to the employment and income of the poor farmers and landless labourers under unorganized sector who primarily depend on livestock. The remaining about 2% of the equine population as organized sector is owned by elite sections of society and is used for sports such as racing, polo and for national security purpose by military and paramilitary forces. Indigenous horses like Marwari, Kathiawari and Manipuri have been utilized for equestrian events, polo and ceremonial events. Equine being an important animal for draught and transport plays a significant role in rural economy and constitute main source of income for sizeable underprivileged section of society in many parts of the country. The major aspects of Agri-Entrepreneurship development through equines lies with the application of farming in connection with marketing of byproducts or value added products. There are limitations on economics for development of market with equines and the end users and clientele is very limited.

2. INDIAN SCENARIO OF EQUINE POPULATION

India has about 2% of the total World's equine population or 5% of Asian equine population (Chauhan, 2005). As per last livestock Census (2012), the total population of equids in India is 1.13 million, comprising of 0.19 million mules and 0.32 million donkeys (Table 1). Major population of equidae *viz.*, donkeys, mules and ponies provide livelihood to the rural societies living in arid, semi-arid and hilly regions, especially in the foot hills

of Himalayas, through transport and draught where as remaining small population of equines is used in army, police, border security force, racing industry and sports.

Table 1: Population Trends of Equines from 1966 to 2012 in India.

(Population in Millions)				
Species/Year	Horses & Ponies	Mules	Donkeys	Total
1956	1.50	0.04	1.10	2.64
1961	1.30	0.04	1.10	2.44
1966	1.10	0.08	1.10	2.28
1972	0.90	0.08	1.00	1.98
1977	0.90	0.09	1.00	1.99
1982	0.90	0.13	1.00	2.03
1987	0.80	0.17	1.00	1.97
1992	0.80	0.20	1.00	2.00
1997	0.70	0.29	0.78	1.77
2003	0.79	0.31	0.67	1.77
2007	0.61	0.14	0.44	1.19
2012	0.62	0.19	0.32	1.13
% Change from 1956-2007	(-) 59.33	(+) 250.00	(-) 60.00	(-) 54.92
% Change from 1997-2007	(-) 12.85	(-) 51.72	(-) 43.59	(-) 32.77
% Change from 2007-2012	(+) 2.08	(+) 43.34	(-) 27.22	(-) 0.05

Source:

1. *Basic Animal Husbandry Statistics, 1999; 2004, Deptt. Of Animal Husbandry & Dairying, Ministry of Agriculture, Govt. of India.*

2. *Agricultural Statistics at a Glance, 2002, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India.*

It seems from population dynamics that population of horse and donkeys reduced by 1.07% per year from 1956 to 2007. Contribution of mule as pack animal has increased considerably registering an annual growth rate of 0.57% per year during the above said period. A negative annual growth rate of (-2.84%) animals for pack work over the year 1956 to 2007 (2.64 to 1.19 million) indicate farmer's preference for faster mode of

mechanized transport. There has been a continuous decline in the equine population starting with 1966 up to the last census conducted in 2012. From this it is evident that equine population is continuously declining but we do not have any check on this decreasing trend and in coming future this animal species will become an extinct one. In view of decrease in world fuel reservoirs, we have to conserve and preserve this species for future as at present we do not know future requirement related to equines.

3. TYPES OF EQUINES IN INDIA

Presently, India has a rich biodiversity of equids in the form of seven distinct indigenous breeds of horses namely Marwari, Kathiawari, Kachachi-Sindhi, Bhutia, Spiti, Manipuri and Zanskari. FAO has recognized 3 more breeds, namely Chummarti, Deccani and Sikang besides indigenous donkeys and wild asses in the Rann of Kutch in Gujarat and Kiang in Laddakh. These equines are well adapted to different agro climatic regions and possess certain unique characteristics which are discussed here. The Arab, the first to be introduced is believed to have contributed substantially for the evolution of Kathiawari, Marwari, and Manipuri horses. Besides this, the exotic breeds of horses introduced in India include English Thoroughbred, Waler, Arab, Polish, Connemera and Halflinger.

3.1 Horses

Marwari

As the name indicates this breed of horse has its origin in Marwar and Mewar region of Rajasthan. The breeding tract of Marwari breed is Jodhpur, Udaipur, Jalore, Nagore, Pali, Sirohi, Barmer, Jaisalmer and Rajsamand districts of Rajasthan. These horses facially resembles Kathiawari breed probably due to mixing of Arabian blood. However both the breeds can be differentiated on the basis of a set of biometric indices (Gupta *et al.* 2012). The common colours of Marwari breed are bay, kumet (chestnut), surang (liver chestnut), bhanwar (black or dark brown), dun and cream. Their heights are 14-15 hands and weigh about 360 kg. The ears are located at 90° axis and can rotate at 180° angle. Tips of ears are pointed and curved inward like a sickle. The ears meet or overlap each other when the animal rotates them. In comparison to Kathiawari horses, Marwari horses have more height, length of ears, face, pastern and neck, and prominent nostrils and convex nasal bone. The number of true to breed Marwari horses is quite low probably due to indiscriminate cross-breeding in the native area.

Kathiawari

Kathiawari breed of horses is considered to be the oldest equine breed in India (Gupta et al., 2014). The breeding tract of Kathiawari horses is Rajkot, Bhavnagar, Surendranagar, Junagarh and Amreli districts of Gujarat and in parts of Rajasthan adjoining Gujarat. This breed is believed to have evolved from the wild horses of Kathiawar of Gujarat State and Arabian horses which happened to land on sea shore after the crash of a ship in Arabian sea. The prevalent colours of this breed are mainly chestnut, bay, brown, grey, piebald, skewbald and cream. These animals measure about 14-15 hands in height and weigh about 380 kg. The ears are of medium length located on 90° axis and can rotate at 180°. As compared to Marwari breed the ears of Kathiawari are smaller in length, less in width, broad forehead and mandible, large expressive eyes, small muzzle, big nostrils, shorter face and shorter back with concave profile.

Kachchhi- Sindhi

This indigenous horse breed is inhabitant to Kachchh district of Gujarat and Jaisalmer and Barmer districts of Rajasthan. Total population is about four thousand only. Unique features include roman nose fascia of face, ears curved at tips but not touching each other, 56 to 60 inch height, squat back, short pastern bone length, broader hoof for better grip and compliant temperament. Coat colour is mainly bay. These horses are famous for its 'Rewal chal' as it performs with great speed and stamina covering long distance. The horse possess admirable drought and heat tolerance capacity in arid & semi arid region.

Bhutia

These animals were supposed to be bred from Punjab to Bhutan in the foot hills of Himalayas. Kaura et al. (1961) had linked Bhutia ponies with Punjab area which is very close to home tract of Marwari horses. Recent finding have indicated that there is some link between Bhutia ponies and Marwari horses (Gupta et al., 2014). It is quite possible that some Marwar animals might have migrated long back from plane to hilly area with Indian army.

The prevailing colours are usually grey, iron grey, occasionally chestnut and roan. The height of Bhutia ponies is 13 to 13.2 hands and weighs about 270 kg. These ponies have a short neck, with low withers, a straight back, sloping quarters, deep chest, straight shoulders, and a well-set tail. Their mane is long. They are similar to the Spiti pony and the Tibetan pony, as these breeds have been interbred for years. The Bhutia

Pony can live on much smaller food rations than other ponies of its size. Population of Bhutia breed has decreased drastically from 5436 in 1997 to 546 in 2007. Thus, immediate attention and efforts are required to conserve this precious breed of ponies in India.

Spiti

The breeding tract of Spiti horses is Kaja subdivision of the Lahul and Spiti district and the Yanthang area of the Kinnaur district of Himachal Pradesh in India. They are reared as pack animals at high altitude. The mane is long and has hairs of 25 to 40cm in length. The body colours are grey, brown, black and piebald. On an average, Spiti ponies stand 129cm height, 100cm body length, 148cm heart girth and weigh about 320 kg. Generally, they are hardy, surefooted and used mainly for riding and also as pack animals in cold hilly regions. These horses are capable of tolerating extreme cold conditions very easily as their legs are covered with coarse and long hairs. It has also been ascertained from various sources that their number is declining rapidly. Therefore, an urgent need is felt to conserve this breed taking important and quick steps.

Manipuri

Manipuri ponies are well known as Polo ponies. These are bred and found in State of Manipur and are considered as descendant of both the Mongolian wild horse and the Arab. On genetic analysis these were clubbed with Spiti and Zanskari ponies (Gupta et al., 2014). The prevailing colours are not specific, but brown or reddish brown is common. These horses have small sized body with a fairly long face and well known for elegance, endurance and speed. The height of Manipuri horses is about 11 to 13 hands and they weigh about 300 kg. The legs of these animals are of fine quality, knees and hocks are strong and pasterns possess a gradual and proportionate slope. Ears are alert and almond shaped. Head is light and well proportionate with straight profile. Withers are moderately built, neck well formed with a full mane, chest deep, back straight and shoulders nicely sloping. Since the population of this breed has drastic decreased, its conservation is quite important along with other pony breeds (Gupta, 2012)

Zanskari

These are bred in Leh Laddakh region of Jammu and Kashmir. Common body colours are grey, bay and black. These horses are known for their hardiness and ability to work at high altitude. Their tail is long which touches the ground. Body hairs are fine, glossy and long. The height of the animal of this breed is between 13.2-14.7 hands. Hair coat of Zanskari

ponies is thick and quite similar to that of Spiti ponies. Special mention is made of equines of this region for their exceptional ability to survive and perform under very harsh climatic conditions of their high altitude habitat (between 3000 to 5000 meters). As per information received from local people, only a few hundred horses at present exist in Zaskar and other valleys of Laddakh. For breed improvement and conservation through selective breeding, Govt of Jammu & Kashmir has specially established a Zaskari Equine Breeding farm at Chuchot, Leh, Ladakh (Gupta *et al.* 2010).

3.2 Donkeys

The Donkey is a domesticated version of the wild ass. The donkey was domesticated about 5,000 years ago in Egypt, Iraq and Iran and was important, along with horses and camels in the development of trade and mobility. They were an important pack animal for the Roman legions who introduced the donkey to Britain. Genetic fingerprints indicated that wild African asses were the ancestors of domestic donkeys, making donkeys the only important domestic animal known to come from Africa. Donkey DNA analysis showed that there were 2 distinct populations of domestic donkey (*Science* Vol 304, p 1781): one descended from the Nubian wild ass *Equus asinus africanus* and the other being similar to the Somali wild ass *Equus asinus somaliensis* (<http://www.arthurgrosset.com/mammals/donkey.html>, retrieved August 21, 2010). The Indian donkeys are not much studied animals using molecular genetics tools. However, based on the phenotype, the Indian donkeys have been grouped under “Large White” or “Small Grey” categories. There are no breeds assigned to donkeys (Varshney and Gupta, 1994) except Spiti donkeys (INDIA_DONKEY_0600_SPITI_05001). The total Donkey population in the country has decreased by 27.22% over the previous census and the total donkeys in the country are 0.32 million numbers in 2012.

Poitou Donkeys

Breeding tract of Poitou donkeys is in Europe (France). These donkeys were imported from UK in 1990 for superior quality mule production and breed improvement of indigenous donkeys. Good quality donkey jacks and jennies of exotic breed obtained from France and other European countries are maintained by NRCE, State Animal husbandry Deptt. of Haryana and Uttar Pradesh, and at Equine Breeding Farms of the Army.

Indian Donkeys

Indian donkeys range from white to grey or black in colour. They

usually have a dark stripe from the mane to the tail and a crosswise stripe on the shoulders. The mane is short and upright and the tail has long hair only at the end. The very long ears are dark at the base and tip. The different breeds of donkey vary greatly in size and shape but the average donkey stands 40 inches (102 cm) at the shoulder, the Sicilian donkey stands 24 inches (61 cm), the large ass of Majorca stands at about 62 inches (158 cm), while the American ass may reach a height of about 66 inches (168 cm) (<http://student.britannica.com>, retrieved May 13, 2009).

(a) Large white Donkey

These donkeys were earlier abundant in Punjab, Haryana and Gujarat state. But, now they are localized to parts of Gujarat state only. The larger size donkeys are light grey to almost white in colour. The average height at withers is 110cm and weighs about 150 kg. These donkeys are yet to be characterized. Population of these donkeys has decreased drastically due to preference of end users is small size donkeys.

(b) Small Grey Donkey

Donkeys of this type prevail in almost all parts of northern India. The smaller size ones are dark grey in colour. They usually have a dark stripe from the mane to the tail and a crosswise stripe on the shoulders. The average height at withers is 90cm and weighs about 120 kg. The donkeys of this breed are yet to be characterized.

(c) Spiti Donkey

Donkeys of this breed are found in Spiti valley of Himachal Pradesh. These donkeys are of dark brown to black in colour. These donkeys look like exotic donkeys (Poitou) in appearance and colour. The height at withers varies from 80-95cms of Spiti donkeys. Ears are long. The donkeys of this breed are yet to be characterized at phenotypic and genotypic levels.

Donkey Population Trend

The great majority of donkeys in the world (probably over 95%) are kept specifically for work. Their most common role is for transport, whether riding, pack transport or pulling carts. In most countries, donkeys can be owned and used by either men or women. Children are frequently given responsibility for working with donkeys. Some farmers keep donkeys for guarding sheep. Since donkeys are seldom owned and maintained unless they are worked, estimates of national and regional donkey populations provide useful indicators of donkey work worldwide. Overall population figures cannot provide information on the frequency of donkey use.

Donkey's population has declined dramatically in the most industrialized countries of Europe and North America. Although donkey populations are low in the developed countries, but it is the relatively stable in many rapidly industrializing countries such as Brazil, China, Dominican Republic, Ecuador, Egypt, Mexico, Morocco and Pakistan. These countries may be rapidly urbanizing, but they also have large rural populations with low incomes. These rural people continue to benefit from donkeys for local transport. The countries that have shown major declines in donkey numbers in recent years, have often have been those where the rural populations have had access to private motor vehicles (e.g., Italy, Ireland). The implication is that urbanization and industrialization only starts to have a significant effect on donkey populations when rural people are wealthy enough to replace donkey power with motor power. This is still a long way off in many parts of Africa, Asia and Latin America.

Certainly, declines have been recorded from Turkey, Israel and South Africa. In these countries (as in others) the use of donkeys is perceived as 'backward' and there are sometimes psychological pressures to remove the donkeys and become modernize. In Indian context also somehow more industrialization/mechanization may be responsible for decreased trend for donkey population.

In industrializing countries, expectations of declining donkey populations could become self-fulfilling prophecies, if accompanied by social pressures or legislation that marginalize donkey owners.

4. SCOPE OF EQUINE BASED LIVELIHOOD SYSTEM IN INDIA-AGRI-ENTREPRENEURSHIP OPPORTUNITIES

The present scenario with respect to equines in the economic and social milieu varies in different parts of the world and so is in India. In contrast to the affluent Western societies which prefer horses for sports and recreation, in India it is for the livelihood of the landless, small and marginal farmers the equine serve. However equines are playing a silent but an important role in human life.

Approximately, 98% equine in India contributes to the employment and income of the poor farmers and landless labourers under unorganized sector who primarily depend on livestock. The remaining about 2% of the equine population as organized sector is owned by elite sections of society and is used for sports such as racing, polo and for national security purpose by military and paramilitary forces. Indigenous horses like Marwari, Kathiawari and Manipuri have been utilized for equestrian events, polo and

ceremonial events. Equine being an important animal for draught and transport plays a significant role in rural economy and constitute main source of income for sizeable underprivileged section of society in many parts of the country. Though horses and ponies are scattered all over India, the donkeys are mainly concentrated in North-Western India (Rajasthan, Gujarat, Haryana, Uttar Pradesh, Uttaranchal and Delhi). The use of equines for draught purpose has special economic significance in difficult hilly terrains, arid and semi-arid zones where motorable roads are inadequate. The improvement of equine production has great potential and significance for uplifting the economic status of the poorest of the poor in rural and semi-urban areas. In spite of mechanized transport and all unfavorable circumstances, the use of mules for draught and of Thoroughbred and other horses for sports, tracking and racing has increased considerably. This clearly indicates the distinct role played by the mule as a draught animal for transporting the agricultural commodities and household goods in the states where agricultural and horticultural produce is affluent requiring transport from the point of production to the point of sale and consumption.

4.1 Role of Equines at Pilgrimage places and in tourism: As saddle-horses, ponies of the Kashmir valley are providing entertainment to numerous tourists since many decades in world famous places like Gulmarg, Pahalgam, Sonamarg and Yousmarg etc. They also carry the tourists and their belongings up and down the Himalayan Mountains while tracking over the beautiful slopes of the valley. The Amar Nath (Kashmir) and Vaishno Devi Yatra (Katra pilgrimage, Jammu) by millions of Hindus every year would not have been possible without this quadruped. Besides these places, equines are also used in places of tourist attractions in other parts of the country in earning livelihood for their owners.

4.2 Role of horses in Safari: In many parts of Rajasthan, horse safaris and trekking has also been initiated during the last 10-15 years by some of the organized Marwari equine breeders for earning a handsome amount from the tourists. Mostly such safaris are preferred by tourists coming from American and European countries. This has also highlighted the importance and quality of Marwari horses in foreign countries which may pave way for export of this breed.

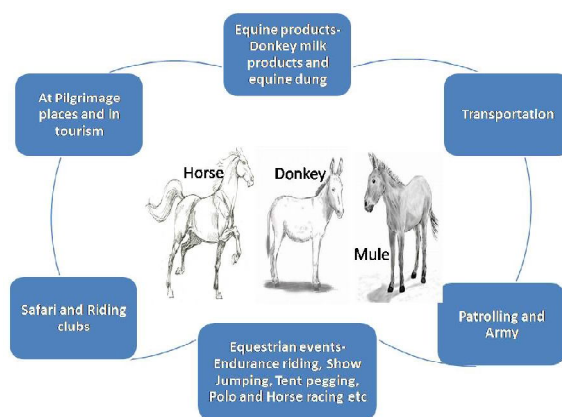
4.3 Equestrian events: There are many ways to show off your horse, competitions being one of them. Some of the competitions are Endurance riding, Show Jumping, Tent pegging, Polo and Horse racing etc. A lot of people take interest in such equestrian events at different levels in earning their livelihood. Some people are engaged in feeding & watering, exercising,

grooming, foot care and farriery, as Jockey and general management of horses. Livelihood of these people is based on existence of horse and their use in equestrian events.

4.4 Patrolling: In most of the states, horses are being used by police/BSF/ Para-military forces to patrolling purposes in their routine activities. Beside this good quality horses including Marwari horses are also being maintained by important Govt houses including Rashtrapati Bhawan also. Presence of equines at such places results in employment of a fleet of trained personnel in earning their livelihood.

4.5 Riding School: Horse riding is becoming an integral part of school education in different parts of our country. Students are being trained in horse riding and handling during their schooling in India. This has also lot of potential in equine based livelihood system in India if State Govts and education institutions make it compulsory for all young students during their school education itself. This will definitely help in developing a bond between horse and rider and ultimately interest in riding of such riders will help in horse development and conservation.

4.6 Transportation: In many parts of northern India especially in western UP, horses, mules and ponies are being used for transporting the children to schools, passengers from villages to main roads/high ways. These horse owners earn their livelihood through transporting the human beings from one place to other. As a transport animal, donkeys are used by owner for earning livelihood in different manners *viz.*, use of donkeys at brick-kilns, construction sites, construction of multi-storied buildings, sale of vegetables, milk transport etc. In different parts of the Country, one can find utility of equines in transporting various items.



Livelihood resources from equines

5. UTILITY OF EQUINE PRODUCTS

i) Equine milk: It has been observed that equine milk has tremendous medicinal value, curative agent for metabolic and allergic diseases, use in cosmetics and anti-aging property. In some part of the country, donkey milk is sold for medicinal uses. The donkey milk fetch a good amount of money for donkey milk providers and is in fair demand. Donkey milk based cosmetics and health mixtures can be an attractive agribusiness for equine framers in India. This new possibility of increasing the income of the equine owners is very widespread among general public.

ii) Vermi-composting: Earlier disposal of equine dung was havoc. But, now the same is being used for production of vermi-composting at some research and private farms. The vermin-compost is quite beneficial in agricultural fields also. This can also be exploited as a source of livelihood.

6. ECONOMIC EVALUATION

Some economic studies have been carried out previously related to earning obtained by the equine owners. Pal *et al.* (2013) reported that average income per donkey per day of donkey owners was Rs 75.0±1.89 and Rs 187.2 ±7.74 in SE and NE Rajasthan, respectively. Average income per donkey per day in NE Rajasthan was high may be due to use of donkey in carting to carry more goods in small duration of time. But, overall income from donkeys per household and their economic status was higher in SE Rajasthan than NE Rajasthan. In another study, donkey owner earned Rs 100 to 250 per day with cart including his own salary. Slightly low (Rs 100 to 200) earning was observed at brick kiln and construction sites (Singh *et al.* 2007). The study indicated that donkeys contribute to sustainable rural development in Rajasthan. At certain Pilgrimage, equine owners earn a handsome amount (Rs. 250-500) from their ponies and mule per day per animal.

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ORNAMENTAL AQUACULTURE FOR AGRI-ENTREPRENEURSHIP DEVELOPMENT

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1. INTRODUCTION

Aquaculture is a big platform which provides vast opportunities to become a successful entrepreneurship and ornamental aquaculture is a limited risk business. The scope differs with investment varying from minimal capital of Rs. 50,000 to Rs. 50,00,000 roughly. A beginner has to learn the skills with limited facilities and later on venture into expansion. The business is built on market of around 300 exotic fish species and their variants. There are around 100 indigenous ones catering to the needs of export and domestic market. Creation of new varieties and introduction of new attractive species into the market is the key to this profession.

Ornamental fishes are nature's wonderful creation. They create a peaceful and relaxing ambience that's why they are often referred as Aquatic Jewels. Keeping the ornamental fish is the second most important hobby in the world followed by photography. There is a steady increase in aquarium fish trade and more and more people are entering in the farming and trade as there is a great demand of ornamental fish and aquarium accessories among the hobbyist. Ornamental fish farming is one of the most lucrative business opportunities within aquaculture which creates ample opportunities in terms of growth and expansion. FAO (2014) estimates the size of the world trade of ornamental fish to be US \$ 362 million. So far India has only explored only a minor fraction of the international market potential. But in recent times, the sector has shown tremendous growth due to the efforts of

the farmers and entrepreneurs and developmental efforts of Govt agencies. Therefore many entrepreneurs are venturing into this lucrative business which in turn facilitates the growth of the overall subsector.

The hobby of ornamental fish keeping in India started momentum in the country since the beginning of 21st Century though it was started during British raj during 18th century. The hobby of ornamental fish keeping started at Kolkata during 19th century. The ornamental fish are mainly produced in large quantities in small villages in and around Kolkata, Chennai, Mumbai and other cities like Bangalore, Kochi, Madurai and small cities of India. Several backyard units have been developed involving all the family members for a secondary source of income. To sell their products several pet shops mainly comprising aquarium fishes are also established in India. There are about more than 5000 aquarium shops and almost same number of ornamental fish production units in the country. It is estimated that presently, the number of house-holds in country keeping an aquarium is only 2% of a total number of about 50.00 million middle income group house-holds whereas in developed countries it is as high as 20%. The National Fisheries Development Board (NFDB), Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmer's Welfare (MOAFW), Hyderabad, have introduced few schemes for development of ornamental fisheries in the country.

Export of ornamental fishes from India accounted to Rupees 567 crores (US \$ 1 Million) in 2014-15 as stated by Marine Products Export Development Authority (MPEDA). The major share of export market of ornamental fishes is done to Singapore amounting Rs. 170 crores. There is a huge market as far as indigenous fishes are concerned with much of the fish diversity remains unexplored.

Kolkata has been the largest exit point for ornamental fish export, followed by Mumbai and Chennai. These metropolitan cities are also the major breeding centres for freshwater ornamental fishes. In the recent years, people in the States of Kerala, Andhra Pradesh, Gujarat, Karnataka, Orissa and other places have started producing ornamental fishes. It has been observed that most of the aquarium breeding centers and the related trade have been confined in and around the metropolitan cities like Kolkata, Chennai and Mumbai, obviously due to ready urban market and availability of international airport facilities for import and export business.

Ornamental fish village have been developing throughout India. The main attractions include Udairampur in Amtala (West Bengal) and Kolathur (Chennai). The cities of Karnataka namely Bangalore and

Mangalore has few ornamental fisheries commercial production units developed in private sector. In Mumbai, there are many indoor breeding units, where breeding of high value fishes like Angels and Discus are done.

2. BREEDING STRATEGIES AND SPAWNING ENVIRONMENT

Many of the ornamental fish species readily spawn in the aquarium or cement tanks, but the eggs or hatchlings often do not survive due to predatory nature of the parents. Sometimes the mortality occurs due to unfavourable, polluted or adverse water conditions. It is always preferable to check the water quality before planning for any breeding programme. It is always better to breed the fish in a separate spawning tank. Depending on the spawning method, the spawning tank can be set up in number of ways based on the spawning behaviour of the fish.

A. Ovo-viviparous (Livebearers)

Livebearers are fish that bear live young. They are ovoviviparous in nature, where the eggs form and hatch within the female before birth. Livebearers are often prolific, easily bred species. Breeding of most of the livebearers is relatively easy. They are mostly molly, platy, swordtail and platy. Development of young ones takes place inside the female body and they are released after about four weeks. The species of livebearers include the guppy (*Poecilia reticulata*), black molly (*Poecilia sphenops*), swordtail (*Xiphophorus helleri*) and platy (*X. maculatus*). The number of babies produced by a livebearer is normally 50-60 only, though some larger swordtails and guppies may produce as many as 100 nos. If the livebearers are fed properly with natural feed and supplemented with better artificial feed, the mother produces more than 100 young ones. Soon after the baby comes out from the mother, they have to be separated out to reduce mortality caused by predation. Small livebearers can be bred in breeding traps where the newborn come out of the reach of the brood mother. However, a more traditionally preferable set-up is a separate, densely planted tank where only gravid females are kept. As the young ones are visible in the water surface, they are to be removed and fed the powdered feed and zooplankton. As soon as all the young are born, the mother is to be removed and fed suitably.

B. Oviparous (egg layers)

Most of the aquarium fish are egg-layers with external fertilization. Egg-layers can be divided into five groups' viz., egg-scatterers, egg-depositors, egg-burriers, mouth-brooders, and nest-builders.

(i) Egg-scatterers

Zebra fish (*Zebra danio*) which is considered as an egg scatterer, lays non-adhesive eggs. The larger ones are grouped under the genus *Danio* and other smaller varieties are under genus *Brachidanio*. The important varieties of danios include the giant danio (*Danio aequipinnatus*), pearl danio (*Brachidanio albalineatus*) and zebra danio (*Brachidanio rario*). Since the egg scatterers and often drives the egg do not show parental care and eat their own eggs, the spawning tank has to be set in such a way that the eggs fall out of the reach of spawning parents.

For breeding such fishes the male and female ratio should be maintained at 1:1 or 2:1. Around 40-50 l capacity tank is sufficient for spawning for most eggs scatterers. The female is introduced in the breeding tank one day earlier than the males. But it is very difficult to know whether the female has already laid the eggs because of the smaller size of eggs that may remain hidden behind the pebbles. Sometimes the brood fishes are kept in a mesh net happa from where the eggs drop to the bottom. If the temperature is favourable, the eggs require two-three days hatching time. As soon as the tiny hatchlings are seen in the aquarium tanks the parents are to be removed. The hatchlings take 2-3 days to absorb their yellow yolk sac. Then they are fed with infusorians for 4 days followed by rotifers and smaller zooplanktons for a week, after which they can be provided powdered formulated feed along with zooplankton.

The egg scatters laying adhesive eggs are mostly the Gold fishes, *Carassius auratus*. When secondary sexual characters appears (by observing the maturity condition), the male and female gold fish are selected and kept in glass tanks or ferro-cement tanks. Since gold fish eggs are sticky in nature, they require some surface for adhesion. With various types of natural submerged aquatic plants such as *Hydrilla* can be used after treatment for this purpose. Artificial nests can be prepared by making split plastic ropes with one end tied or burnt to make it blunt. Even polythene strips have been found suitable for the purpose.

The female and male in the ratio of 1:2 are released into breeding tank during late evening hour. The male chases the female, presses its operculum against female's abdomen and fertilizes the eggs while swimming beside her. Egg laying usually takes place within 6-12 hrs of releasing the broods. After spawning the nest is transferred to a different container, or alternatively, the parent fish transferred from the breeding tank. If this is not done, the parents are most likely to eat away the eggs to compensate the post-spawning loss of energy.

Generally, the female lays about 2000-3000 eggs. Healthy eggs are golden transparent in colour and the unfertilized eggs will remain opaque and continue to remain as such with arrested growth. These dead eggs become pale white and hair such as aquatic fungus would grow on all the sides, giving it the appearance of a small powder-puff. Under ideal condition, within three days, the eggs hatch out with a hatching rate of 80-90% when the young larvae start to float, the nest materials are taken out from the tank. Generally, the tiny hatchlings remain clinging to the nest, so precaution has to be taken while transferring the nest from the breeding pool

(ii) Egg-depositors

These species deposit their eggs on a substrate (tank glass, wood, rocks and plants). Egg depositors usually lay fewer eggs than egg-scatterers, and the eggs are larger. Depending on the type of egg depositor, the tank should be furnished differently. For those egg-depositors that care for their young, the parents can be retained in the tank after spawning.

Substrate *spawners*, depending on the species, should be given a tank furnished with glass panes, broad-leafed plants, or flat stones for spawning sites. Some species such as Discus and Angelfish prefer vertical surfaces. From a group of such fishes a pair is selected by providing a slanting serrated glass surface plate, where a suitable pair comes near the plate for cleaning the surface for laying eggs. At that time, the pair is carefully removed for further breeding in a separate tank. For cavity spawners such as *Badis badis*, Chameleon fish, flower pots turned on their side, coconut shells, and rocky caves are suitable spawning sites. The tank should be furnished with either live or plastic plants to give the fish a sense of security.

Egg-depositors that do not care for their young should be given a tank furnished with fine and broad-leafed plants. After spawning the parents or plants with the eggs are to be removed. If the plants containing eggs are removed, new plants should be placed in the tank for future spawning. The very common ones are *Rasbora daniconius* (Slender rasbora). They require soft, slightly acidic (pH 5.5-6.5) waters with a pivotal temperature on 28°C. After conditioning the male and female, they are placed in a breeding tank planted with flat leaved plants. Rasboras prefers peace and quiet environment for breeding with low lighting conditions. The male and female brooders are placed together in breeding tank. Once spawning has occurred, as indicated by the slimness of the female fish, both parents from the breeding tank need to be removed. The eggs laid on the underside of the flat levels will hatch after 25-30 hours. Generally from a larger female up to 250 eggs are produced and resultant hatchlings become free swimming after 3-4

days. At this stage the tiny hatchlings should be fed infusorians and newly hatched brine shrimp. As they grow bigger they should be fed zooplankton. They can also be bred by another method by putting the gravid brood fish in a mesh net through which eggs are dropped to the bottom and hatching takes place.

(iii) Egg-burriers

These species usually inhabit waters that dry up at some time of the year. The majority of egg burriers are Killifish which lay their eggs in mud. The mature parents lay their eggs before dying when the water dries up. The eggs remain in a dormant state until the fresh rains which stimulate hatching. These fishes are *Aplocheilichthys lineatus*, *A. panchax*, *A. dayi* and *A. parvus*. Some breeders prefer a peat-moss substrate for egg-burying species. In order to initiate hatching, the stored peat can be immersed in soft water.

(iv) Nest-builders:

Nest builders build the nest for their eggs. The nest is usually in the form of bubble-nest formed with plant debris and saliva-coated bubbles (labyrinth fish), or an excavated pit in the substrate (cichlids). Nest builders practice brood care. Therefore, they should be provided with a wide leafy material with which to build their nests and the tank should have no water current to disturb the nest. Good nest builders are Gouramies (*Colisa lalia*, *C. fasciata*) and fighter fish (*Betta splendens*).

For breeding such fishes the sexes are kept separately for few weeks. As the abdomen of female becomes grossly distended with eggs it is transferred to a smaller breeding tank containing few floating plants with water level of 5-6" at a temperature of 28-30°C. After one or two days a good male is introduced in the breeding tank. A transparent perforated plastic sheet or a glass is covered over the tank to keep the humidity and temperature at high level and help to maintain the bubble nest in good condition. The male soon begins building a bubble nest. This is possible by taking a large gulp of air at the water surface and converting it into many smaller bubbles that are passed into gill chamber and coated with an anti-burst agent before release. During and after making the nest, the male displays to the female which usually ends with both fish embracing near the nest resulting in the deposition of a large number of eggs in the nest. After making the bubble nest if the female does not lay eggs then the male becomes very aggressive and may kill the female. After breeding, the female is removed. The male guards the eggs which remain attached to the floating

bubble nest. Within 24 hours, hatching takes place. The moment, the fry begin leaving the nest, the male is also removed from the tank. After 36 hours, the young ones remain in free swimming stage, they are provided with infusorians as starter feed. After a week the fry starts taking small zooplanktons. During this stage the fry require vigorous feeding. Subsequently when they grow little bigger they can be stocked in larger cement tanks for further growth.

(v) Mouth-brooders:

These are species that carry their eggs or larvae in their mouth. Mouth brooders can be divided into ovophile and larvophiles groups. Ovophile or egg-loving mouth-brooders lay their eggs in a pit, which are sucked up into the mouth of the female. The small number of large eggs hatches in the mother's mouth, and the fry remain there for a period of time. Fertilization often occurs with the help of egg-spots, which are colorful spots on the anal fin of the male. When the female sees these spots, she tries to pick up the egg-spots, but instead gets a mouthful of sperm, fertilizing the eggs in her mouth. Many cichlids and some labyrinth fish are ovophile mouth brooders.

Larvophiles or larvae-loving mouth-brooders lay their eggs on a substrate and guard them until the eggs hatch. After hatching, the female picks up the fry and keeps them in her mouth. When the fry can fend for themselves, they are released. Ovophile mouth-brooders can be bred in the main aquarium because the eggs are protected in the mouth cavity. However, it is better to separate mouth-brooders with eggs because of their potentially aggressive behavior. There are no special breeding tank requirements other than the usual tank set-up for the species. Larvophile mouth-brooders should be placed in a breeding tank because the eggs are not protected in the mouth, but laid on a surface where they are open to predators. For mouth brooders, open cement cisterns of 2 feet water depth with planted long leafed plants are generally used for commercial production.

3. RANGE OF ORNAMENTAL FISH SPECIES

A large number of the exotic ornamental fishes are accepted by the hobbyist and are enlisted in Table 1. The fishes that are acclimatized in captivity range from cheap guppies to costly neon tetra, discuses and other expensive fishes, are bred by the aqua-culturists and available with retailers at every city and town. But for commercial production, the infrastructures needs to develop are a number of cement tanks of various sizes, aerators, overhead tank, bore well, electric/diesel pump, a hatchery shed and other

necessary items. For the same one may require Rs 80,000 to few lakhs of rupees depending on the production capacity.

Table 1. Important exotic ornamental fish traded in India (Swain *et.al.* 2010)

	Category /Common name	Scientific Name	Family	Remarks
LIVE-BEARERS				
Swordtail				
1	Red velvet swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
2	Black swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
3	Marvel swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
4	High-fin tangerine swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PD
5	High-fin lyre tail	<i>Xiphophorus helleri</i>	Poecillidae	PD
6	pineapple swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
7	Tuxedo swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
8	Tangerine swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
9	Orange pineapple swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
10	Green swordtail	<i>Xiphophorus helleri</i>	Poecillidae	PE
Molly				
11	Black molly	<i>Poecilia spenops</i>	Poecillidae	PE
12	Spotted molly	<i>Poecilia spenops</i>	Poecillidae	PE
13	Chocolate molly	<i>Poecilia spenops</i>	Poecillidae	PE
14	Silver molly	<i>Poecilia spenops</i>	Poecillidae	PE
15	Albino molly	<i>Poecilia spenops</i>	Poecillidae	PE
16	Albino lyre-tail molly	<i>Poecilia spenops</i>	Poecillidae	PE
17	Sail fin molly	<i>Poecilia latipinna</i>	Poecillidae	PE
18	Veil-tail molly	<i>Poecilia latipinna</i>	Poecillidae	PE
19	Lyre-tail molly	<i>Poecilia latipinna</i>		PE
Guppy				
20	Neon guppy	<i>Poecilia reticulata</i>	Poecillidae	PE
21	Cobra guppy	<i>Poecilia reticulata</i>	Poecillidae	PE
22	Butterfly guppy	<i>Poecilia reticulata</i>	Poecillidae	PE
23	Mixed guppy	<i>Poecilia reticulata</i>	Poecillidae	PE

24	Golden guppy	<i>Poecilia reticulata</i>	Poeciliidae	PE
25	Black guppy	<i>Poecilia reticulata</i>	Poeciliidae	PE
26	Swordtail guppy	<i>Poecilia reticulata</i>	Poeciliidae	PE
Platy				
27	Variatus platy	<i>Xiphophorus variatus</i> hybrid	Poeciliidae	PE
28	Maculatus platy	<i>X. maculatus</i> hybrid	Poeciliidae	PE
29	Red wagtail platy	<i>X. maculatus</i> hybrid	Poeciliidae	PE
30	Gold crescent platy	<i>X. maculatus</i> hybrid	Poeciliidae	PE
31	Blue platy	<i>X. maculatus</i> hybrid		
32	Bleeding heart platy	<i>X. maculatus</i> hybrid	Poeciliidae	PE
33	Red tuxedo platy	<i>X. maculatus</i> hybrid	Poeciliidae	PE
EGG-LAYERS				
Gold fish				
34	Shubunkin gold	<i>Carrassius auratus</i>	Cyprinidae	PE
35	Red cap gold	<i>Carrassius auratus</i>	Cyprinidae	PE
36	Red cap oranda	<i>Carrassius auratus</i>	Cyprinidae	PE
37	Black moor	<i>Carassius auratus</i>	Cyprinidae	PE
38	Pearl scale gold	<i>Carassius auratus</i>	Cyprinidae	PE
39	Calico gold	<i>Carassius auratus</i>	Cyprinidae	PE
40	Peacock tail gold	<i>Carassius auratus</i>	Cyprinidae	PE
41	Bubble-eye	<i>Carassius auratus</i>	Cyprinidae	PD
Shark				
42	Red-tailed Black shark	<i>Epalzeorhynchus bicolor</i>	Cyprinidae	PD
43	Tiger shark	<i>Pangassius species</i>	Cyprinidae	PD
44	Silver shark	<i>Balantiocheilus melanopterus</i>	Cyprinidae	PD
Gourami				
45	Kissing gourami	<i>Heleostoma temminckii</i>	Anabantidae	PE
46	Golden gourami	<i>Trichogaster trichopterus</i>	Anabantidae	PE

47	Siamese fighting Fish	<i>Betta splendens</i>	Anabantidae	PE
48	Chinese paradise fish	<i>Macropodus opercularis</i>	Anabantidae	PD
49	Pearl gourami	<i>Trichogaster leeri</i>	Anabantidae	PD
50	Blue three-spot gourami	<i>T.trichopterus sumatranus</i>	Anabantidae	PE
51	Moonlight gourami	<i>Trichogaster microlepis</i>	Anabantidae	PE
Angel and Discus				
52	Pearl scale angel	<i>Pterophyllum scalare</i>	Cichlidae	PD
53	Vail tail angel	<i>P. scalare</i>	Cichlidae	PD
54	Ghost angel	<i>P. scalare</i>	Cichlidae	PD
55	Black angel	<i>P. scalare</i>	Cichlidae	PD
56	Marble angel	<i>P. scalare</i>	Cichlidae	PD
57	Marble pearl scale angel	<i>P. scalare</i>	Cichlidae	PD
58	Discus (pompadour fish)	<i>Symphysodon discus</i>	Cichlidae	PD
Severum				
59	Albino severum	<i>Cichlasoma severum</i>	Cichlidae	PE
60	Convict cichlid	<i>C. nigrofasciatum</i>	Cichlidae	PE
61	Fire-mouth cichlid	<i>Cichlasoma meeki</i>	Cichlidae	PE
62	Ramirez's dwarf cichlid	<i>Papiliochromis ramirezi</i>	Cichlidae	PE
63	Albino Oscar	<i>Astronotus ocellatus</i>	Cichlidae	PD
64	Tiger Oscar	<i>A. ocellatus</i>	Cichlidae	PD
65	Red Oscar	<i>A. ocellatus</i>	Cichlidae	PD
Catfish				
66	Sucker mouth catfish (Crocodile fish)	<i>Plecostomus spp.</i>	Loricariidae	PD
67	Albino sucker mouth cat	<i>Plecostomus spp.</i>	Callichthyidae	PD
68	Leopard catfish		Callichthyidae	PD
69	Bronze catfish	<i>Corhdorismelanistius</i>	Callichthyidae	PD
Tetra				
70	Congo tetra	<i>Micralestesinterruptus</i>	Characidae	PD

71	Diamond tetra	<i>Moenkheusiapittieri</i>	Characidae	PD
72	Bleeding heart tetra	<i>Hyphessobrycon erythrostigma</i>	Characidae	PD
73	Black-widow tetra	<i>Gymnocorymbus ternetzi</i>	Characidae	PD
74	Neon tetra	<i>Paracheirodon innesi</i>	Characidae	PD
75	Cardinal tetra	<i>Cheirodon axelrodi</i>	Characidae	PD
76	Buenos Aires tetra	<i>Cheirodon axelrodi</i>	Characidae	PD
77	Albino Buenos Aires	<i>Cheirodon axelrodi</i>	Characidae	PD
78	Golden widow tetra	<i>Cheirodon axelrodi</i>	Characidae	PD
79	Serpae tetra	<i>Hyphessobrycon serape</i>	Characidae	PD
80	Boehlke's penguin	<i>Thayeria boehlkei</i>	Characidae	PD
Barbs				
81	Rosy barb	<i>Pethia conchonius</i>	Cyprinidae	PE
82	Tiger barb (Sumatra barb)	<i>Puntius tetrazona</i>	Cyprinidae	PE
83	Albino Tiger barb	<i>Puntius tetrazona</i>	Cyprinidae	PE
84	Green tiger barb	<i>Puntius tetrazona</i>	Cyprinidae	PE
Koi carp				
85	Two color koi (Asia Koi)	<i>Cyprinus carpio</i> var. koi	Cyprinidae	PE
86	Nishiki koi (3 color koi)	<i>Cyprinus carpio</i> var. koi	Cyprinidae	PE
87	Manila koi (mongrel koi)	<i>Cyprinus carpio</i> var. koi	Cyprinidae	PE
Knife fish				
88	Black ghost knife fish	<i>Apteronotus albifrons</i>	Gymnotidae	PD
89	Glass knife fish	<i>Eigenmannia virescens</i>	Gymnotidae	PD

(PE- Propagation easy; PD-Propagation difficult)

4. PLANNING AND IMPLEMENTATION

The success of any entrepreneur depends on planning the business in terms of site selection, successful layout and design of the breeding or rearing unit. Once the unit is established in any site and later on found

uneconomical due to unavailability of certain important facilities such as water and power. Beautification will be difficult. Therefore, proper planning is required. At present the variety of commercial enterprises producing ornamental fishes is varied and diverse as the species produced. The degree of intensification and species farmed depends on following aspects.

- Capacity building is a prerequisite before starting an ornamental fish unit.
- The minimum land area required is 500-1000 square feet for a small scale unit whereas 1 acre and more for large scale farming in which few earthen ponds are to be excavated for some species such as Koi carps, Gourami, and barbs
- Site selection is one of the main criteria where the farmer should select a cool environment for the culture and breeding.
- Breeding and rearing unit should be made near a constant supply of clear water source and with electricity.
- In cold climates farming is too expensive as the water has to be kept warm to culture tropical fish. The tropical climates favour the production rate because of year round breeding, probability as successful rearing and better growth. Hence, it is a prerequisite for the entrepreneur to select the species accordingly.
- The selection of candidate species depends on the water quality of that area as species which prefers either soft water or hard water for breeding at the same time. There are species that are tolerant to a wide range of water conditions. For example all the live bearers prefer hard water- alkaline. Egg layers such as goldfish, gourami, danio, catfish, rosy barb and fighter etc. can tolerate wide range of water condition. Species such as angel, discus, tetras, Oscar, Loach prefers soft -acidic water. Therefore, water quality need to be checked.
- In certain areas, some species are difficult to breed, where there is a severe problem of water quality due to physico-chemical factors. Therefore, site selection for establishing ornamental fish farms is important.
- Bio-filtration unit is a prerequisite for smooth functioning of an ornamental fish culture and breeding unit.
- The brood stock selected for breeding should be of superior quality, so that good quality fish seed could be produced. If brood stocks

are not available in an area, one can think of rearing healthy smaller fish in to brood stock.

- Brood stocks can be allowed to breed for not more than two years. Fresh stocks from different source may be added in every two years to the selected parent stocks to improve the breeding efficiency and produce healthy offspring.
- The small fish breeder should concentrate preferably on one species so that it helps the breeder to develop expertise on the particular species and good quality fishes can be produced as per the market demand.
- The availability of agro-based byproducts facilitates the preparation of pelleted diet for the fish. For preparing a pelleted diet, a mini pelletiser may be a requirement.
- The breeding and rearing unit may be established preferably nearer to an airport/railway station, bus stand etc. for easy transportation for export and domestic market
- The breeders should develop market relations with pet/ retail shops, potential farmers, vendors dealing with ornamental fish, marketing network, etc. to facilitate the process of selling/procuring new brood stocks.
- A committed entrepreneur should always ensure regular contact with the recent research developments in the field and attend training and have exposure visits.
- All new incoming fishes should be quarantined from resident stock. Movement of fishes should be restricted from a suspected or unknown disease status area.
- Few quarantine tanks are required little away from the unit so that proper observations can be made on health aspects.
- If any abnormal behaviour is observed in any culture tanks then the fishes needs to be isolated immediately. If mass mortality occurs, express opinion has to be sought as the lead fish as well as equipments water be dispersed.

5. RECENT UPCOMING DEVELOPMENTAL PROJECTS IN INDIA

5.1 Launching of Network project by ICAR

By keeping the Indian trade and export in concern, Indian Council

of Agricultural Research has come out with a network project taking all the expertise of ICAR fisheries research Institutes like CMFRI, CIFA, CIBA, CIFE, CIFRI and DCFR, irrespective of Marine, brakishwater, coldwater and freshwater indigenous species for development of captive breeding technology besides linking the entrepreneurs for production of ornamental fish. The productions of high value exotic ornamental fishes were also taken in to the consideration. The net work project was launched at CMFRI, Cochin on 25th July 2018 for coming 4-5 years.

5.2 Aquatic rainbow technology park, Chennai

Now with the the facility developed by Fisheries College and Research Institute (FCRI), Ponneri in Tamil Nadu, the second largest exporter of ornamental fish after West Bengal. After its completion, the technology park would be handed over to breeders and farmers of ornamental fish on lease for three years. the concept is being developed by Fisheries College and Research Institute in Ponneri (Tamil Nadu) with MPEDA as part of the steering committee for the project. It is expected to cater to the needs of 200 to 250 ornamental fish culturists, providing advanced infrastructure, and modern production technologies for ornamental aquaculture, besides offering assistance in skill-development.

The project's components are multispecies ornamental fish hatchery (10 units), indoor raceway systems (10 units), outdoor raceway cum RAS systems (10 units), live feed culture nit (1 unit), disease diagnostic laboratory, and quarantine (2 units). An exclusive mall of about 50 retail shops selling both indigenous and exotic ornamental fish species will come up on the campus, and the CM had laid the foundation for that as well. It is expected to compete with Singapore, which remains on top of the ladder in terms of the sale of ornamental fish.

5.3 CIFA- The gateway of ornamental fisheries

CIFA has successfully bred and standardized the successful rearing of 16 indigenous ornamental species from NEH, Eastern and Southern Western ghat region. They are barbs, danios, rasboras, catfish, eel, black carp and chameleon fish. Recent achievement of captive breeding technology of an endangered fish *Dawkinsia tambraparniei* has been successful at CIFA leading to commercial production. Larval rearing of *Ompak pabda* is successfully done by the Kalyani centre of CIFA leading towards commercialization as some of their food fishes also have ornamental value. The catfish, *Mystus vittatus*, tyre truck eel, *Mastocembalus armatus*, yellow or sun catfish (*Horabagrus brachysoma*) which are successfully

bred at CIFA also come under this category. Development of “**Shining barb**” through selection process is one of the major achievements of CIFA and in ornamental fish industry, now under field trial in a private company at Udaipur, Rajasthan. Development of **CIFACURE**, a medicine for controlling fungal and bacterial diseases is gaining the momentum in many states of India commercialized through a Private company based at Bhubaneswar. CIFA is playing major role for conducting research and training programmes on freshwater ornamental fish breeding and culture in the country by conducting several national level training programmes both in and off-campus comprising more than 2000 participants from all over the country.

CIFA has developed a feed for some of the commercial varieties of ornamental fish containing 40% protein. Further, a pigment-enriched fish feed for rosy barb and gold fish for enhancing colours in fish has also been formulated. Institute has also made a documentary film on ‘Ornamental fish breeding and culture’ with the collaboration with SAARC Agricultural Information Centre (SAIC), Dhaka, Bangladesh for SAARC member countries. CIFA has also given the technical input for making two documentary films by UNDP and GRAMSAT. A comprehensive report has been prepared for UNDP for development of ornamental fish farming and trade in Orissa state. Odisha based local television channels and All India Radio also popularizing the sector with the help of CIFA.

As regard the North-Eastern region, the Institutes regularly conduct the training programmes as also awareness programmes to conserve and breed the important ornamental fish species. To popularize ornamental fishes in the North East region Four (4) demonstration portable breeding units have been established at Killing, Meghalaya; Itanagar, Arunachal Pradesh; State Fisheries Department, Dimapur, Nagaland and Ecology and Environmental Science Department, Assam University, Silchar. Few progressive farmers of Assam are engaged in ornamental fish production after undergone training at the Institute.

6. STEPS REQUIRED TO DEVELOP ORNAMENTAL FISHERIES

- Standardization of breeding technology of important Indian ornamental fishes for conservation and export with the guidelines of Green certification.
- Standardization of high value ornamental fishes within the purview of NBFGR guidelines.

- Breeding and seed production of commercial varieties of important ornamental fish through backyard and entrepreneurial level for domestic trade.
- Standardization of various live food production system and supply is important, hence research and popularization is necessary.
- Development of a common fish feed for omnivorous fishes, with colour enhancers by enriching natural carotenoids available in our natural resources
- Development of ornamental fish villages in different parts of the country by involving the State Governments and other Stakeholders.
- Development of world class public aquaria's in every state capital especially in major metropolitan cities for the public, students, entrepreneurs and hobbyist for popularization.
- Good quality stocks of important commercial varieties should be available in India for farmers
- Development of large scale hatcheries in every State Fisheries Department for seed distribution for growers.
- Development of a National Centre on ornamental fisheries, attached to any National Institute with a mandate of exclusive research on ornamental fish production
- Development of trained manpower on breeding and farming practice with a exposure to Asian countries such as Singapore and Malaysia is essential.
- Unemployed youths and rural women are to be encouraged for production and trade.
- With the concept of "Students Ready", more number of students are to be encouraged for research by Educational Institutes.

7. IMPORTANT ASPECT OF WATER QUALITY

The degrees of hardness have several biological effects upon aquatic life. Bicarbonates tend to prevent a solution from changing acidity. Soft water, lacking this protection, may become particularly acidic when much carbon dioxide is present; such a change creates stress for organisms. For soft water species excessive hardness causes an organism problem in absorbing substances through its delicate membranes. This is most true of the sensitive naked cells of eggs and milt, so that soft water has been found

to play a vital role in the successful reproduction of many species of freshwater fishes. Thus, at least for purposes such as fish breeding, a soft solution is desirable.

To maintain soft water, all sources of calcium carbonate such as calcareous rocks, gravels, coral, broken shell and algae must be kept out of the aquarium system whilst using only soft water initially and during exchange. Conversely, presence of such sources will preserve the water hardness. Some of the important water quality parameters and their optimum ranges for tropical aquarium fish are presented in the table below:

Table-2(a) Water quality parameters for ornamental fish

Temperature	24-28°C
pH	7.0-8.5
CO ₂	< 5 ppm
Alkalinity	75-120 ppm as CaCO ₃
Hardness	60-100 ppm as CaCO ₃
Dissolved oxygen	6.0-8.0 ppm
Free ammonia	<0.05 ppm
Ionized ammonia	<0.1-0.4 ppm

Table 2 (b) Species preferable for different types of water quality

Water Quality (Hardness)	Species Preferred
Soft water (Hardness < 100 ppm)	Tetra's, Barbs, Gourami's, Corydoras
Hard water (150-350 ppm)	Live bearers, Cichlids, Betta's
Above 350-1000 ppm	Gourami's, Rosy barb, Danio's, Gold fish, Koi carp, Siamese Fighter, etc

8. PRODUCTION SYSTEM

There are two types of production system existing in any aqua-farming practice. First type is production through breeding and larval rearing up to 2-3 months and that could be possible by constructing cement tanks of various sizes meant for breeding and larval rearing. The second type is culture/ farming to produce fish from larvae to marketable size for a period of 3-6 months of rearing either in cement tanks or in pond culture system depending upon the species. The farmer may go for any one of the above production system for better result. Accordingly, the farmer or entrepreneur

has to decide to take up the breeding/culture or both as per his skilled technical manpower. However, the small scale farmer in a back yard dealing with small fishes like livebearers may not come in the above categories.

8.1 Pond cultures of some ornamental fish

Some of the ornamental fish can be cultured in earthen ponds, the culture practice being followed are similar to conventional fish culture. The technique is extensive and is characterized by low stocking densities and with a heavy emphasis given on live food (plankton) production. Due to a low labour requirement, pond culture is one of the cheapest production methods but the entrepreneur enjoys limited control over the culture system. The culture system in such a case must be provided with proper guard against predating animals such as cormorants and snake. Small water bodies such as tanks, cisterns and small sized lined pond are most suitable for 'pond' culture of ornamental fish. Small tanks or cisterns are suitable for breeding purpose. For rearing, little larger sized tanks/cisterns are preferable. Small sized lined ponds are suitable for brood-stock. Most significantly, the size of tank/cisterns/ponds depends on the different species to be cultured, though in certain cases breeding/culture practice being employed could also be considered. However, the species like Koi carps, normal gold fishes, Gouramies, Cat fishes and other hardy fishes can be very well cultured in earthen tanks, provided all facilities for controlling the predators are existing. There are farmers in Bengal, producing many egg layers and livebearers together in pond system and as per the need they supply to the venders without acclimatizing them in aquarium conditions and resulting large mortality at the hobbyist tank.

9. ECONOMICS OF ORNAMENTAL FISH BREEDING AND CULTURE

The economic viability is the foundation of the any popular and successful enterprises. On the basis of the business scale, the ornamental fish farms can be categorized as small scale or large scale. The large scales are further divided into live bearers and egg layers units. The small scale units are low investment backyard enterprises with low intensity of production whereas, the large scale commercial enterprises involve higher cost and returns. The detailed economics of three categories of the ornamental farms are presented below.

Table-3. Economics of small-scale breeding and rearing for live-bearer ornamental fish

1. a) Fixed Capital	Amount (Rs.)
Low-cost shed of 300 sq. ft. area (bamboo frame with net covering)	10,000
Breeding tank (Brick walled 6' x 3' x 1'6" @ Rs. 2500/tank (4 nos.))	10,000
Rearing tank (Brick walled 6' x 4' x 2'0" @ Rs. 2800/tank (2 nos.))	5,600
Brood stock tank (Brick walled 6' x 4' x 2'0" @ Rs. 2800/tank (2 nos.))	5,600
Larval tank (Brick walled 4' x 1'6" x 1'0" @ Rs. 1200/tank (8 nos.))	9,600
Bore-well facility with 1 HP Pump	8,000
Oxygen cylinder with accessories (1 no.)	5,000
Sub-total	53,800
b) Recurring Expenditure (for one year)	
Brood fish of guppy, molly, swordtail & platy (800 female & 200 male @ Rs. 5.00/pc.)	5,000
Feed 150 kg/year @ Rs. 30/kg	4,500
Different types of nets	1,500
Electricity and fuel @ Rs. 250/month	3,000
Wages for labour (@ Rs. 1000/month)	12,000
Miscellaneous (chemicals, medicine, packing material, gas cylinder/ filling, perforated plastic breeding basket etc.)	2,500
Sub-total	28,500
2. Total Expenditure	
Recurring cost	28,500
Interest on fixed cost (12% per annum)	6,460
Interest on recurring cost (12% half yearly)	1,710
Depreciation (20% of fixed cost)	10,760
Total	47,430
3. Gross Income	
Sell of 76,800 nos. fish @ Rs. 1.5/pc, reared for one month (@ 40 nos./ female/cycle from 3 cycles/year, and considering survival of 80%)	1,15,200
4. Net Income (Gross income-Total expenditure) Rs. 76,800-43,210	67,770
5. Monthly income	5,647
	Say 5500

It is estimated that, within a year's time of three breeding cycle, a beginner may earn a sum of Rs. 5500 per month. If a farmer does the breeding and rearing work single-handedly, he/she can add the labour cost into the income. Upon acquiring further expertise, the farmer can increase his/her income by many ways, such as by increasing the number of breeding cycle per year, standardizing the overall hatchery procedures that would further reduce the expenditure on feeding, and mastering upon the breeding techniques to increase fry/young ones production in each cycle. Therefore, the monthly income of the three thousand rupees is the most conservative estimation of the economics of the enterprises. The farmers can earn upto 10000 rupees per month with the same infrastructure by developing expertise, improving efficiency and better price. This income can be considered to be high compared to any other similar enterprises.

Table-4. Economics of large-scale ornamental fish breeding and rearing for live-bearers

1. Investment	Amount (Rupees)
a. Fixed Capital	
Land required 1 ha	5,00,000
Shed with electrical supply (4000 sq. ft.)	8,00,000
Breeding tanks (Brick walled, 6' x 3' x 2', 24 nos @ Rs. 2500/tank)	60,000
Rearing tank (Brick walled, 8'x4'x2' @ Rs. 4000/tank; 30 nos.)	1,20,000
Brood stock tank (Brick walled 6'x3'x2' @Rs. 2500/tank; 40nos.)	1,00,000
Larval tank (Brick walled 3' x 2 x 1' @Rs.1000/tank; 20 nos.)	20,000
Pump, overhead tank and water supply facility	1,50,000
Air blower and other aeration systems	1,50,000
Sub-total	19,00,000
b. Recurring expenditure	
Brood fish (6000 female, 2000 male @ Rs. 5.00 /pc for each livebearer (potential reproductive period two years)	40000
Feed (600 kg/year @ Rs. 30/kg)	18,000
Nets and other materials	25,000
Wages for labourer (@ Rs. 5000/month x3 nos)	1,80,000
Miscellaneous	25,000
Sub-total	2,52,000

2. Total Expenditure	
Recurring expenditure	2,52,000
Depreciation (10% of capital cost)	1,90,000
Interest on capital cost (12%)	2,28,000
Interest on recurring expenditure (12% for half yearly)	15120
Total	6,85,120
3. Gross Income	
Fish sale (for 6,48,000 nos. @ Rs 3.00/piece) (Considering 90% survival from 7,20,000 seed produced from 4000 female in 3 times in a year)	19,44,000
4. Net Income (Gross income-Total expenditure)	12,58,880
5. Monthly income	104906
	Say 1,00,000

Table-5. Economics of large-scale ornamental fish breeding and rearing unit for Egg layers

Species maintained: goldfish (Red cap, Oranda, Subhunkin and Black moor)	
1. Investment	Amount (Rupees)
a. Fixed Capital (Land requirement 1.5 ha)	7,50,000
Shed with electrical supply (5000 sq. ft.)	10,00,000
Broodstock tank (Brick walled 6'x3'x2' @Rs. 2500/tank; 30 nos.)	75,000
Breeding tanks (Brick walled, 5' x 3' x 2', @ Rs. 2000/tank; 30 nos)	60,000
Larval tank (Brick walled 3' x 2 x1' @Rs.1000/tank; 50 nos.)	50,000
Rearing tank (Brick walled, 8'x 4'x2' @ Rs. 4000/tank; 60 nos.)	2,40,000
Earthen ponds (0.05 ha 2 nos)/large brick walled tanks (50 sq. m 6 nos)	3,00,000
Pump, overhead tank and water supply facility	2,00,000
Air blower and other aeration systems	2,00,000
Generator, gas cylinder and other requisites	1,50,000
Sub-total	30,25,000
b. Recurring expenditure	
Broodfish (3000 female, 4000 male @ Rs. 50.00 /pc)	3,50,000
Feed (1,500 kg/year @ Rs. 50/kg)	75,000
Nets and other materials	50,000

Wages for labourer (@ Rs.5000/month x 4 nos)	2,40,000
Miscellaneous including power, fuel etc.	3,00,000
Sub-total	10,15,000
2. Total expenditure	
Recurring expenditure	10,15,000
Depreciation (10% of capital cost)	3,02,500
Interest on capital cost (12%)	3,63,000
Interest on recurring expenditure (12% for half yearly)	60,900
Total	17,41,400
3. Gross Income	
Fish sale (for 12, 00,000 nos. @ Rs 5/ piece) (Considering breeding success in 2000 female with average fecundity of 1000/fish once in a year 60% survival from 20,00,000 seed produced)	60,00,000
4. Net Income (Gross income-Total expenditure)	42,58,600
5. Monthly income	3,54,883
	Say 3,50,000

10. CONCLUSION

A successful economic enterprise requires lot of dedication, hard work, sincerity and timely marketing of the produce. So also in ornamental fish, the success depends on the investment, species selection, demand, and proper marketing. The model economic analysis of the various types of the ornamental fish farms presented here are indicative, and average estimation. The actual profitability varies from the place to place depending on the condition and efficiencies in the operation and management of the farm. As the enterprise involves live specimen, the involvement of the risk is higher. At the same time, the ornamental nature of the product provides opportunity to harvest comparatively higher prices than food fishes. The demand creation and arousal of the interest of the people can fetch the entrepreneurs' higher prices. Therefore it is always advisable to make a proper viable project prior to establishing any ornamental fish breeding unit with due consultation.

Considering the proven success of involvement of women in development of backyard enterprise in farming of ornamental fish in West Bengal and Kerala, it is necessary that due encouragement is given for creation of women SHGs for such enterprise. It may be interesting to note

that, Malaysia with similar climatic condition like that of India has been able to grow the industry only with small backyard units at individual levels. Thus, development of ornament fish farming in any region, not necessarily requires very large-scale enterprises, but a few successful clusters of back yard units in different regions. In this regard special packages may be provided to these SHGs and unemployed youths or Ex-service men for establishment of such enterprise.

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ESTABLISHMENT OF POULTRY AS A PROFITABLE VENTURE

S. Malik and Sunil Kumar

1. INTRODUCTION

Poultry industry is one of the fastest growing industry in India and registered average growth rate of 5-6% in layer and 10-15% in broiler production during the last decade. India, with poultry population of 729.21 million (2012) and estimated more than 74,752 million eggs production (2013-2014), ranks third largest egg producer in the world. The total poultry meat production of the country was 1.917 million tones (2013-2014) and India ranks 5th in broiler production in the world. Broiler chicken industry has now occupied the second place in volume in the world just after pork. The chicken meat represents 25 % of total meat production from farm animals. FAO predicted that 42% of meat will be chicken meat consumed worldwide by 2020, overtaking pork and beef.

The annual per capita consumption of egg and meat in India is only 63 and 1.56 kg., respectively (2013-2014), which is very low as compared to world average 124 eggs and 5.9 kg. meat consumption per year. Moreover, the recommendation of Nutritional Advisory Committee of Indian Council of Medical Research is 180 eggs and 11.0 kg poultry meat per capita per annum. India's 75% of egg produce is consumed by the 25% population living in urban and semi-urban areas. It is indicated a wide gap in availability and demand of egg and meat, which can not be fulfilled only by the commercial poultry sector contributing nearly 70 % of the total output. So there is need of joint effort to establish more poultry unit in rural as well as in commercial sector to fulfill this gap and develop poultry as profitable venture to improve the livelihood of rural household and commercial business

enterprises, respectively.

2. ESTABLISHMENT OF POULTRY UNIT AND POULTRY BASED INTEGRATED FARMING SYSTEMS

According to resources, demand and purpose, the poultry unit may be established as rural poultry unit or commercial poultry unit. Under rural poultry, the unit may be established as backyard, semi intensive or small scale intensive poultry unit, may be under integrated farming system or purely backyard system. In commercial system, it is always intensive poultry unit specific to layer or broiler unit or may be both.

Poultry based Integrated Farming Systems:

1. Crop-livestock-Poultry-Fishery
2. Crop-Horticulture-Livestock-Poultry
3. Poultry-Fishery-horticulture
4. Poultry-fishery-Crop

Rural poultry farming may be divided into following categories as given in table 1.

Table 1: Types of Rural Poultry Farming:

	Traditional free range	Backyard poultry	Semi Intensive	Small Scale Intensive
Flock size	01-10	10-50	50-200	100-500
Type of breeds	Indigenous	Indigenous/ crossbreds	Improved	Layers/ broilers
Feed Resources	Scavenging	Scavenging & supplementation	Local/ commercial	Commercial
Egg production (nos.)	30-50	50-150	80-160	250-300

2.1 Poultry Breeds and Varieties:

(A) Egg purpose:

- (i) **Commercial:** White leghorn breed and its different strains / varieties developed by public and private sector can be used for commercial egg production. The age at sexual maturity of White leghorn is 140 days and on average its egg production is 320 eggs in a laying year. The Rhode Island Red breed can also be used for egg production.

- (ii) Backyard System:** The improved layer varieties have the potential of producing 160-200 eggs in a laying year at the organized farm conditions and 140-170 eggs in a laying year in free range conditions. The birds have on average 1.5-2.0 kg body weight in females and 2.5-3.5 kg. body weight in males. List of improved varieties of poultry for egg purpose is presented in table 2.

Table.2: Improved egg purpose varieties developed for rural poultry production.

S.No.	Name of the Variety	Name of the Organization	Breeding methods used for the development
1.	Gramapriya	PDP, Hyderabad	Crossing an exotic breed with a synthetic population
2.	Krishna J.	JNKVV, Jabalpur	Synthetic cross
3.	CARI Gold	CARI, Izatnagar (U.P.)	Exotic breed cross
4.	CARI Nirbheek	-do-	Crossing an indigenous breed with an exotic breed
5.	CARI Shyama	-do-	-do-
6.	CARI Hitcari	-do-	-do-
7.	CARI Upcari	-do-	-do-
8.	Gramalaxmi	KAU, Mannuthy	Exotic breed cross
9.	Kalinga Brown	CPDO, Bhubneshwar	Exotic breed cross

(B) Meat purpose:

- (i) Commercial:** Broiler hybrids Vencobb-100, Vencobb-400, Saguna broiler, Hybro Hebard and Shaver stabro etc. developed by private sector are available for commercial broiler production. These strains/ varieties can achieve 2.25 kg body weight in 40 days with feed efficiency 1.7 kg. feed per kg. body weight.
- (ii) Backyard System:** The varieties developed for meat purpose have the potential to gain 1.40-1.60 kg. body weight in 8 weeks of age in semi intensive conditions but the dual purpose varieties may gain only 1.20-1.40 kg. body weight during the same period.

Table 3: Improved dual and meat purpose varieties developed for rural poultry production.

S.No.	Name of the Variety	Name of the Institute developed variety	Purpose
1.	Vanaraja	PDP, Hyderabad	Dual
2.	Krishi- Bro	PDP, Hyderabad	Meat
3.	CARI Dhanaraja	CARI, Izatnagar (U.P.)	Meat
4.	CARI Devendra	CARI, Izatnagar (U.P.)	Dual
5.	Giriraja	UAS, Bangalore	Dual
6.	Swarnadhara	Vety Ani. & Fishery Univ., Habbal (Karnataka)	Dual
7.	Nicorock	CARI, Portblair	Dual
8.	Nishibari	CARI, Portblair	Dual
9.	Nandanam – 1 & 2	TANUVAS, Chennai	Dual
10.	Krishnapriya	KAU, Mannuthy	Dual
11.	Gramashree	KAU, Mannuthy	Dual
12.	Kuroiler	Kegg Farms, Delhi	Dual
13.	Satpuda Deshi	Yashwant Agro Tech, Jalgaon	Dual
14.	AVM Coloured	AVM Hatchery, Coimbatore	Meat

2.2 Storage of fertile Eggs:

The temperature for holding fertile eggs before incubation varies 10-21°C. At very low and very high temperature, the eggs do not hatch well. Stored the eggs with broad end up, hatch better.

2.3 Hatching of eggs:

Hatching is the production of chicks from fertile eggs. In chicken hatching period is 21 days. Hatching of fertile eggs can be done in two ways.

- (i) Natural hatching: When the fertile eggs are placed under the broody hen. The birds provide heat from her body to the eggs. The eggs also get humidity (moisture) from nest as well as from the soil and oxygen from the air. Birds have natural instinct for rearranging (turning) of eggs to make certain that they are well covered and uniformly getting temperature. The native birds (desi) hens are excellent for this purpose. This method is suitable only for small scale chick production because one hen can hatch only 10-15 eggs

at a time.

- (ii) Artificial hatching: By this method, incubators are used for hatching of eggs. Incubators are more efficient and suitable for large scale chick production.

In incubators system the total incubation and hatching period is divided into two parts. The first period is called incubation period, which is 18 days and second period is called incubation and hatching period, which is 3 days long. The requirements of temperature and humidity for both the periods are slightly different. For successful hatching four factors are very important.

- | | | | |
|-------|---------------------|------|-----------------|
| (i) | Temperature | (ii) | Humidity |
| (iii) | Gaseous environment | (iv) | Turning of eggs |

Incubation period: The temperature in incubation period is maintained in between 99.5 – 100.5°F (37.5 to 38.0°C). Very high or low temperatures reduce hatchability by increasing embryonic mortality, weak and deformed chicks. The relative humidity should be 60 % during incubation period. Dry and wet bulbs thermometers are used to determine humidity. The reading of the wet bulb should be around 85. The oxygen concentration should be 21 %, which is generally available in normal air. More or less oxygen concentration decreases hatchability. On average the CO₂ concentration should not go beyond 0.5 %. The oxygen and CO₂ concentrations are maintained by proper ventilation and exhaust system in the incubator and hatcher. Turning of the eggs should be done at least 4 times in a day. All the incubators are provided mechanism for automatic turning of eggs, 8 times in a day. Turning of eggs is essential during incubation in order to prevent the embryo from adhering to the shell membrane in the early stage of incubation and in later stage of incubation to avoid adhesion between yolk and allantois. Turning of eggs improve hatchability.

Incubation and hatching period: The eggs are transferred to a separate machine called Hatcher during this period. The eggs with live embryos are only transferred to the hatcher. The temperature of the hatcher is maintained at 98°F (37.0°C) and relative humidity is maintained at 70- 80%. The oxygen and CO₂ requirement is same as in the case of incubation period. The turning of eggs is not required during this stage.

For small scale chick production, machines are available in which incubation and hatching (21 days) can be performed in the same machine. Eggs are set in upper trays for incubation during first 18 days and shifted in

lower trays during the last three days for hatching. However, hatchability is slightly lower in comparison to separate incubator and hatcher.

2.4 Candling of Incubated eggs:

The eggs should be candled on 7th day to remove infertile eggs and on 18th day to remove dead germs. Candling is performed in dark room using Egg Candler fitted with electric bulb, and according to behavior of light, the eggs can be classified into fertile and infertile eggs as follows.

Transparent eggs	-	Infertile eggs
Translucent eggs	-	Dead germ
Opaque eggs	-	Live embryo

Eggs only with live embryos should be transferred into the hatcher machine.

2.5 Brooding of chicks:

Brooding is the care and management of new born chicks for successful rearing without hen. During this initial phase of brooding, young chicks can not regulate their body temperature so they require artificial heat to sustain body temperature. The young chicks needs shelter /brooder house upto 6 weeks of age to save from predators viz. crow, rats, snake, fox, stray dog and raccoon. Brooder house should be separate from other houses. There should be adequate ventilation in the brooder house to maintain the balance of oxygen and carbon dioxide. Direct and chilled wind of high speed should be avoided.

Brooder house should be thoroughly cleaned and disinfected with a disinfectant solution (kohrosolin/Phenyle) much before arrival of chicks. All the equipments, feeders, waterers and hovers should be thoroughly cleaned and kept in working order. Poultry diseases are highly contagious therefore movement of workers should be restricted in brooder house. There should be 2-3 inches thick layer of dry saw dust /rice husk or other locally available material in the brooder house. The moisture of the litter should be 20-25%, higher moisture may create ammonia problem, which cause ill effect on chicks.

Optimum temperature of brooder house maintains good growth rate and reduce mortality in chicks. The starting temperature should be 95°F during the first week and it should reduce 5.0°F per week during the successive week till 70°F. The heat source of 2 watts /chick is adequate upto 6 weeks of age. The season of brooding also define the requirement

of heat. Monitoring chicks' behaviour whether they are comfortable or not is very essential, if the temperature is high than required, the chicks will stay away from the source of heat; if it is low the chicks come closer to the source of heat. Brooders should be warmed up 24 hours before the chicks' arrival. The chick guard may be prepared by locally available material. The per chick brooder space is 45-65 cm².

Table 4: Floor, Feeder and Drinker space of different categories of chicken.

	Chick	Grower	Adult
Floor space	½ -1.0 ft ²	2.25 ft ²	3.25 ft ²
Feeder space (linear cm)	2.5-6.50	6.5-10.0	14 .0
Drinker space (linear cm)	0.50-1.50	1.50-2.50	2.50

2.6 Nutritional requirements of poultry:

(A) Average per day requirements of feed and water for the birds:

The average per day requirements of feed and water of different age groups of birds are mentioned in the table 5. The farmers should know per day requirements of feed and water so that according to the number of birds' farmer may arrange full requirements of feed and water. If birds will not provided water for two days, the birds start moulting and cease egg production. It requires at least 10-15 days to restart egg production if it is good laying season. Water is very important for the poultry; a bird can drink twice as much water in weight as it eats in feed. The quantities mentioned in table may be slightly varying according to season and breed / variety of birds.

Table 5: Average per day requirements of feed and water.

Age (Weeks)	Amount of Water/100 birds (in liters)	Feed consumption/bird (in gms.)
0-4	2.8-4.0	6-30
5-8	12-14	32-50
9-12	20-25	55-70
13-16	35-40	70-80
16 -20	45-50	80-100
20 & above	- do -	100-150

(B) Feeding requirements of Poultry:

The ISI requirements of chicken feeds of different categories of birds are presented in table 6. Feeding balance feed is essential, because, when feeds lacks essential protein type, minerals and vitamins, much more will be eaten, and much less will be produced.

Table 6: ISI requirements of chicken feeds.

	Broiler Starter (0-5 Wks)	Broiler Finisher (6-9 Wks)	Layer chick starter (0-6 Wks)	Grower (7-20 Wks)	Layer (21-80 Wks)
Energy (Kcl/Kg)	2900	3000	2700	2700	2800
Protein (%)	22.0	19.0	22.0	16.0	18.0
Crude Fibre (%)	6.0	6.0	7.0	8.0	8.0
Calcium (%)	1.0	1.0	1.0	1.0	2.75
Available phosphorus (%)	0.5	0.5	0.5	0.5	0.5

* Mineral mixture and vitamin mixture as per ISI.

2.6.1 Energy Sources:

The energy sources are used in feed at the levels of about 50-70 percent. Moreover, they also add about 25-35% of total protein requirement of poultry. All the monocotyledon crops are the good source of energy. The major energy sources are Maize, Barley, Rice, Rice polish, deoiled rice polish, Oat, Wheat, Wheat Bran, Pearl millet, Sorghum, Sal seed, Broken/ Damaged food grains, Tapioca meal, Hominy fees, dried poultry waste, molasses, Mango seed kernel and small millets.

Yellow maize is the major source carotene (precursor of vitamin A) and xanthophylls, a pigment deposited in broilers and egg yolk. Due to fibre and manganese in oats, mixing of oats in the feeds reduces the incidence of cannibalism, feather picking and hock disorders. Wheat bran is excellent source of manganese, iron and a good source of riboflavin, pantothenic acid, choline, niacin and thiamine. Germ-free caged layer droppings can be used as feed ingredient for poultry. It is high in calcium and phosphorus and has about 10-12% of protein.

Fats as Energy Source:

Mutton fat, Beef tallow, lard and edible oils. 3-8 % included in the ration.

Protein Sources:

The protein of the feed supply amino acids to the body. The quality of the protein of particular ingredient is dependent on the composition of amino acids in the ingredient. So the amino acids are divided into two groups viz. essential amino acids and nonessential amino acids. The maximum protein synthesis occurs, when all the essential amino acids are present in the feed in proper proportions as required for growth and production. The excess of the amino acids goes waste as the amino acids are not stored in the body.

Vegetable Protein Sources:

All the dicotyledonous crops (mainly pulses and oil seeds) are the good source of protein. Soybean cake, Ground nut cake, Mustard cake, Cotton seed cake, Maize gluten meal, Maize gluten feed, Cluster bean meal, Sesame meal, Sunflower meal, Ram til cake, Linseed meal and Penicillin mycelium waste.

Several vegetable protein sources have anti-nutritional factors. Antitrypsin in Soybean meal, thioglucoside (sinigrin) and erucic acid in mustard meal, gossypol and cyclopropenoid fatty acids in cotton meal, and antipyridoxine factor and cyanogenic glycoside in the linseed meal are most potent examples. The vegetable protein sources in common are deficient in both the limiting amino acids (lysine and methionine).

Animal Protein Sources:

Fish meal, Meat meal, Meat cum bone meal, blood meal, liver residue meal, hatchery by product meal, feather meal and silk worm pupae meal.

The animal protein sources contain higher levels of limiting amino acids (lysine and methionine) than vegetable protein sources. The animal protein sources are good source of calcium and phosphorus and supply vitamin B₁₂ through natural sources. Lysine requirement is more for growth than for egg production and a deficiency in diets not much affecting egg production. Fish meal is chief source of all the required amino acids and good source of riboflavin, pantothenic acid, choline, vitamin B₁₂, calcium and phosphorus.

Mineral Supplements:

Oyster shell meal (38% Calcium), Bone meal, Ground limestone (Calcium) and Di-calcium phosphate. Do not give much salt, a little is put in the feed if required, too much can become poison for poultry.

(C) Upper limit (percent) of feed ingredients used in poultry rations:

For formulating low cost ration, farmers should know how much maximum an ingredient can be mixed in the poultry ration. By this way costly feed ingredient may be avoided by using cheap locally available feed ingredients for reducing feed cost without hampering the production level.

Table 7: Upper limit of different feed ingredients.

Ingredients	Chicks-/ Growers/ layers	Ingredients	Chicks-/ Growers/ layers
Energy Sources:		Vegetable protein sources:	
Maize	60	Groundnut cake/ Soybean meal	40
Wheat/ Pearl millet	50	Groundnut cake (Deoiled)/ Safflower cake/ Linseed meal/ Maize gluten meal/feed	20
Rice Polish	40	Mustard cake	10
Sorghum (White)/ Barley	20-40	Cotton seed meal	5
Tapioca meal	25	Animal protein Sources:	
Rice polish (Deoiled)	20	Fish meal	15
Oats	10-20	Liver residue meal	10
Wheat bran	10-15	Meat meal	5-10
Poultry manure meal	10	Silk worm pupae meal/ Meat cum bone meal	6
Molasses/Salseed meal (deoiled)	5-10	Blood meal/ Feather meal/Poultry/ hatchery by product meal.	5
Fats as Energy Sources:			
Mutton fat, Beef tallow, lard and edible oils	3-8		

(D) Suggested rations for Layers and Broilers:

Some of the suggested rations for egg type and meat type chickens are given below.

Table 8: Suggested rations for Layers.

Ingredients (kg./100 kg.)	Starter (0-6 Wks.)		Grower (7-20 Wks.)		Layer (above 20 wks.)	
	1	2	1	2	1	2
Maize	10.0	44.10	27.0	—	35.0	20.0
Broken Rice	38.0	—	—	41.0	—	25.0
Rice polish	—	18.0	40.0	40.0	30.0	30.0
Wheat bran	—	6.80	15.0	—	3.30	—
Rice bran (deoiled)	8.1	—	—	—	—	—
Groundnut cake	40.0	6.0	5.0	11.0	10.0	10.0
Maize gluten meal	—	6.0	5.0	—	10.0	—
Mustard cake	—	6.0	—	—	—	—
Fish meal/fish offal	2.50	12.0	6.0	6.0	4.0	5.0
Meat meal	—	—	—	—	—	6.0
Bone meal	—	—	—	—	1.60	2.0
Lime stone	—	—	0.60	1.0	5.0	1.0
Methionine	0.06	—	—	—	—	—
Choline chloride	0.06	—	—	—	—	—
Antibiotic & coccidiostat	0.10	—	—	—	—	—
Salt	0.45	0.50	0.80	0.50	0.50	0.50
*Minerals Mixture.	0.68	0.56	0.50	0.40	0.50	0.40
*Vit. premix	0.05	0.04	0.10	0.10	0.10	0.10

* Mineral mixture and vitamin mixture as per ISI.

1. Broken Rice, deoiled rice bran or broken rice can be mix in place of maize as a principle source of energy upto 80 %.
2. Groundnut meal can be replaced with Til cake (100%), sunflower (100%) or mustard (50%).
3. Rice polish can be replaced with rubber seed cake, tapioca or mango kernel cake.
4. Rice bran (deoiled) can be replaced upto half with by products from pine apple pulp, banana peel, tea garden waste, cabbage waste, jack bean, apple waste, orange pulp.

Table 9: Suggested rations for Broilers.

Ingredients (kg./100 kg.)	Starter(0-5 Wks.)		Finisher(6-20 Wks.)	
	1	2	1	2
Maize	14.0	49.0	15.0	50.0
Broken Rice	30.0	—	40.0	—
Rice polish	10.0	—	—	20.38
Rice bran (deoiled)	—	8.21	—	—
Groundnut cake	14.0	20.0	10.0	13.0
Sunflower cake	14.0	20.0	12.0	—
Animal fat	3.0	—	—	—
Fish meal/fish offal	10.0	—	10.0	10.0
Blood meal	3.18	—	1.30	—
Silk worm pupae meal (deoiled)	—	—	—	5.0
Bone meal	1.0	—	0.60	1.0
Limestone	—	—	0.60	—
Methionine	0.06	0.06	—	—
Choline chloride	0.06	0.06	—	0.02
Antibiotic & Coccidiostat	0.10	0.10	—	—
Salt	0.50	0.45	0.40	0.50
*Minerals & Vit. Mixture.	0.10	2.12	0.10	0.10

* Mineral mixture and Vitamin mixture as per ISI.

1. Broken Rice, deoiled rice bran or broken rice can be mix in place of maize as a principle source of energy upto 80 %.
2. Groundnut meal can be replaced with Til cake (100%), sunflower (100%) or mustard (50%).
3. Rice polish can be replaced with rubber seed cake, tapioca or mango kernel cake.
4. Rice bran (deoiled) can be replaced upto half with by products from pine apple pulp, banana peel, tea garden waste, cabbage waste, jack bean, apple waste, orange pulp.

(E) Feeding of Rural Poultry production

Rural germplasm should be very efficient in scavenging waste materials (insects, earthworms, white ants, fallen grains, kitchen waste, green grass etc.) and should have minimum requirement of feed and converting them into protein rich egg and meat for human consumption. Clean drinking water should be provided, when the birds are let out for foraging at morning and after foraging, the supplementary feed (broken rice, kitchen waste etc.) can be provided preferably at the afternoon. The nutritional requirements of rural poultry are much lower upto 30 % than the commercial birds. Generally, 40-50 gms supplementary feed /bird/day is required to sustain good production. The quantity of supplementary feed is depends on the season, the rainy season required lower quantity of supplemental feed being the availability of good forage and insects etc. Nutritional deficiencies particularly energy, calcium and vitamins are common in birds reared under backyard system. Energy deficiency can be removed by feeding grains/ grain by-products as supplemental feed. Calcium requirement can be fulfilled by supplementing the calcium sources (Shell grit, Stone grit, Lime powder, Ground limestone (Calcium) and Di-calcium phosphate, shell of boiled egg etc.) @ 3-4 gms. /day /bird. The approximate balance layer ration can be prepared as follows. Energy source: 50-70%, Vegetable protein source: 20-25%, Animal protein source: 3-5%, Bone meal & lime stone: 5.0-6.5%, Salt: 0.50%, Mineral mixture: 0.50% and Vitamin mixture: 0.10%. The maximum limits of mixing of ingredients of different sources are given in table.7. According to availability they can be mixed as per formula in the ration. The ration prepared by this formula can be used as feed supplement to sustain the egg production. Extra males can be sold at the age of 12 – 16 weeks of age, only females should be kept after 16 weeks of age. A hen lay better without a male bird and produce infertile or vegetarian eggs. The eggs can not produce chicks but will keep in good condition, for long time and good for consumption.

2.7 Litter Management:

The shelter of poultry required locally available litter material, viz. Rice husk, paddy / wheat straw (2-3" size), saw dust, wood savings, dry leaves, groundnut kernels, sugarcane waste (broken into small pieces), dry grass or maize stalks. There may be problem of dampen in the litter in long rainy season of N.E region. This may initiate infection in the flock so mix hydrated lime @ 1.0 kg / 15-18 sq. ft. or Super phosphate @ 1.0 kg / 15 sq. ft floor space. More lime can interfere in the process of decomposition so restrict the quantity at optimum level. Super phosphate assist in preserving

nitrogen level and no ammonia formation occurs. The litter is most important component, which after one year can convert into very good compost, which will be very useful to fertilize crops and vegetables. One poultry shelter consisting of 10 birds can produce approx. 300 kg. poultry manure in a year.

The other advantages of poultry litter:

- (1) Litter maintains its own temperature in all weather so that it helps to maintain the bird temperature uniformly and acts as insulator.
- (2) Birds and eggs are safe with enclosed condition.
- (3) Part of the feed requirement of poultry comes from the litter. The well built up litter supplies animal protein factor (Vitamins B₁₂) as in fish meal, meat meal and high in riboflavin (Vitamin B₂) content so there is no need to supplement feed for these factors. It can be mixed at high proportion into cattle feed (McArdle and Panda, 1970).
- (4) Saving of labour because there is no need to clean floor daily.
- (5) Some diseases are controlled by its action. Dry litter-reducing coccidiosis than the base floor sheds. Birds control body lice by dust bathing in the litter.
- (6) It produce rich manure, has the value 3 times the cattle manure viz. 3% Nitrogen, 2% Phosphorus, 2% Potash, 0.68% Magnesium, 0.68% Sodium and 2.70% calcium plus trace elements. Nitrogen to organic matter ratio is approx. 1 to 33.
 - ❖ 8-12 kg. Grains can be increased by the use of only one kg of nitrogen; an extra 6-8 kg grains for each kg of phosphorus and an additional 4 kg of grain for each kg of potash.

40 birds supply one ton of deep litter in a year, which is enough fertilizer to meet the full fertilizer needs of one acre of paddy or maize or 2 acres of sorghum or about ½ acre intensively cultivated crops, such as vegetables. An extra ton of paddy per acre is possible from one ton of deep litter from 40 birds.

2.8 Vaccination and Health Management:

The vaccination of birds is very essential to save the birds from deadly viral diseases because there is no medicine for viral diseases except vaccination.

Table 10: Vaccination schedule.

Age (days)	Name of the Vaccine	Dose	Route of Administration
01	Marek's disease (HVT strain).	0.2 ml	Subcutaneous
4-7	New Castle disease (Ranikhet disease) - F ₁ / Lasota strain.	One drop	Intraocular/Intranasal (Eye/nasal)
14 day	Infectious Bursal disease (Gumboro) - MB strain.	One drop	Intraocular/Intranasal (Eye/nasal)
35 day	New Castle disease (Ranikhet disease) – *R ₂ B strain.	0.5 ml	Subcutaneous
42 day	Fowl Pox.	0.2 ml	Wing web prick

*Repeat R₂B at every 6 months interval.

2.9 Medication and Debeaking Schedule:

Regular monitoring and deworming of birds for internal parasites is very important due to scavenging nature of birds, which exposes them to internal parasites. Debeaking of birds is not required in rural poultry production. The beak helps in foraging and scavenging of insect etc. in the backyard of the farmer. But in case of more birds (100-200 or more) with the farmers, the birds may start cannibalism or may be start eating eggs also. Therefore, debeaking of birds in this case may be performed. The flock may affect their growth and production performance without deworming.

Table 11: The debeaking and medication schedule.

Age	Programme
1- 4 days	Electrolytes and Vitamins solution.
9-15 days	Vitamins solution.
16-22 days	Cocciostate / Coximer.
23-30 days	Calcium supplements (Ascal / Vetkal)
31-42 days	Liver tonics, first Debeaking.
42-50 days	First deworming (Albendazole/Piperazine).
13-16 weeks	Second Debeaking and second deworming (Albendazole/Piperazine).
Growers & Adults	Vitamins solution and Calcium supplements

2.10 Direction for Minimizing Loss from Diseases:

- (i) Keeping fresh and clean drinking water in plenty in the backyard is most essential. It is observed that most of farmers are not keeping water for their birds in the backyard so the birds are taking water from dirty source of the village, which is the major source of the infection.
- (ii) Chicks should be procured from reliable source and from disease free flock.
- (iii) Watch the birds at the morning on daily basis, if the birds show any abnormal behaviour, not consuming feed and water or symptoms of any disease or mortality. The affected bird should be immediately isolated from the other birds. Prompt action should be taken to arrange treatment by Veterinary Surgeon. The suggested medicine should be given to all the birds of the flock.
- (iv) If any disease spread in the village, control your birds only in your backyard and not allow birds of other neighbouring houses to enter in your backyard. Keep the night shelter and backyard area clean and disinfected. Put lime in the boundary area of the backyard. Vaccinate the birds if the disease is viral.
- (v) Birds should be vaccinated and de-wormed at regular intervals as per the direction of Veterinary Surgeon.
- (vi) It is common in backyard/rural poultry production to find different species of poultry like chickens, ducks, turkey, etc. in the same premises, thereby transmitting many diseases among them. Therefore, it is better to raise different species separately.
- (vii) The litter should be kept dry and the houses should be ventilated.
- (viii) Balance ration should be provided as supplementary feed preferably at the after noon, after scavenging of birds at the morning so the birds may fulfill their maximum feeding requirement from scavenging. The drinker and feeder must be regularly cleaned.

3. ECONOMICS OF 100 BACKYARD LAYER FARMING

Input Cost: A. Non-recurring:

- | | | |
|----|--------------------------|--------------|
| 1. | Poultry shed (200 sq ft) | Rs. 20,000/- |
| 2. | Feeder and drinker | Rs. 3,000/- |

Total Rs. 23,000/-

B. Recurring:

- | | |
|--|--------------|
| 1. Cost of chicks (110 chicks @ Rs. 15/- chick) | Rs. 1650/- |
| 2. Feed cost: | |
| (i) First 5 weeks @ 1 kg/chick, @ Rs. 30/- kg | Rs. 3300/- |
| (ii) 6-20 weeks , 40 g./ day for 105 days, @ Rs. 30/- kg, 4.6 q. | Rs. 13,800/- |
| (iii) 21 – 80 weeks, 50 g./day, 420 days, @ Rs. 25/- kg, 21.0 q. | Rs. 52,500/- |
| 3. Litter, electricity and water | Rs. 2,000/- |
| 4. Medicine, vaccine etc. | Rs. 1500/- |
| 5. Labour cost (2 hrs/day, total 136 days, @ Rs. 300/- day) | Rs. 40,800/- |

Total Rs. 1,15,550/-

Av. Yearly expenditure = Rs. 1,15,550 + 7,650 (1/3 of NR) = Rs. 1,23,200/-

Output:

- | | |
|---|----------------|
| 1. Cost of eggs (150eggs/bird, @ Rs. 10/- egg) | Rs. 1,50,000/- |
| 2. Cost of poultry meat (Av. 1.50kg wt/bird, @ Rs. 150/-kg. | Rs. 22,500/- |
| 3. Cost of poultry manure (25 q. manure, @ Rs. 200/- q.) | Rs. 5,000/- |

Total Rs. 1,77,500/-

Net income = Rs. 1,77,500 - Rs. 1,23,200 = Rs. 54,300/-**3. ECONOMICS OF 100 COMMERCIAL BROILER FARMING****Input Cost: A. Non-recurring:**

- | | |
|-----------------------------|--------------------|
| 1. Poultry shed (200 sq ft) | Rs. 20,000/- |
| 2. Feeder and drinker | Rs. 3,000/- |
| | Total Rs. 23,000/- |

B. Recurring:

- | | |
|---|-------------|
| 1. Cost of chicks (100 chicks @ Rs. 20/- chick) | Rs. 2,000/- |
| 2. Feed cost: | Rs. 9,900/- |
| (Total 3.3 kg/chick for 2 kg B.W., 330 kg, @ Rs. 30/- kg) | |
| 3. Litter, electricity and water | Rs. 2,000/- |
| 4. Medicine, vaccine etc. | Rs. 1000/- |
| 5. Labour cost (2 hrs/day, total 9 days, @ Rs. 300/- day) | Rs. 2,700/- |

Total Rs. 17,600/-

Av. Yearly expenditure = Rs. 17,600 + 1,300 (NR cost of 1 batch) = Rs. 18,900/-

Output:

1. Cost of poultry meat (Av. 2.0 kg. wt/bird, @ Rs. 120/-kg. Rs. 22,800/-
2. Cost of poultry manure (18 q. manure, @ Rs. 200/- q.) Rs. 3,600/-

Total Rs. 26,400/-

Net income = Rs. 26,400 - Rs. 18,900 = Rs. 7,500/-

Per Year net income = Rs. 7,500 x 6 = 45,000/-

4. CONCLUSION

The poultry rearing can be used as a tool for higher income, employment generation, nutritional security as well as poverty alleviation in the country. Poultry still has good scope for development, considering the gap in availability and demand of the poultry products. For the sustainable development of poultry the following steps are suggested. Firstly Breeding technologies should be used for the development of the quality poultry products, not only the improvement in quantity. Secondly, availability of poultry feed is major problem in some areas of the country so formulations of cheaper balance ration using locally available feed ingredients should be developed on regional basis so that poultry industry can develop uniformly in the country. Thirdly, development of thermostable vaccines for viral diseases in small doses particularly for Ranikhet disease is essential for avoiding the cold chain system, which is difficult to maintain in the country.

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YAK HUSBANDRY BASED FARMING SYSTEM FOR HIGH ALTITUDE AGRI- ENTREPRENEURSHIP DEVELOPMENT

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1. INTRODUCTION

The yak (*Bos grunniens* or *Poephagus grunniens*) must be regarded as one of the world's most remarkable multipurpose ruminants as it thrives in conditions of extreme harshness and deprivation while providing a livelihood for Highlanders. The major yak distribution areas in the Hindu Kush Himalayan (HKH) lie in the high mountains in the border areas between India and neighbouring countries. Over the past 10,000 years or so, the yak developed on the HKH region extending over about 2.5 million sq km. In India, yak-rearing states are Jammu and Kashmir, Arunachal Pradesh, Sikkim, Uttarakhand, and Himachal Pradesh. The yak rearing tract included bordering the southern slopes of the Himalayas, have a cold, humid climate (Arunachal Pradesh, Sikkim & Uttarakhand), while the two northerly states are cold and arid (Himachal Pradesh and J&K). Yaks are reared on a pastoral system at 3,000- 6,000 m above MSL on alpine pastures and grasslands throughout the Indian Himalayan regions. Yak population in India is 76,237 in 2012 (19th Livestock census), which is declined by 7.6 % as compared to the previous census; distributed in Ladakh region of J & K (54 398), Arunachal Pradesh (13,758), Sikkim (4,036), Himachal Pradesh (2,895) and Darjeeling part of West Bengal (1,088). Various social and ethnic groups of pan-Himalayan India are associated in yak rearing. In the Ladhak region of J & K state, yaks are raised mainly by the Buddhist as

well as Muslim nomads. In Himachal Pradesh yaks, are raised by Buddhist and Hindu community people. In Sikkim, yaks are mostly reared by Bhutia tribe of Buddhist faith. In Arunachal Monpa tribe of Buddhist faith rears yaks. Yak is treated as wealth and sacred animal and worshipped as God by the people of the snowbound Himalayan region.

The yak rearing, being a transhumance pastoral system of grazing on alpine pasture, is facing the challenges like harsh geo-climatic conditions with an acute nutritional crisis during winter when the alpine pasture is covered with heavy snow and rearers have to come down to lower altitude near the villages. At that point of time yak rearers stay in the village and allow the yaks to graze in adjoining pasture land (Deb, 2016). Due to the scarcity of fodder during the winter, yaks lose approximately 25-30% of their total body weight (AICRP Annual Report, 2010-11) In North East India; yaks are reared on the temperate and alpine pastures fed by plenty of rainwater. However, in Sikkim, Yak reared on Lachen axis has pasture land on alpine as well as the cold arid zone of North Sikkim. The highest populations of yak are found in Ladakh region of Jammu and Kashmir where these animal graze on the cold arid pastures fed by glacier water. The feed and fodder availability is become worse in Ladakh during winter as in cold arid region the vegetation is quite poor and yak has to live on scanty pastures near the riverside throughout the year and many yaks die due to starvation during winter as sufficient grasses are not available in cold arid region. Thus nutritional intervention in yak rearing pockets of India should be the utmost priority.

Yak is reared above the tree line where agricultural practices are subtle to nil and highlanders livelihood fully depends on yak as it provides milk, meat, hair fibers and dung for fuel. Products made from these materials used for household consumption and also for sale. Apart from intense economical importance yak also possess huge ecological significance to the one of the fragile Himalayan ecosystem as dung and urine manure whole alpine pasture and maintain soil fertility and overall providing livelihood to the people which have been designated as poorest of poor and remotest of remote in India.

2.METHODOLOGY TO TAKE UP FOR DEVELOPMENT OF ENTREPRENEURSHIP (IN RESPECTIVE FIELD)

2.1 Economical importance of yak

Yaks, a marginalized livestock, do not compete with human and other livestock species for consumption of cereals, oilseeds and other feed

ingredients. Additionally, yak reared in a location where very little agriculture activity is possible. Yak is primarily reared for meat purposes. The milk produced by the yak is less in quantity but highly nutritious one. The consumption of liquid milk is not a routine practice by the tribal people. Yaks produce up to 1.5 kg milk per day which contains higher fat, protein and SNF as compared to cattle milk. Therefore value-added milk products traditional or otherwise have superior marketability. The wool and hair harvested from yaks are used for making warm clothes and has good marketing opportunities.

Whether the yakzees of Kashmir valley or the brokpas of Arunachal Pradesh or dokpas of Sikkim one thing which was common to them, since time immemorial, was the way they traditionally pursued their livelihood in isolation (Borgohain, 2016). In one sense it could be said that remoteness was a means of preservation to their livelihood as they lived in self-sufficiency with little demand in life. Their life process revolved around the yak herding in alpine and subalpine meadow taking the same migratory route every year in nomadic or semi-nomadic lifestyle. It was indigenous strategies of herder to utilize the seasonally available pasture simultaneously weaving a safety net for themselves and the animals along a known pathway. Life was full of extreme hardship and devoid of modern amenities. Every part and product of yak is utilized by the high Lander for subsistence and for a livelihood. It includes meat, milk, hair, skin, hide, dung etc. Yak products like meat and milk are the main source of protein requirement of isolated highlanders who have little access to modern life. Traditional yak farming provides milk and meat products to highlanders by default.

3. FOCUS ON ENTREPRENEURIAL OPPORTUNITIES AND RESOURCES

3.1 Milk and milk product

The dokpas (yak herders) have no other alternative than to rely on the yaks as above 3,000 msl agricultural practices subside. Yak is generally milked once in a day in Sikkim. The dokpa milk their yak in Jodung; a special wooden vessel with the inner fitting of stems of Tibetan herbs (Lama Stick for separation of cream) and the milk is churned in a wooden churner called Dzshum. In Ladakh region bag made from yak-skin is used to separate cream. Butter, cheese, from the milk, is further processed into wet cheeses known as churpi. The lesser amount of ghee (clarified butter) was generated. This “churpi” and its smoke-dried form were relished and in great demand (Avasthe, 2005). The major source of income for yak farmers comes from milk. Milk production is low ranging from 129 to 350 kg per lactation. Yak

milk is rich in protein, fat, lactose, mineral elements and essential amino acids. (Jain and Yadav, 1985; Nivsarkar et al., 1997). The total dry matter is 17 -18 % during the main lactating period, whereas fat and total proteins are 6.9-8.9 percent (average 7.5 per cent) and 5.9 per cent respectively. The total dry matter is 1.2-1.4 times more than that of a cow. Yak milk is more concentrated than cow milk.

Churpi is delicious items from yak milk prepared by traditional method in an indigenous cylindrical churner made of wood and bamboo strips. Dry-matter percentage of churpi ranges from 24 to 52. Consistency ranges from soft, hard and slightly hard; colour is white to dark pale colour; taste is sour and odour pungent; pH is from 5.97 to 7.0. Whey is the by-product of churpi- making process. It is boiled until it becomes a dark and thick concentrate called doja. Some of this is applied immediately (with a small tuft of wool) on the face while rest is stored in a can or wooden box. Originally the packaging of the products was done in animal skin bags utensils of wood and bamboo and tree leaves (Kataktalware et al., 2008). Bag of skin and internal organ like the dried stomach are used for storing milk product like butter and churpi, a type of cheese. Off late a gradual shift to packaging in poly ethane bags has gained the popularity because of their exposure to the general marketing trends and consumer preferences. Because of growing demand and popularity of hard cheese, it is now commercially available in small sachets in the Gangtok of Sikkim.

3.2 Meat product

Yak meat is excellent cooking qualities. It is fine textured and scarlet in colour. It is regarded as very palatable, but muscular and marbling is poor. It is rich in myoglobin and has a flavour akin to that of wild animals (Sharma, 2004). Among local people, yak meat is highly prized above that of ordinary cattle since ancient time. Dressing percentage is 42 to 62 (Sharma, 2004). Yak meat is used for making various products. Yak meat is preserved using various types of traditional methods. Surplus meat is either smoked immediately on kitchen earth driers or kept deep frozen under snow.

In Arunachal Pradesh during Losar festival period, prior to winter, herdsmen cut yak meat in long narrow strips (approximately, 4-5 cm wide and 30 cm long) and dry these suspended from woven-hairs ropes. These can be kept for 1-2 years either hung or in hiding bags. In this method, meat can be stored longer than naturally frozen meat. Meat sausages are encased in the large intestine. Fresh meat is minced into small pieces, and a mixture of 50 percentage yak meat, 25percentage visceral fat and 25 percentage

blood is used as filling material. Salts and condiments are added to this mixture before filling in the casing (Nivsarkar et al., 1997). Bhattacharya et al., (2003) reported about sausage, prepared from yak meat by incorporating pork and fat (in the ratio of yak meat 60 percentage, pork 20 per cent and pork fat 20 percentages).

In Sikkim, many yaks are slaughtered every year and this is normally done when the animals are in their best condition, before the onset of winter. Some of the meat is consumed fresh and much else is frozen in nature's own "deep freeze" and stored that way. Meat is also dried and can be stored longer in hanging state through the roof of a house than when frozen. The herders and their families eat meat mostly for the four to five months following slaughter. Yaks are not slaughtered deliberately in spring or early summer because they are in poor condition and very lean at that time – through a few yaks may die or be killed as casualties. Meat is obtained mostly from animals slaughtered before the onset of winter when they are in good condition, but animals that die accidentally are rarely used. Meat is eaten fresh around the time of slaughter, but over a more prolonged period after being naturally frozen. Meat is also preserved by drying. Dried meat keeps longer than frozen. Sausage is made both from meat and from blood or from a mixture of the two. Some parts of the viscera are eaten; others are used as casings for sausage or as storage containers for other products. Hooves, after canning, have become a popular and nutritious food in pastoral areas and other places (Kumar et al., 2015) of Sikkim.

3.3 Yak hair skin and horns

Yak produce two type of fibres, viz. coarse outer hair and a fine down fibre, the later grow prior to the onset of winter as additional protection against cold. The down fibre is like pashmina or mohair of goats. Shedding of down coat in young animals, intermediate and down coat in adult yak starts from May and continue through July. Shearing is done mostly once in a year in the month of May or June. Better yield and quality can be obtained by combing out the down first with a wire comb and shearing a few days later. An Indian yak yields 4 to 5 kg of coarse hair and about 0.4 to 0.6 kg wool annually (Kataktalware et al., 2008)

The skin and hair of yaks are used in making like leather mats; jacket and hairy tails being used as treasure. The hides are processed simply and dried before tanning locally. The leather has many different uses. Pelts of calves that have died are also processed and made into coats and tanned skin used for storage of ghee/ cheese. The coarse hair and the fine down hair find many uses from making ropes to garments to tents. The hair from

the yak's tail is used ceremonially and as a fly-whisk. Horns form house decorative pieces and chopped horns with mild trimming are used for salt and medicine drenching of the yaks and its heads and tails are also made into ornaments and sold as gifts.

3.4 Dung

The nutrient resource of the soil pool is the most important basis for the growth and maintenance of the alpine vegetation. Any small change in this soil nutrient pool will have a profound effect on other components in the system. The dung of yak is an important source of fuel for highlanders as no other alternative available there. Yak faeces are used principally as fuel, after drying or, in some localities, used by the herdsmen in building walls. The manure out of yak dung acts as a good source of fertilizer helps in maintaining soil fertility and rejuvenates vegetation.

3.5 Yak as a pack animal

The yak is considered as the backbone for the Highlanders and widely used for drought purposes where it makes its home and not only as the pack animal for much publicized Himalayan mountaineering expeditions, known worldwide. The yak has strong limbs, small solid hooves with hard and slightly sharp edges and a narrow hoof fork. This attributes the yak to walk in dangerous places and over marshland and to climb over steep mountains. It can open up a path with its head and its hooves for people to follow, and it can swim across the water rapidly (Hanah et al., 2016). In difficult terrain, it is said to be safer to ride on a yak than on a horse, as the yak will not readily panic, for example in swampy ground. Since ancient times, the yak has been known in the mountainous region of China and surroundings as the "Boat of the plateau". In the semi-agricultural area, yak is also used for ploughing and other cultivation. Yak has great endurance for example; carry loads over long distances for two or three days without water or feed. In other circumstances, the yak may be required to carry loads during the day, with the opportunity to graze only at night, for as long as a month at a stretch. Most the yak used for drought are steers. Male F1 hybrids (yak-cattle) are also chosen (as they are sterile and cannot be used for breeding). The drought animals are used mainly for riding and as pack animals. Yak races are one of the games at folk festivals much loved by Tibetan people. In the semi-agricultural area, yak is also used for ploughing, thrashing and other cultivation.

As far as India is concerned little work has been done regarding the load carrying capacity of yak as pack animals. Kataktalware, et al.,

(2008) conducted one experiment to evaluate the efficiency of yak as a pack and reported that there was no adverse effect of load up to 30% of its live body weight. Hanah et al., (2016) conducted one experiment at NRC on Yak, Dirang and reported that a well-trained yak can carry up to 35% of its live body weight (i.e. 140 kg) and walk 14 Km at a stretch without any adverse effects on its health.

3.6 Yak and tourism

Pack animal playing a significant role to the inhabitant of this Himalaya belts, maybe, in defence forces, tourism and transhumant livestock herder since time immemorial. Even in today era of modernization, the pack or drought animal cannot be done away with many strategic areas for the Himalayan region. The yaks are natural habitat at high altitude and they are adapted to a harsh cold hypoxic environment of high altitude. Therefore, yak is the most suitable animal that will assist the Indian army in high altitude.

Yak safari or yak joy ride is another source of income for the yak herdsman. It is the unique safari in high altitude Himalayan belt such as Leh, Ladakh and Sikkim, which tourist are always fond of it as the safari offers breathtaking views of high peaks of this rugged land. In Leh- Ladakh, the yak herds' men charge rupees 150-400 per person per hour as yak safari or yak riding fee or charge. However, in Sikkim yak joy ride in Chhangu Lake; Colourfully decorated yaks with woollen knitwear over the horns and forehead and strings of bells around the necks are ready to take you for a ride around the lake or go up the mountain. The herd men charge as 50 to 250 depends upon distance covered and other activities related with yak. In Ladakh, many herds' men camped near roadside as they took to the diversification of their income by providing yak rides to tourists and putting up restaurants that serve yak milk and milk derivatives. In addition to this, with special efforts by self help group, they expose the tourist to special restaurants that exclusively sale yak products and delicacy like yak cheeses momo, yak milk coffee, salted yak butter tea etc. this practice can be replicated in other yak rearing states in strategically located tourist destination like Sela Pass in Arunachal Pradesh, Nathula, Yumthang valley and Chhangu lake and other places of Lachen and Lachung in North Sikkim where tourist prefer this kind of amenities.

3.7 Ecological importance

The yak and sheep also act as the rejuvenator of the whole alpine agro-ecosystem as its act of grazing prunes of the vegetation which is very much required for proper growth and maintenance of the pasture. It also

helps in seed dispersal, pollination and seed germination because some plant seed with very hard coating requires priming which is sometimes fulfilled by the Tibetan sheep and yak. Occasionally sheep and yak calves are also hunted by canines of the high altitudes. The sheep and yak hooves are stiff cloven-footed animals and graze in the group and walk in multiple rows fashion which forms mini tracks and micro ridges and rills on hill slopes which prevents soil erosion, especially from wind, as these areas experience high wind velocity throughout the year.

4. DEVELOPMENT SYNERGIES BETWEEN ENTREPRENEURSHIP AND AGRICULTURE

4.1 Agri-based diversification

As ICAR-Sikkim Centre, Gangtok, has taken lead role in agricultural diversification with introduction and strengthening of cultivation of high altitude leafy vegetables, reddish and vegetable pea with special emphasis on potato production with improved variety on naturally farm terraces and abandoned yak/sheep enclosures and also enclosures not in use during migration as these soil posses very high soil fertility leads to a boost in organic vegetable production improve income of herders. Furthermore, ICAR-Sikkim Centre, Department of A.H.L.F. and V.S. in collaboration with National Research Centre on Yak, Arunachal Pradesh, have distributed 100 kg concentrate feed, solar light, gumboot, raincoat, umbrella, solar light, silpauillin, tripal, rope bundle and other human amenities useful in working at higher altitude along with essential veterinary medicines have been distributed in yak rearing area and also training and awareness were imparted regarding improved yak husbandry. This particular experimentation showed that yak-based high altitude vegetable farming not only increases the nutritional security of highlanders but also efficient utilization and recycling of the resources which prolong vegetable availability and nutritional security of the Highlanders.

4.2 Hair fibres value addition

Similarly, a joint intervention by NRCY, Dirang and NIRJAFT, Kolkata, sets fabric machinery for the weaving of yak wool product blended with other fibre is installed at NRCY, Dirang. Though yak wool sale does not take much percentage in herder income portfolio, it is an interesting product in terms of its export potential for both herders and processors. On the other hand, many herders do not use yak wool for commercial use, so they have an opportunity to step further to increase their income by selling yak wool. Although yak produced sufficient wool per individual, herders

use wool only for their own use, like for making ropes and making into yarn. As the market price for yak wool is cheap and no scientific intervention is introduced herders shows the least interest in this avenue, instead of many of them just use for domestic purposes like making some household items including belly support belt, bags, mattresses and blankets. This initiative will bring new prospect for value addition of coarse yak wool by blending other fibres which are already standardized. Carpets, Jacket, Sweater, wall hanging etc. from yak wool have been prepared and evaluated for quality. NRCY has also taken an initiative for a cooperative business framework as well as disseminating scientific know-how for making yak wool as a commercial entity to traditional yak farming system for the overall economic development of yak herdsman.

5. ECONOMICS INVOLVED TAKING UP THE VENTURE FOR ENTREPRENEURSHIP DEVELOPMENT

5.1. Economic of yak farming

The husbandry, in one hand, is highly remunerative with the cost-benefit ratio (B: C ratio up to 4: 1 in Arunachal Pradesh; Maiti et al., 2012), on the other hand, it is facing several constraints. Challenges of transhumance system of farming in all yak rearing states of India are major concerns of this husbandry. Lack of scientific management practices, reproductive disorders, improper nutrition, lack of degradation of the natural grassland, inbreeding, weak marketing linkage and non-adoption of technologies for value addition of yak products are reducing the profit margins of yak reares. And due to these difficulties, the youth of yak rearing communities are abandoning the yak husbandry (Ramesha and Bhattacharya, 2008)

5.2 Economics of Yak Rearing

Yaks are reared under rangeland system. Cost of adult breedable female yak (with calves) is taken as at Rs 20, 000 and male at Rs 15000. Average herd size observed under field conditions is 55-60. Hence it is proposed to have a herd of 55 adult animals with 39 breedable female (26 in different stages of lactation and 13 pregnant heifers), 5 breedable males and 15 male calves. Salary paid to Brokpa towards grazing of animal one year under the traditional system is @ Rs 5000/month (normal one young male with family, cloth and other accessories also provided by the yak owner). Tenant herding or contractual grazing is common. The cost towards pasture royalty per year is Rs 15000-20000. Cost towards transit encloses prepared with the biodegradable material and types of equipment for making

milk by-product are Rs 30000. Cost milk by-product is Rs. 400-500/kg Churpi and Butter is Rs.300-350/kg (on the basis of quality). Thick hair , Rs. 300/kg, down-fibers Rs.400-500/kg (on the basis of quality). The meat of yak Rs. 350-400/kg and also male animals up to one year of age live weight approximately 150-200/Kg. Pack animal/ Tourism Rs.200/ day per animal.8. Average age at first calving is 3.5 years and an inter-calving period is 14-16 month. The assumed mortality rate is 8% (depreciation due to death) (Ramesha, K.P. and Bhattacharya, M. 2008).

1. Economics of yak husbandry with a unit of 55 yaks.

PARTICULARS	Unit	AMOUNT(in Rs)
A. Fixed Cost		
1. Cost of breedable adult female with calf @Rs 18,000 (15 calves)	40	Rs 720000
2. Cost of breedable adult male/yak male for pack @15000	10	Rs 150000
3. Transit house and equipments	01	Rs 20000
Total fixed investment		Rs 8,90,000
B. Recurring Cost		
1. Interest of fixed investment @7% annum		Rs 63000
2. Feed supplementation during winter (2Kg/per animal/day) for 3 month @ Rs28 Kg	55	Rs 184800
3. Summer feed supplement(1Kg/per animal/day) for 9 month @ Rs 20Kg (Productive animals)	30	Rs 162000
4. Cost of labour @4,000/month	01	Rs 48,000
5. Pasture tax/community tax/royalty/annum	-	Rs 5000
6. Medicine and other miscellaneous expenses	-	Rs 6000
Total recurring cost		Rs 468100
Total cost (Expenditure)		Rs 1358100
C. Returns		
I. First year		
1. Churpi (1500 kg)	Rs 450/kg	Rs. 675000
2. Butter (800 Kg)	Rs 350/kg	Rs. 280000
3. Hair (110 kg)	Rs 300/kg	Rs. 44000
4. Thin fibres (down fibres50 kg)	Rs 600/kg	Rs. 30000

5.	Male yak /pack/tourism (10 animals)/ 30 days	Rs 200/day	Rs. 60000
6.	Male yak for meat (surplus 10 animals) 150 kg	Rs 300/kg	Rs. 450000
	Total return		Rs. 1539000

Second years

1.	Churpi (1500 kg)	Rs 450/kg	Rs. 675000
2.	Butter (800 Kg)	Rs 350/kg	Rs. 280000
3.	Hair (110 kg)	Rs 300/kg	Rs. 44000
4.	Thin fibres (down fibres 50 kg)	Rs 600/kg	Rs. 30000
5.	Male yak /pack/tourism (10 animals)/30 days	Rs 200/day	Rs. 60000
6.	Male yak for meat (surplus 10 animals) 150 kg	Rs 300/kg	Rs. 450000
	Total return		Rs. 1539000

Cash flow statement**(Amount of return expected up to 5 years)**

S.no.	Particulars	1 st Year	2 nd year	3 rd year	4 th year	5 th Year
1.	Repayment of fixed cost (cost of animals and equipments)	Rs. 50000	Rs. 2,10,000	Rs. 2,10,000	Rs. 2,10,000	Rs. 2,10,000
2.	Recurring Cost	Rs. 468100	Rs. 466100	Rs. 464100	Rs. 462100	Rs. 461000
3.	Depreciation cost 10%	N.A.	Rs. 89000	Rs. 89000	Rs. 89000	Rs. 89000
4.	Total expenditure	Rs. 148100	Rs. 765100	Rs. 763100	Rs. 761100	Rs. 760000
5.	Returns	Rs. 1539000	Rs. 1539000	Rs. 1539000	Rs. 1539000	Rs. 1539000
6.	Net profit	Rs. 130000	Rs. 7,73,900	Rs. 7,93,900	Rs. 7,77,900	Rs. 7,79,000

Net asset Value of the project at the end of fifth years

Cost of 55 average body weight 250 Kg adults available@ Rs 90/kg live weight (Govt. Rate Arunachal Pradesh) =12,37,500.

6. CONCLUSION

The highlander's rear yak for meat, milk, wool and hide purpose; while interacting with them it was found that lack of regulated market and transport linkage were the main constraints, apart from shrinkage of pasture. A product from highlands could be certified as "Organic" or "Mountain meat product" as it is produced from chemical and fertilizer free pasture

and while the animals are treated with naturopathy. Agricultural produce from yak rearing area and product derived from yak itself can fetch good income provided Government should facilitate marketing linkages and also provide transport and storage facilities to Highlanders. Local markets also activated since the area, blessed with so many scenic beauties and attract a lot of tourists.

7. FUTURE PERSPECTIVES

The yak plays a major role in the Indian economy of the tribal population living difficult terrains of foothills of Himalayas as it provides milk, meat, hair fibres and dung for fuel. Products made from these materials used for household consumption and also for sale. However, a large quantity of coarse yak fibres remained underutilized, except its usage in the form of rope and tent. Chemical treatment of yak hairs in the presence of bleaching agent and alkali, its colour changed from black to golden yellow, a very similar colour to jute fibres. Additionally, the fibres to the metal coefficient of friction was found to improve from 0.280 to 0.368 in the untreated to treated samples, respectively. Like other woollen textiles, the jute/yak fibres blended textiles would be used for winter/warm garment as a jacket, overcoat, and blazer. Therefore, such type of intervention required at a larger scale for efficient utilization of yak hairs and overall improvement of livelihood of yak herders. The high altitude agriculture practices evolved around yak and sheep husbandry along with the very limited cultivation of potatoes, rayasag, high altitude radish and millet on naturally form terraces in traditional ways which quite insufficient to fulfill the household demand. Therefore, it needs to strengthen high altitude horticultural components by providing hands-on training, a supply of improved varieties, awareness apart from that periodic animal health camp and improved husbandry practices to reduce calves mortality for making yak husbandry more ruminative. The major threats at present are the growing number of feral dogs which use to attack yak calves leading to severe mortality almost 20 to 30 % sometimes it goes to 50 % in Sikkim. Winter fodder scarcity, the prevalence of haemoprotozoan and ectoparasitic diseases during down migration are major challenges before sustainable yak husbandry. Effective marketing channels from the domestic market to international market, development of ecotourism, yak riding, yak safari, trekking are the additional activities to make yak husbandry more sustainable and improve the economic status of Highlanders.



White yak



Breeding bull



Yak riding during Yak Mela



Potato cultivation in yak enclosures



Yak in completely snow bound valley



Stored yak butter



Churapi madeup of yak milk

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COMMERCIAL PIGGERY FOR ENTREPRENEURSHIP DEVELOPMENT

Nihar Ranjan Sahoo

1. INTRODUCTION

Animal husbandry is an integral component of Indian agriculture supporting livelihood of the rural population. They are the natural capitals acting as living banks with offspring as interest and act as an insurance against income shocks of crop failure and natural calamities. Livestock employs about 9 % of the agricultural work force although it varies widely from 3% to 40-48% from state to state. Livestock sector did not receive appropriate policy and financial attention it deserved. Hence the time has come to think rationally to make it as growth engine of agriculture. Furthermore, while the goals for agriculture in our country have shifted from food security to nutritional security, the role of food proteins has increased many folds. In this context, pork being the quality animal protein with low cost of production draws the attention of the entrepreneurs. The pork is an energy packed and the most widely consumed meat till today, almost in all major parts of the world. It is a rich source of proteins and fats. This meat being used to make sausages, ham and bacon is an essential part of people's daily nutrients requirement in many countries. Pork a calorific value of 458.0 per 100 gm which has a high mineral content of Phosphorus, Selenium, Sodium, Zinc, Potassium and Copper. This contain good quantities are Iron and Magnesium, while Calcium and Mangnese are found in traces only. This is a rich source of Vitamin B whereas Vitamin A and Vitamin E are found in very small amounts. Consumption of Pork is good for skin, eyes, nervous system, bones and mental performance. This

also ensures better immunity to body due to presence of essential antioxidants. According to ICMR recommendation, out of 60 gm daily protein requirement; 20gm should be from animal protein source. It's cost of production is cheapest among the animal meats. Apart from providing meat, it is also a source of bristles and manure. India stands second in bristle production which is a byproduct harvested from indigenous pigs.

2. STATUS OF PIGGERY SECTOR IN INDIA

India's pig population is 10.29 million (CENSUS, 2012) which is about 2 % of total animal population. Pork production in India was about 460 thousand metric tons in FY 2014-15 contributing approximately 8 percent of the country's animal protein sources. From year 2010 to 2015 pork imports increased at a rate of 11 percent which in 2015, increased by 28 percent from the previous year to 527 metric tons showing a huge gap in demand and supply. If we consider requirements for nutritional security, the per capita availability of meat in our country is about 3 kg/ year where as ICMR recommended to the tune of 11kg/ year.

Table 1: Leading states in pig population

State	Population (in 000)
Assam	1636
Uttar Pradesh	1334
Jharkhand	962
Bihar	650
West Bengal	648
Meghalaya	543
Nagaland	504
All India	10294

Source: Livestock Census, 2012

Table 2: Leading states in pig productivity

State	Productivity (in kg per Animal)
Mizoram	87.5
Nagaland	80.0
Kerala	75.0
Arunachal Pradesh	60.0

Sikkim	60.0
Punjab	58.5
Manipur	52.1
All India	40.62

Source: Basic AH Statistics, 2014-15

The national average productivity or per animal yield is 40.62kg/animal. There is a lot of scope for improvement in production and productivity. Despite the tremendous potential for economic animal protein production this species has drawn the attention of planners since last few decades only. Furthermore, due to social taboo and religious impact the farming and unscientific rearing practices consumption has been restricted to particularly socially backward as well as tribal population to a great extent. The tribal masses rear pigs under nomadic system (scavenging) both as a source of income and a choice of meat for consumption. In India, more than 60% farmers belong to small and marginal category, within which pig raising and pork production represent farmers belonging to lowest socio-economic stratum. Among Indian states, Assam has the maximum number of pigs with about 16 % of the total pigs followed by Uttar Pradesh (~13 %), Jharkhand (~ 9 %) and Bihar (~ 6 %). The production system is mostly backyard scavenging pig to family operated smaller farms. These farmers are unable to effort costly feed stuff for pigs, hence resort to feed stuff from kitchen waste, hotel waste, market waste and from waste areas of neighbouring localities. This creates unhygienic mind set for pork in perception of majority of Indians. However, if managed properly in terms of breeding, feeding, management, housing, disease control and marketing, without much investment, miraculous returns can be ensured along with hygienic pork production. Despite being small-scale (generally no more than one to five crossbred pigs), production contributes significantly to the livelihood of the majority of pig-rearing households. The income from pig sales meets essential household and farming expenses. The bulk of the pig population in India is of indigenous type with poor growth rate and productivity.

3. PIGGERY: AN ENTERPRENURIAL EVALUATION

As of now, the pig farming in India mostly constitutes the livelihood of rural poor belonging to the lowest socio-economic strata. However, the preference for the piggery entrepreneurship is desirable owing to the following factors.

- ◆ Highest feed conversion efficiency from wide variety of feed stuffs starting from grain to garbage among the meat producing animals. Produce high live weight among meat producing animals. Converts wide variety of feed stuffs viz. grains, forages, damaged feeds and garbage and convert them into valuable nutritious meat.
- ◆ High growth rate achieving about 100 times of birth weight at about 8-9 months. Pig farming provides quick returns since the marketable weight of fatteners can be achieved with in a period of 6-8 months.
- ◆ They mature early at about 8 months and thereby decrease the time taken for marketing.
- ◆ They are prolific and produce two to three litters per year with a litter size from 8-12 each time. Therefore, they can multiply up to 20 times in a year.
- ◆ Frequent economic return can be obtained by shorter generation interval.
- ◆ In entrepreneurship point of view pig farming requires smaller investment and gives quick as well as high return. Pig farming requires about 75 % of total investment on buildings and equipments
- ◆ Pigs manure is widely used as fertilizer for agriculture farms and fish ponds. This can be integrated suitably with other entrepreneurship like Rice-Fish-Pig or Pig-Fish-Duck etc.
- ◆ Pigs store fat rapidly for which has a good commercial value.
- ◆ There is good demand for pork products such as, bacon, ham, sausages, lard etc from domestic as well as export market.
- ◆ They can produce higher meat yield in terms of dressing percentage ranges about 70 % in comparison to other livestock species (below 65%).

4. DIFFERENT AREAS WITH ENTREPRENEURAL POTENTIAL

Although the piggery sector in India has got tremendous growth potential, currently it is not fully explored to get its shape in an industrial form like poultry sector. The following area where there are lots of scope for entrepreneurship.

Commercial rearing/ fattening unit: Here the farmers procure the piglets, grow them to prepare finisher/ fatterer pigs and market. They may rear 3 batches of 3 months interval per year. Here the feed conversion efficiency

and faster growth rate are used effectively. The key to success here is how to reduce the feed cost using locally available ingredients without affecting the growth rate of fatteners. The disease prevention measures are also important. The scope is very high as there is a tremendous gap between demand and supply of pork in our country and the rise of paying capacity of people has increased many folds since last decades.

Pig breeding unit: Another area where there is tremendous shortage is production of quality piglets. This opportunity needs bit more expertise of breeding management and piglet management and consequently can fetch more profit than the fatterer unit. The main purpose is to supply piglets for the fatterer units. Here the prolificacy or rapid rate of multiplication of the species is encashed. The litter size and frequency of farrowing are the keys to success for this enterprise.

Backyard farming unit: This unit are more of a livelihood approach rather than an industrial form. Here there is low input production system traditionally maintaining pigs with kitchen waste and low cost agro-industrial byproducts employing family members for self sustainance. The units are generally consists of 2-10 number of sows. They have both breeding and fattening.

Retail pork outlet: This is an ancillary area of piggery sector which needs attention for hygienic pork marketing. This can fetch a good number of employment opportunities. As there are pork eaters across the country the cold supply chain with hygienic pork retail units can be established.

Modern slaughter house and pork processing unit: The humane, ethical and hygienic slaughter facilities are not available in sufficient numbers across the country. A significant constraint in this area is lack of investment and lack of requisite skill for large scale slaughter and processing. There are lots of scope for various food industries to invest and consequently employment generation.

Byproduct utilization and value addition: The utilization of byproducts like fecal materials and bristles in indigenous pigs can fetch some employment opportunities. Although, the contribution of India to global pork production is about 0.5%, the country ranks second in bristle production. The harvesting and processing for export can be done commercially which is relatively less explored. Another area of waste utilization is bio-gas production using pig dung.

5. PIGGERY ENTREPRENEURSHIP: SWOT ANALYSIS

Strength

- ◆ A population of 11.29 million (2012 census) pigs is the strength to meet the animal protein deficiency. These animals are hardy and can thrive in adverse situation which is common in the country.
- ◆ Large number of people below poverty line. Most of this population is again in the tribal belts where the people are non-vegetarian in their dietary habit. The low cost protein supplementation can be achieved by industrial piggery.
- ◆ Improved pig husbandry programmes can be an important area in the poverty alleviation programme of the Government.
- ◆ Commercialized pork production can give a meat revolution to provide employment to a large section of the rural poor.
- ◆ Large amount of agricultural products/ byproducts and kitchen waste etc can be properly utilized.

Weakness

- Absence of sufficient numbers of breeder farmers is a weakness for which sufficient numbers of quality piglets are not available for the fattener farmers as well as to the markets.
- Religious and social taboo associated with pig production and consumption.
- Lack of organized market for pork aggravates the situation.
- Present management system of scavenging pigs with garbage eating discourages quality customers.
- Preference for pork of local pigs in some part of the country.
- Lack of adequate support from the development and financial bodies to establish pork based industries is hindering the growth of pig to the desired extent.
- Inadequate publicity for pig rearing, consumption of pork and pork products.

Opportunities

- ◆ Pig is being a live source of insurance for rainfed agriculture, there is a tremendous opportunities to use this as a medium of poverty reduction in the state.

- ◆ India has a big market for pork and pork products. The demand and supply gap is widening day by day due to rise in demand. Here lies an opportunity for development of industrial piggery.
- ◆ Since pig is a prolific breeder achieving the targeted growth in meat sector is another opportunity through this. A very good opportunity exists for year round employment generation for tribal youth in this sector even better than the rainfed agriculture that give engagement to a maximum of 7-8 months in a year.
- ◆ Utilization of otherwise waste items in an environment friendly manner.
- ◆ There has been tremendous improvement in transport system which can be utilized for reviving the marketing network of live pig as well as pork and products.

Threats

- Deficiency in concentrate feed sources is a threat to the pig industry which compete human for grains.
- Recurrent natural calamities as well as outbreak of diseases are potential threats.
- Unavailability of sufficient number and doses of vaccines and diagnosis for swine diseases.

6. MODEL COMMERCIAL FARMING WITH ECONOMICS

The commercial piggery units can be established with financial support from the banks. For obtaining bank loan the farmers / entrepreneurs should apply to the nearest branch of a Commercial, Co-operative or Regional Rural Bank in the prescribed application form, which is available in the branches of financing bank. The bank examines the proposed scheme for its technical feasibility and economic viability. The scheme should include all relevant information on the number of and types of animals to be purchased, their breeds, production performance, cost and other relevant input and output costs with their description. Based on this, the total cost of the project, margin money to be provided by the beneficiary, requirement of bank loan, estimated annual expenditure, income, profit and loss statement, repayment period, etc. can be worked out. The relevant information can be obtained from NABARD website (<https://www.nabard.org/>). However, one small scheme of 10+2 units of pig for small pig rearers is being discussed here for better understanding.

Economics of rearing 10+2 units of pig for small pig rearers:

The parameters adopted for calculation of the economics of pig farming comprising 12 animals has been worked out on the following techno-economic basis.

1. The unit is managed by own family members without the help of external labour.
2. Ten female and two male piglets (grower pigs) to be purchased of around 4 month of age. They will act as breeding stock. The piglets born from them will be reared for 6-8 months and live pig would be sold in the market.
3. Female gives birth to ten young ones twice a year. Litter size at weaning would be eight.
4. The market weight will be 80.00 Kg as live weight at about 8 month.
5. Adult pig will take 1.00 Kg concentrate per day and young one 0.50-1.00 Kg per day. The rate of concentrate is Rs. 15.00 per Kg. In addition to concentrate, the adult pigs and piglets fed kitchen wastage/ vegetable wastage @ Rs. 2.50/ day and Rs. 2.00/ day, respectively.
6. The floor space requirement is 50 sq. ft./ adult, while piglets need 20 sq.ft.
7. A minimum of 1200 sq. ft. semi-pucca house is required at a construction cost rate of Rs. 350/ sq. ft.
8. Equipments purchased will be @ Rs. 500/ adult.
9. Depreciation on buildings and equipments will be @ 10% per year and 15% per year, respectively.
10. Animals will be insured at a premium rate of 7% of the value of the animals.
11. Veterinary expenses will be @ Rs. 300 per adult.
12. The farmer can only contribute 25 % of total non-recurring cost or working cost of capital, rest will be in the shape of loan amount of 75 %. The amount of loan and interest can be repaid by the farmer in equal half yearly installments within a period of 5 years, with a repayment holiday of 6 months. Grace period will be 12 months.

13. Production cycle of the herd for calculating cash inflow and outflow:

Sl. No.	Kinds of stock	Years				
		I	II	III	IV	V
1	Foundation Stock (Boar + Sow)	12	12	12	12	12
2	Number of piglets born	200	200	200	200	200
3	Number of piglets weaned and reared	160	160	160	160	160
4	Male and Females retained for replacement	03	03	03	03	03
5	Marketable Pigs for sale	150	150	150	150	150
6	Adult Breeding Pig for sale	03	03	03	03	03

Economic analysis:

I. Fixed Investment: (in Lakhs Rs.)

1. Cost of building (1200 sq. ft. @ Rs. 350/ sq.ft.) = 4.200
2. Cost of equipments (12 adults @ Rs. 1000/ adult) = 0.12
3. Cost of 10 females (@ Rs. 4000 each) and 2 males (@ Rs. 5000)
= 0.50

Total investment on fixed capital = 4.82

(NB: Cost of foundation stock and materials for shed may vary from place to place)

II. Annual fixed cost (in Lakhs Rs.):

1. Interest on fixed investment @ 15% per annum = 0.73
2. Loan payment of 5.0 Lakhs in 5 years @ 1 Lakh per annum = 1.00
3. Insurance charges @ 7% = 0.22

Total Fixed cost annually = 1.95

III. Variable cost (in Lakhs Rs.) annually:

1. Feed

a. Concentrate

- (i). Breeding stock @ 1 Kg x 12 pigs x 365 days @ Rs.15.00 per Kg
= 0.66

(ii) Piglets (2 months weaning age) @ 0.75 Kg x 160x240 days x Rs. 15.00
= 4.32

b. Kitchen wastage/ vegetable wastage

(i). Breeding stock @ Rs. 2.50 x 12 pigs x 365 days = 0.11

(ii) Piglets (2 months weaning age) @ Rs. 2.00 x 160 x 240 days
= 0.76

2. Veterinary expenses @ Rs. 300.00 per adult = 0.04

@ Rs. 50.00 per piglet = 0.08

3. Electricity charges @ Rs. 200.00 per month = 0.03

Total Variable cost annually = 6.00

**A. Total annual cost in Lakhs (1.95 Lakhs + 6.00 Lakhs)
= 7.95**

IV. Returns annually (in Lakhs):

1. Sale of 160 pigs per year of 80.00 Kg live weight @ Rs. 100.00 per Kg.
= 12.80

2. Value of manure = 0.10

3. Sale of gunny bags = 0.05

4. Sale of replacement 3 breeding stock of 230 Kg each @ Rs. 80.00 per Kg
= 0.55

Total return annually = 13.5

Net Income / Profit per year = 13.5-7.95 = 5.55 Lakhs

Profit per month = Rs. 46250.00

Note: The balance value of the adult stock in hand after five year, if added to income, it would increase the profit.

7. IMPORTANT ASPECTS OF PIGGERY ENTREPRENEURSHIP

- 1. Input availability and support system:** In piggery enterprise one important aspect is input availability i.e availability of piglets, feed, vaccine and medicine etc. The piglets are supplied from the AICRP on Pig as well as Mega seed centers across the country along with the state government farms. Besides several private breeder farms also supply improved quality piglets. The vaccines

are available with the state biological product departments. The insurance for the pigs are available under the livestock insurance scheme provided by several companies.

2. **Attempt for reduction of input cost:** The input cost can be reduced using the locally available materials in housing, replacing a part or full of the diet with kitchen waste, hotel waste and remnants of bakery etc. The feed alone covers 70% of the cost of production. Therefore, reducing the cost of feed the production cost may be greatly reduced.

8. CONCLUSION AND FUTURE PERSPECTIVES

The pork provides high quality protein with lowest cost of production which has potential to feed the large number of poor. There is a big market for pork and pork products in our country which is widening day-by-day. The pig as a species is capable to multiply at a very rapid pace with a better converter of feed to pork. The increasing demand for animal-source foods in India is matched with the current low productivity of pig population, suggests that well targeted interventions to improve pig production could deliver significant livelihood benefits for tribal and other marginalized groups in India. Therefore, suitable schemes to popularize the scientific pig breeding cum rearing of meat producing animals with adequate financial provisions are necessary to improve the production. As of now the piggery sector has not occupied its proper place which needs to be supported looking to its high potential to provide nutrition, employment, insurance to the poorest of the poor.

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MODEL GOAT FARMING FOR ENTREPRENEURSHIP DEVELOPMENT

P K Rout, M. Verma and A. Kumar

1. INTRODUCTION

Livestock rearing is one of the most important economic activities in the rural areas and contributes significantly to the national economy. Livestock contributes 30% of total protein requirement of world. The rapidly growing livestock market provides an opportunity for global trade; and imparts income generating opportunity for livestock farmers. India holds agricultural land spreading up to 297 million hectare and contributes 16.6% to GDP. Livestock products (90% of the production) are consumed locally and 70% of the produce is sold informally. In India, 70% of milk and 82% of meat are produced by small holders. Small holder livestock production system can be transformed by

- Agribusiness/innovation
- More value addition- more return
- Should be sustainable, equitable and healthy manner
- Carbon foot print / environmental foot print management

2. GOATS IN AGRICULTURE AND RURAL DEVELOPMENT

Goats are best animal component in arid, dry land and rain fed agro-climatic zones, providing livelihood to over 5 million households in India. Goat keeping has been a traditional activity and a primary source of livelihood for small holders. Goats have distinct social, economic, managerial and

biological advantages over other livestock species. Goat is the best adaptogenic animal and a key driver for inclusive growth. It is the earliest animal domesticated by man and provides food, fiber, skin and leather and livelihood security. Goats serve as smart card like RuPay for resource less poor people and have special significance in disadvantage place. Goats are distributed in all types of extreme climate and well adapted to the specific environment. They have comparatively low susceptibility to prevailing diseases and can be easily raised with the locally available feed and fodder resources or under intensive, semi-intensive grazing system.

In India goats are mainly distributed in Eastern (35.85%) and Northern (34.73%) regions followed by Southern (24.88%), Northern temperate (3.46%) and NEH region (1.10%). India has 28 defined breeds of goat with a total population of 135.4 million. The country stands first in goat milk (26.31%) and second in meat production (10.41%) in the world.

2.1 Indicators for sustainability in goat farming

Goat is a champion animal for social justice; also as an emerging companion. It provides a potential pathway from poverty to prosperity for resource less people; providing livelihood to over 5 million house hold in the country. Modern scientific inputs in goat rearing have tremendous potential for social transformation to people in most disadvantage places. Goat production system fulfills all the indicators for sustainability as the system is ecologically stable, economically viable and energy efficient.

a. Ecological Stability

Goats have no major ecological impact and their role in ecological degradation has been exaggerated (RTF, 1987). Anatomical features permit the goat to nibble tiny leaves from thorny trees and nitrogen from saliva induces re-growth of leaves. They defoliate smallest branch of the tree without damaging the twigs, improve soil fertility by even distribution of manure and improve grazing land by dispensing seeds.

b. Viable Economy

Goat farming is a very enumerative source of income among all livestock farming in the entire farm situation. It offers flexibility to farmers in capital investment (space, feed, management) and support a steady source of income (sell one bunch get another ready); moreover, goats can be sold at any point of time with ease. Their high reproductive capacity, short gestation period, high prolificacy and fast turnover are the key benefits to the farmers. They fit well into existing farming system with no competition

to traditional large livestock rearing and are complementary to other husbandry practices due to unique physical, physiological, behavioral and economic characteristics. The relative economics of 1 buffalo vs. 5 goat unit in Rajasthan was studied as it was observed that profit per annum was Rs. 1945 from goat unit and Rs. 1755 from buffalo unit (Pasha, 1990).

c. Energy Efficient production system

Input such as support energy, land and labour are not costly for the goat production system. As far as the grazing habit is concerned, goat can thrive on vegetation which is not suitable for other species. As a ruminant it can use roughages and non-conventional feeds for its energy utilization and growth. Land mainly targeted for goat grazing is rangeland and wasteland. Another major input is for labour, which is lowest in goat farming (Sastri, 1995). It does not require skilled labour as it is mainly handled by women and children in village conditions.

Similarly, output of the system is milk, meat, fiber and breeding stock. The meat demand is high, so question of over production of animal does not arise in present situation. Other by-products are hides, offal, and bones which are not causing pollution from processing point of view. However, excreta of goat urine and dung have been proved to be rich sources of nitrogen for soil fertility. If a farmer starts raising goats with loan then the owner can repay all the debt in a period of five years. The input-output ratio will be 1:2.3. The income per animal per year was estimated as Rs. 71.00, Rs. 105.75, Rs. 140.50, Rs. 176.25 and Rs. 210.00 respectively. Again from the simulation study Verma and Prasar (1991) indicated that the goat owner can repay all the debts within 5 years and the rate of profit from 6th year onwards will be Rs. 572.75/doe/year. It is necessary to make correct decision on the nature of their mixed farming enterprise in order to obtain efficiency on certain products.

3. GOAT FARMING- A DEMAND LED REVOLUTION FOR ENTREPRENEURSHIP

Entrepreneurship is key driver for economic development. It is necessary to plan and implement entrepreneurial programmes on agriculture for employment. Thus, entrepreneurship development in agriculture and livestock production is the best potential alternative to find employment avenues for the rural population. The importance of entrepreneurship development in agricultural sector and business planning is required to prepare a thorough business plan.

Entrepreneurship in livestock production is a demand led revolution as it increases job opportunity, provides nutritional security, better use of existing natural resource and managing the production system in better climate smart way. There are vast opportunities for entrepreneurship in livestock. Demands for milk and meat increase by 1.08—1.97 fold every year. World food demand is expected to increase up to 20% by 2050 and meat demand by 76%. By 2030 in India, the increase in demand of meat is expected to increase by 100% and of milk by 52%; whereas, the average income of India will increase by 30%. Meat supply increases by 3% in developing country with the highest demand being from South Asia and Africa. Therefore, the demand itself attracts various entrepreneurs to work in this area.

4. GOAT FARMING ENTREPRENEURSHIP: SWOT ANALYSIS

Strength

Presently goat ensures income to five million households in India and many of them are surviving on income only from goats. Goats are found more in ecologically fragile arid and semiarid areas and mostly with poor people. Strong consumer preferences for quality animal foods especially from goat are likely to change the prevailing goat production scenario in the country during the coming years and goat is being projected as 'Future Animal' owing to following favorable attributes:

- ➔ Goat is comparatively tolerant to different environmental stress and has higher feed utilization efficiency on forest based resources/ rangelands. They have varied genotypes adaptable to wide range of agro-ecological condition.
- ➔ They sustain themselves by top grazing habit and can be raised with the locally available feed and fodder resources or under intensive, semi-intensive grazing system.
- ➔ Goats fit well into existing farming system with no competition with traditional large livestock rearing.
- ➔ They have an efficient production system due to short gestation and early maturity.
- ➔ Better rearing potential under constraints of limited land and forage area, higher environmental stress and disease prevalence due to comparatively low susceptibility of goats to prevailing diseases.
- ➔ Economically more viable and profitable i.e. low investment, high

and consistent returns, flexibility for farmers in capital investment (space and feed, management), salable at any point of time and steady source of income (sell one bunch get another ready)

- ➔ Entrepreneurs realize commercial viability due to remunerative price of goat produce.
- ➔ Changing consumers' preferences: popularity for non-vegetarian diets by growing Indian middle class and change in choice of West Asians for Indian goat meat from Australian sheep as the meat of goat is tastier and low in fat. India emerging as the major exporter of goat meat to West Asia. Domestic demand for goat meat is set to rise to 1.27 million tonnes in 2020 (3 times more than present production).
- ➔ Goat milk has medicinal value and source of nutrition for children and pregnant women. Goat cheese and butter has export potential.

Weakness

Goats are associated with poorest people and distributed over most disadvantage places of the country. Due to low socio-economic status and lack of awareness, the resource-poor goat keepers often fail to adopt or implement modern methods of goat husbandry. Poor production of non-descript goats, poor nutrition, improper health care are limiting factors for optimum productivity. Following are can be flagged as the major weakness of goat production system

- ➔ Goat rearing is not well accepted by all classes of people; mostly confined to backward classes and small holders.
- ➔ Lack of value added and demand based goat production system and unscientific slaughter practices.
- ➔ Lack of definite breeding, grazing, marketing and goat slaughter policies.
- ➔ Shrinking grazing land and inadequate feeding practices.
- ➔ Scarcity of inadequate health covers programmes and affordable disease preventive measures for goats. Kid mortality up to one month of age is more than 15% in different parts of the country.
- ➔ Limited availability of superior germplasm for improving native/non-descriptive breeds.
- ➔ Unorganized and middleman/buyer oriented marketing.

- ➔ Limited credit and insurance schemes for goat farming.
- ➔ Misconception that goat is an ecological threat is hindering goat farming in forest rich states
- ➔ There is no platform for all players (breeder, farmers, various input supplier, butchers, middlemen, marketing, and professionals) to interact and find solution to their problem for increasing and sustaining productivity.

Opportunities

Various opportunities are there in goat farming management and production system. Major ones have been identified as:

- ➔ Designing of programmes and strategies to improve the welfare in goat farming management and has better scope of using artificial intelligence in this field.
- ➔ Gain support from below poverty line people.
- ➔ Role to play in cottage Industry.
- ➔ Goat milk is being recognized as an important health food for the future and can be produced for different health requirement as such of as processed food especially cheese.
- ➔ Goat butter – a rich and conscious consumer item as it contains short and medium chain fatty acids.
- ➔ Goat milk powder and Cheese have better significance in human nutrition and excellent quality cheese has export potential.
- ➔ Tailor made foods from goat milk to better fit human needs.
- ➔ Lean meat of goat is the most preferred by consumer.
- ➔ Valued as best bio-organic manure producer.

Challenge & Threats

Why livelihood projects did not perform to our expectations? Activity based groups and/or commodity based groups never focus on improving the backward and forward linkages required by producers to extract maximum profit from their enterprises. Various challenges and threats are associated with goat farming in present scenario:

- ➔ Non-availability of superior bucks and their indiscriminate slaughter at early age.

- ➔ Loss of germplasm due to change of strategy in agricultural production pattern and intensity.
- ➔ Poor condition of farmers.
- ➔ Endemic and emerging diseases are causing high mortality. Lack of proper diagnostic tools and immuno-prophylactic measures has led to high mortality.
- ➔ Due to increasing scarcity of breeding bucks of important breeds like Jamunapari, Beetal, Sirohi, Surti, farmers have resorted to breeding using bucks of other breeds like Marwari, which have large numbers. As a result animals have started losing their breed characteristics. Thus valuable germplasm of goats is under great threat of extinction.
- ➔ Pastureland is diminishing where the goats were otherwise traditionally reared.
- ➔ Due to frequent natural calamities such as drought, floods etc. farmers are compelled to dispose of good animals including kids, as they do not have the resources to face such eventualities.

5. ENTREPRENEURIAL OPPORTUNITIES AND RESOURCES

Goat enterprise can play a pivotal role in empowering rural farmers and rural women. Goat farming attracts the attention of youth and needs innovation in various key areas to increase profit level, better management and animal welfare. Development of seed stocks of different breeds for providing superior germplasm, development of nutritional feed and fodder options, commercial feed development, housing and herd management, health management, devices and appliances for goats, development of various products for human health and development of a platform and policies for marketing of goats and products are few options identified for entrepreneurs. Pashmina industry needs the attention and technological input for entrepreneurship from production to designer product development. Moreover, it is necessary to produce healthy and safer produce from goat by hygienic milk and meat production.

A. Development of breeding stock of different goat breeds (Seed stock)

Raising nucleus stock of superior germplasm of improver breeds (Jamunapari, Sirohi, Jakharana, and Barbari) to increase productivity of non-descript native goats (Fig. 1). For a small flock of 3-5 goats, the farmers

often do not prefer to maintain a breeding buck. Naturally they depend on sharing of community buck maintained in the villages by a flock owner maintaining 10 -15 or large number of goats. These bucks are not maintained on optimum feeding regimens and are often sub fertile. There is a great demand for the fertile/ tested bucks among goat farmers in the country. Under the breed improvement programmes ICAR-CIRG provides breeding bucks of superior genetic merit of different goat breeds to progressive goat breeders, non-government organizations, development agencies and various government departments.

To raise and maintain superior germplasm (seed stock) and making them available to goat farmers is an opportunity for entrepreneurs. This has a huge market in India as well as abroad.



Fig. 1: Seed stocks: Different breeds of goats

B. Nutritional feed and fodder development:

Standard package of feeding and complete feed development are the requirement for enhancing productivity. Community based Agro-forestry for goat fodder is an approach for solution to fodder shortage. Promoting stall feeding and use of household available feed resources and/or complete feed pellets to address problem of declining grazing area. (Fig. 2)



Fig. 2: Feed management at farmer's house and at farm respectively

C. Housing and Shelter management:

Goats are generally not provided any kind of housing in the field conditions. Proper housing of goats is however, very important (Fig. 3). Housing is required to protect the goats from vagaries of environment and protection from predation (Fig. 4). The important features of ideal goat housing that animal sheds should remain dry and comfortable to the animals and there should be provision for sufficient space as per standard guideline (Fig. 5). Goat houses can be made up of traditional material such as thatch or modern material like plastic/fibre roof and concrete pillars and walls.



Fig. 3. Different kind of shelter for rearing and managing goats made from various materials



Fig. 4. Kids' cradle for protection from predators



Fig 5. Erection of elevated platform for protection from parasites and dampness and shelter made of wooden flooring

D. Appliances for Goat

Metallic or earthen utensils are generally used for feeding of ration to the goats. Some farmers use conventional troughs or hayracks. CIRG has developed some improved feeding and watering devices for goats which can reduce the wastage as well contamination of feed. Some of these like hexagonal or rectangular feeders are highly popular (Fig. 6). These feeders have provisions for individual or simultaneous feeding of various types of feed materials. There is a lot of scope for innovation and experimentation in this field to meet particularly specific needs of goats and even facilitate the goat farmers. Developing portable, cost effective feeders to meet less wastage and space optimization can prove useful to farmers.



Fig. 6. Feeder to minimize wastage of feed and for space optimization

E. Health management:

A wide range of bacterial, viral, parasitic infections causing higher mortality in the form of disease outbreaks results huge economic losses to goat farming system. Thus, serious and meticulous efforts are needed for early identification of diseases and confirmatory diagnosis of goat disease in order to increase opportunities for international trade in goats. Infectious diseases like FMD, Goat pox, PPR (*Peste-des-petits Ruminants*), pasteurellosis, coccidiosis and parasitic infestation are responsible for higher mortality in goats. Some of the important diseases of bacterial, viral, and parasitic, origin which need proper prevention to check high mortality among goats.

Organising health camps, disease awareness camps and providing medicines and measures for medicine transportation along with first aid trainings is a good option for start-ups. Vaccine production and marketing can also be taken up in collaboration with experts. Developing various mobile applications for health management a good option for entrepreneurship.

F. Milk, meat and other products

The market for goat products is invariably huge and offers scope and choices to the beginners (Fig. 7, 8). Goat meat and milk quality: Goat meat is leaner with less fat, high in iron and high in B12 with balanced amino acids and lower n6:n3 ratio with conjugated linoleic acid. Likewise, goat milk is the most humanized milk with small fat globule size and is a food for infant and other people. It is a rich source of calcium and other minerals and holds various health beneficial properties like hypoallergenicity,

anti-oxidative, anti-hypertensive, antimicrobial, anti-inflammatory, immune stimulatory, immunomodulator, antithrombotic and many more. Goat milk possesses medicinal property and can cater to nutritional requirement of family. Goat meat is a preferred food item with tremendous export potential. Goat cheese, butter and other dairy products are way healthier. Goat milk finds its application in nutrition industry, food industry, medicine and even fashion industry. Goat faeces prove good bio-manure and pashmina from goats is highly valuable in textiles (Fig. 9). Goat skin leather is also used variedly.

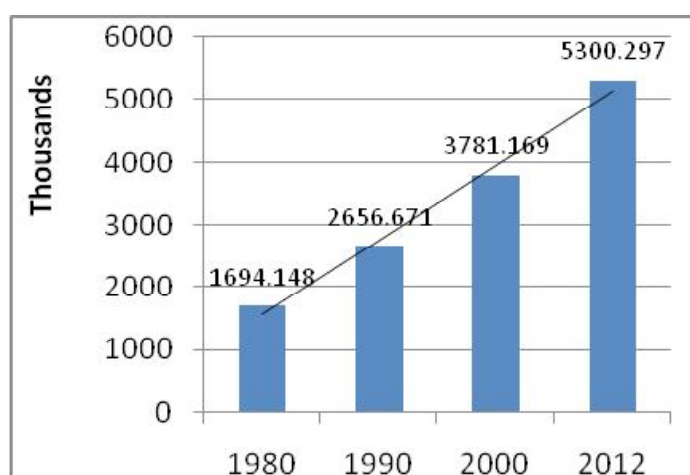


Fig.7. Changes in global goat meat production (Almost 200% increase from 1980)

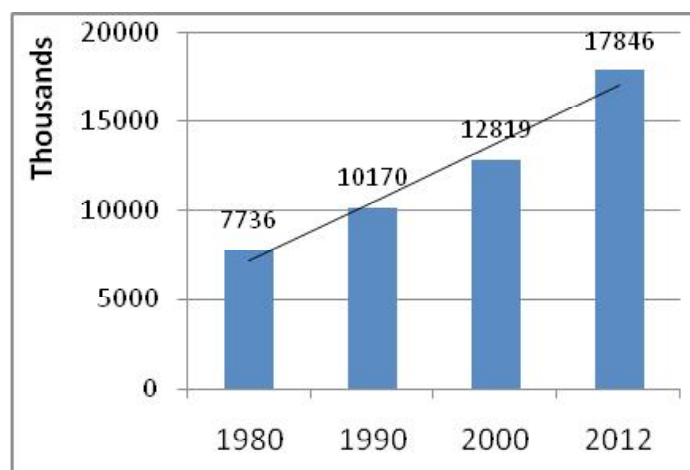


Fig.8. Changes in global goat milk production (Almost 120% increase from 1980)



Fig. 9. Various products from goats: cottage cheese, meat, pashmina

G. Development of a platform for Marketing of goats and products

Marketing is an important aspect of any production process. Livestock marketing including goats in the country is highly unorganized. As the goat farmers are illiterate, middlemen exploit them. There is incessantly increasing demand for meat and breeding goats in the country. Sale price of live goats are directly proportional to the market price of goat meat. Farmer should plan to maximize their sale at the time of festivals like Eid, Holi, Durga Puja and Dusshera to realize 2-3 times higher price. The main marketable products include the fattened kids, culled animals, breeding animals, manure and milk. Potential buyers like big retail meat outlets and wholesale traders should be identified to bypass middlemen.

H. Transportation of Goats

Goats are transported from one place to another and therefore, it is necessary to optimize the space and standard management practices to reduce stress and to maintain welfare standard. Designing transportation vehicle and service can also be taken up as entrepreneur market. Standard means of transportation of animals may also involve international business.

I. Compost/ Vermicompost Development

Goats are adaptogenic making their existence in various climatic conditions, from coastal areas to mountains, and plains. Goats have been known to enhance soil fertility by distribution of manure in far areas. The lands chosen for grazing of goats is usually rangeland and wasteland. Goat faeces are a very good bio-manure. Goats improve soil fertility by even distribution of manure and improve grazing land by dispensing seeds. Compost/ Vermicompost from goat waste can also be developed as an industry providing a source of additional income to goat farmers.

6. GOATS FARMING ECONOMY

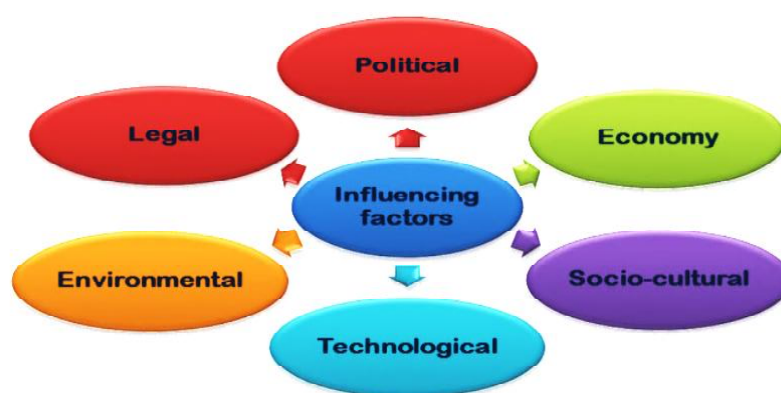
The poor people in rural areas find goat as the most suitable alternative for supplementary income and milk as there is a scope to harvest more benefits in short period of time. Goat sector contributes around 12% output from livestock sector and offers tremendous scope of doubling the existing income from goat farming by using low cost technologies. Field studies indicated that income per goat per year was about Rs.3200.00, by and large low in productivity and fetch less price. With some little input on health, nutrition, and management, the income per goat per year was improved to Rs.4800.00 (1.5 times). Goat farmers rearing goats under semi-intensive/ intensive management system and with smart marketing may earn profit at the tune of Rs.6500.00 per adult goat per year (double of extensive management system). By doubling income per goat per year, the contribution of goat rearing to the household's income may increase from 15 to 30%. This needs effective support services (prophylactic) from state animal husbandry department, micro credit facilities from financial institutions for increased adoption of technologies and setting up of commercial goat farms, market and cooperative departments. An economic model of 50 breeding does and 2 bucks rearing of medium size breed under semi-intensive management system is given in Table-1.

Table-1 Economics of Goat Rearing: Under semi-intensive management system

Fixed cost	Rs 3,89,000.00(Construction, Animals & Equipment, Depreciation and Interest on Capital Cost)
Recurring Cost	Rs 1,69,276.8
Feed for adults & kids	1,08,540
Veterinary cost	6,600
Labour	36,000
Interest on variable cost	18,137

Returns	Return over variable cost (ROVC)	2,48,143
ROVC per goat	Rs. 4963 say Rs. 5000	
ROVC per month	Rs. 20,679	
Return over variable cost (ROVC): Total Income- (Variable cost + Depreciation on fixed cost + Interest on fixed cost)		

7. EXTERNAL FACTORS AFFECTING ENTREPRENEURSHIP IN GOAT PRODUCTION



7.1. Political

Government is committed for livelihood security, social justice and fulfilling the objective of “Inclusive growth” in our society. At the same time providing safer products for consumers and taking measures for animal welfare are at priority.

7.2. Economy

Livestock sector contributes 25% to the agricultural GDP in our country. However the contribution of livestock to agricultural GDP is estimated to be 40% in semi-arid and 70% in arid regions, where goat is the major livestock species reared. Livestock sector provides employment to about 20-22 per cent of the population thereby would be a major sector for reducing unemployment and alleviating poverty and provides food and nutrition security.

7.3. Socio-cultural

Technology should be linked with the socio-economic status of the farmers for its adoption. For this development of value added products looking into the changing food habits is very essential.

7.4. Technological

Development of cost effective technology and its adoption by farmers are both very crucial. Production of superior germplasm of Indian goats for economic traits like meat, milk and fiber production needs to be done under on-station and on-farm condition. Augmentation in meat and milk production can be done using physiological approaches and reproduction biotechnology. Economic feeding system and feed processing technologies should be developed for small holders and commercial goat farmers. Development of preventive and control measures for economically important diseases of goats are required.

Commercialization of goat farming for integrated small, ruminant management and production system is needed. Farming system research under integrated rural development programme with special reference to goat improvement is needed. Processing technologies should be developed for value added meat, milk and fiber products from goats. Training programme should be conducted on goat production technology for national and international farmers, entrepreneurs, Scientists and other personnel and technology competitive for both domestic and international market.

7.5. Environmental

No scientific evidences are there to show that goat is not detrimental to environment. Shortage of measurements to reduce green-house gas emission from goats and implementation of appropriate bio-security measures to address the zoonotic and trans-boundary diseases affecting livestock economy is requisite. Appropriate adaptation and mitigation strategies to address the impact of climate change and stress in goats need to be realized. Technologies for animal waste management for efficient carbon reduction have to be developed.

7.6. Legal

Need for developing quality database on environmental pollutants, heavy metals and pesticides residues in feed and animal products so as to bring in appropriate legislation for maintaining quality standard. Quality standards are to be put in place for animal feeds, vaccines and other biological products to meet the sanitary and phyto-sanitary standards.

8. COMMERCIAL GOAT FARMING –STATUS AND LESSON LEARNT

The goat rearing using improved management practices undertaken for profit maximization from their enterprise considered as commercial goat

farms. Since last decade, a number of commercial goat farms have come up in different parts of the country. Some of these farms have adopted improved goat technologies for better returns.

Technical aspects of goat farming play an important role to assess cost and returns in goat farming. Increasing human population, increasing income, changing food habits due to improving standard of living are some important factors responsible for high demand for goat meat. Goat meat fetches best price among all types of meat available in domestic market. Low initial investment and sustaining on low grade ration and better returns have made this enterprise more profitable. It can be started on less productive or non-cultivable waste lands. Commercial goat farming has an important option in order to bridge the gap between demand and supply of goat meat and other products. In the present example of technically feasible and economically viable project has been given of a farm starting with 100 (does) and 5 (bucks) of Barbari breed under semi-intensive/intensive system for 5 years under following assumptions:

Goat farming assumes special significance in extreme ecology, particularly in arid, semi-arid and in dry land areas, where farming of other livestock species may not be that profitable and sustainable. Small-scale goat production is of significant benefit to families living in a wide variety of climatic conditions. Resilience of goat production to harsher environmental conditions offer amicable solutions to alleviate the vulnerability of the small and marginal farmers at the time when crop production fails due to adverse climatic conditions and where the natural resources are limited. Prevailing goat production system is all set to be transformed in the coming years due to emerging market trends on account of strong consumer preferences towards quality animal foods. Responding to the market signals, the goat production system in India has been gradually moving from extensive to intensive system of management for commercial production.

9. CONCLUSION

Goat being an adaptable livestock, active in various agro-climatic zones becomes a selection for agri-preneurs. Low cost management and investment are the major reasons goats are chosen by poor farmers. Goat production management is remunerative and offers steady and sustainable growth to farmers. Goat farming provides remarkable opportunities to entrepreneurs to take up as business initiative. Moreover, the commercialized goat farming is capable of providing better turnovers compared to many other agro-industries. The productivity and profitability of the goats rearing system can be improved through different technological innovation, better

welfare measures, product diversification and reducing environmental carbon foot print.

10. FUTURE PERSPECTIVES

Goat farming provides employment and source of income to households where agricultural income is seasonal. The sustainability of goat farming thrives maintaining the ecological and economic stability and providing social justice to farmers. Various aspects and prospects in goat farming have been discussed in this chapter. The enormous scope being offered through goat management and product development will stand agriculture equivalent to other booming industries in future. Goat milk being the most humanized milk and less allergenic will find future in nutraceuticals and medicine and the increase in demand of goat meat will be the major driving force to sustain this as an industry. The value of Pashmina in textiles is proven. Thus, the demand led basis will prove very useful when technology and strategies will combined with this avenue and may even lead to generation of international revenues.

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MODEL DAIRY FARMING FOR ENTREPRENEURSHIP DEVELOPMENT

Ravinder Kumar, Amit Kumar Verma, Rajbir Singh and A.K. Das

1. INTRODUCTION

India's livestock sector is one of the largest in the world. Total livestock population in India is 512.05 million. Contribution of cattle is 190.9 million (37.28%) and buffalo is 108.7 million (21.23%). India is producing about 176.35 million tons of milk annually. India ranks first in milk production in the world. About 20.5 million people depend upon livestock for their livelihood. About two third rural community get its livelihood from the livestock. .Livestock contributed 16 percent to the income of small farm households as against an average of 14 percent for all rural households. It also provides employment to about 8.8 per cent of the population in India. India has vast livestock resources. Livestock sector contributes about 4.11 percent of total GDP (Gross Domestic Products) and 25.6 percent of total Agriculture GDP (19th Livestock Census, 2012). Milk plays an important essential food for human life, since babyhood to end of elderly life. Milk is an important source of food for neonatal life. Apart from energy, it provides passive immunity to young ones in the form of colostrums, which protect the babies from pathogens. Milk contains all the vital nutrients almost in balanced proportion. Milk is a rich source of calcium, magnesium, selenium, riboflavin, vitamin B12 and pantothenic acid (vitamin B5), hence play a key role in maintaining our health and wellness. Due to increasing population of the country, the demand of dairy base product will be increase. However, nearly 33% of the gross Domestic population from agriculture and has 66% of economically active population, engaged in agriculture. The share

of livestock product is estimated at 21% of total agriculture sector. There is strong recognition about the fact that dairying could play a more constructive role in promoting rural welfare and reducing poverty. There is need of enhancement in proper milk production system because India is having large production by mass people landless and marginal farmer's, so we cannot avoid present mass production system, the system may be alter into advanced system by making community dairy farming system. However, mini and micro dairies are rapidly growing nearby urban areas.

The quality control of raw milk in rural settings is a quite challenging and has to be taken up, if we want Indian Dairy products acceptable globally. In Indian scenario, the dairying is a good source of income for small/marginal rural farmers and landless labourers, hence co-operative to community dairy farming system is a better choice. The manure produced from dung is rich in organic matter and helpful in improvement of soil fertility and ultimately in increasing the crop yield. The *gober* gas produced from the dung may also be used as fuel for domestic purposes as cooking, running generators to produce electricity, which may be used for various purposes like drawing water from well. The agricultural by-products, residues and surplus fodder are efficiently utilized as feed for the animals. Most of the times, agriculture is seasonal, hence dairy farming is a good employment opportunity round the year.. Development of Mini and micro dairy hubs linking smallholder farmers to the industry, by making all cluster villages cattle is to brought into Bulk Milk Cooler (BMC)/CC collection point , where AMCU station operate automatic milking machines, immediate cooling and transport by tanker to process plant. Now a days, there are so many companies like AMUL, Parag, Verka, Nestle, Ashmi etc.

2. PROBLEMS OF DAIRY FARMING IN INDIA

In India, the major constraints in dairy farming is low milk productivity in animals, poor animal health services, lack of proper data on dairy sector, weak organized retailing and established cold chain, large unorganized market sector (80%), poor raw milk quality and lack of Good dairy practices. Besides these, weak financial and policy support for dairy industry and low efficiency dairy plants and inappropriate milk collection system are also a hurdle in growth of dairy industry. Like any other business/ organization, dairy farming is also having certain challenges. The major challenges of this sector are high infrastructure and feeding cost for farmers. Most of the farmers don't serious about the total expenditure and profit from this business. They don't count the value of green food grown by themselves withtheir crops. Breeding is another important factor for economic milk production. But the farmers

are generally unaware about this due to ignorance, poor extension education programmes by the government. Thus, for establishing the dairy farm in economic way, there is utmost requirement of hardwork, proper care and management of animals,. In India, one of the family member generally the homemaker of the family is responsible for caring the animals. But in commercial dairy farming, there is requirement of experienced professionals. If one take care of these constraints, then he may be able to run the commercial dairy farm in profit by continuously visiting the other dairies establishment run by public and private sectors..

3. LIVESTOCK DEVELOPMENT INITIATIVE BY GOVERNMENT

Central and state governments have launched various livestock development programmes in the country by implementing the modern technologies in animal breeding, reproductive management and healthcare management. Many research organizations like National Dairy Research Institute (NDRI), Karnal, Indian Veterinary Research Institute (IVRI), Izatnagar, Central Institute of Research on Buffaloes (CIRB), Hisar, Central Institute of Research on Cattle (CIRC), Meerut, Central Institute of Research on Goats (CIRG), Mathura and various state agriculture / veterinary Universities (SAUs/SVUs) are devoted to sustainable basic and advance research in the concerned field. Government is also focusing on the possibilities of production and use of sexed semen in small holders' dairy production system. CIRC and CIRB are continuously working on indigenous breed improvement for Sahiwal, Gir, Crossbred (Frieawal) cattle; Murrah and Nili Ravi buffalo breeds. However, for sustainable development in dairy sector, there is an acute need of development and implementation of suitable farm level policies keeping in view the ensuring socio-economic dynamics and the existing competitive resource advantages. A strong effort is desired in linking the milk producers to the organized supply chain to ensure stable milk prices within the reach of consumers. The Indian dairying is maintaining its milk production growth at an even rate to meet its domestic needs but with the faster economic development, it has to be in better way to cope with increasing demands.. There is challenges in small holder dairy farming, which cane be solved by increasing the productivity and linking the production with the consumer demand. Wholehearted efforts are required in the areas of nutritional management, improved breeding and animal health care systems, financial inclusion, dedicated extension services for dairy farmers and development of procurement infrastructure with ICT support. Capacity building of small livestock owners, particularly women, and promotion of collective farming is essential for development efficient value chains. One of the major constraint has been the feed prices which

are quite high relative to the milk prices. There is great opportunity to exploit the world markets provided India is able to take care of its constraints and strengthen its value chain to deliver quality milk.

4. FUTURE DEMAND DRIVE IN DAIRY BUSINESS

Due to migration of population in urban area and less interest in animal rearing, a large rural market gap and quantity of available milk for processing will increase day by day. Fast growing economy and diversification, large market and investment will provide golden opportunity. Moreover, increasing income of consumers, changing life style and preference for milk and milk products, more number of adult consumers, untapped indigenous milk products market and exports are also increasing. On the other hand, there are some challenges for low cost human resource and employment generation for rural population. India need to immediate focus on this sector related issues like food safety, unhygienic practices by farmers at farm. Injudicious use of medicines particularly antibiotics on milch animals should also be controlled. Unfriendly WTO regime and Imports from other countries also a factor and we have need to manage through better govt. policies.

5. EXTENDING SCOPE FOR COMMERCIAL / CORPORATE DAIRY FARMING IN INDIA

One of the emerging trend in India is commercial dairy farms in the urban and peri-urban areas of the metros and big cities. These dairies mainly cater to the needs of the urban consumers in the form of liquid raw milk. Thus, there is ample scope of organized & modernized dairy farming. Commercial dairy farming is much different from villagers who rear few cows. Later does not employ labor, cultivates most of the green fodder needs on his own land with own labor, does not have to pay bank interest and above all invest too low in infrastructure facilities. Though a profitable business venture dairy farming in India requires hard work, proper planning, active and very alerts managers and supervisors. We all have heard many success stories in dairy farming. In today's technological world there have been many advances in modern dairy farming. Everything from feed for dairy cows to milk processing equipment has added tremendous scope to the dairy farming industry.

7. MODEL DAIRY FARMING

Main objective of model dairy farming: The main objective is safe and quality milk produced from healthy animals using good management practices that are sustainable from an animal welfare, social, economic and

environmental perspective.

Why commercial/model dairy farming?

Beside the employment benefit, so many factor directly provides excellent opportunity to start this business as given below:

- Opportunity for export of milk and milk products
- Organized and well planned project.
- Better management and operations of project.
- Better climate control.
- Cost effective.
- Healthy and happy animals.
- More production with better hygiene.
- Better return to investment and profits.
- Opportunity for export of milk and milk products
- Free antibiotics milk which is suitable for infants to elderly people
- Safe, Health and hygiene of milk will increase the shelf life of milk

Considerable advance practices of a model dairy farming:

At a model dairy farm, animal health, milking, hygiene, nutrition (feed & water), animal welfare, environment, socioeconomic management etc are the major practices, which should be followed properly for sustainability of the farm.

a) *Uniqueness in management system:*

1. Animals need to be healthy and an effective health care programme should be in place
2. Milk should be stored under hygienic conditions
3. Provides feed and water in suitable quantity and of good quality
4. Animals should be kept according to the following simple principles:
 - Freedom from hunger, thirst, discomfort, pain, injury and disease
 - Freedom from fear to engage in relatively normal patterns of animal behavior

- Milk production should be environmentally sustainable and cause minimal damage to the surrounding environment
- Human resource and financial management ensures the sustainability of the enterprise
- Arrangement for animal waste (Urine, dung, water etc.)
- Record keeping and modern application e.g.: Milking, chilling and reproduction management.

b) *Care and Management:* Taking good care is the key to every livestock farming business. So, the animals present in dairy farm should be taken care off. As prevention is better than cure, so the vaccination against economically important diseases like Foot-and-mouth disease, Haemorrhagic septicaemia etc is utmost important. . Provide them nutritious food and clean water regularly. The emergency and routine medicines should be stocked at dairy farms for immediate first hand support.. With the increase in milk production, the dairy farming will be a profitable business.

c) *Breeds:* There are numerous indigenous (Indian) and highly productive foreign (exotic) breeds available in dairy animals, which can be chosen for establishment of dairy. Both the cows and buffaloes can be raised together in separate rows under the same shed. The fat percentage of Cow's milk (4%) is lower than that of buffaloes milk (6%). By market survey, the demand of milk can be identified. . For profitable commercial dairy production Murrah, Surti, Mehasani, Jaffrabadi, Badhawari etc. are common and popular buffalo milch breeds, while Gir, Sahiwal, Red Sindhi, Tharparkar are popular cow breed. Highly productive exotic breeds like Holstein Friesian and Jersey etc. or their crosses like Karan Fries and Frieswal etc may also be reared for high milk yield. All those breeds are suitable for farming in the Indian weather. Always keep in mind the market demand, while choosing breeds for dairy farming business.

d) *Feeding:* Feeding of good and high quality nutritious feed is important for ensuring proper growth and good health of the animals. So, always try to feed them sufficient amount of nutritious feed. Green fodder is very necessary for the animal. It provides water along with vital nutrients to the animals and ultimately increase the milk production in animals. Green fodder also reduces the need of concentrate feeding in animals thus also helps in reducing the feed cost. Concentrate feeding also help in maintaining the good health and milk production

in animals. As a thumb rule, dairy animals require 2.5 kg of concentrate as maintenance. For milk production 400gms of concentrate per litre of milk in cow, while 500gms per litre of milk in buffaloes is additional requirement for lactating animals. If the animal is pregnant then add 2.5 kg of concentrate for maintaining the pregnancy. If possible, try to make a grazing place for your animals, this will be helpful for the exercise of animals. Along with nutritious foods, always provide them sufficient amount (*ad libitum*) of clean and fresh water. Dairy animals need more water than other animals. Generally, a milk producing animal needs five liters of water for producing one liter milk. So, always serve them sufficient amount of clean and fresh water.

- e) **Reproduction:** Reproduction is directly related to milk production in animals. Thus, to improve or develop the condition and production of cow or buffaloes it should meet reproduction with a proper plan. The bulls used for breeding or the semen should be of good pedigree in terms of milk production. Timely, breeding of the dairy animals with good quality semen is required for maintain the milk production in a dairy farm.
- f) **Milking:** Dairy animals should be milked twice a day i.e. once in dawn and another in evening . Before milking, the teats, udder and hand of the milker should be cleaned properly with fresh water along with potassium permanganate solution or any other good antiseptic. For high yielders (>10 litres of mil per day per animal), milking machine may be used to collect milk.
- g) **Housing:** The need for livestock housing is important from the point of animal health, welfare and comfort, hygiene, efficient and economical use of labour. A suitable and comfortable housing is essential to make best use of the efficient environment. Generally 40 square feet inside shed and 80 square feet open space is required per dairy animal. In small scale dairy farm (20 animals), 3000 square feet land area is sufficient enough, while for medium scale dairies (100 animals), 13,000 to 15,000 square feet space is required. However, ensure availability of all types of essential facilities in the house includes proper ventilation, sufficient flow of fresh and clean air, sufficient space etc. (Table 1).

Goal of ideal housing: The goal of housing is to protect the animal from adverse environmental conditions such as cold winds, rain and direct sun light. Proper housing contributes animal comfort, good

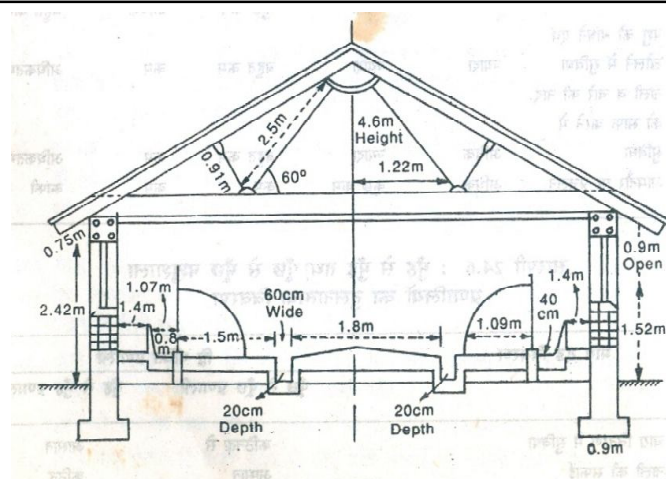
sanitation and efficient farm work.

Calf pen: This is meant for housing young calves separately. It can be located either at the end or on the side of the milking barn. This facilitates taking calves to their dams quickly. If there are large numbers of calves, the separate unit of calf shed should be arranged and located nearer to the milking shed. Calf pens should be well ventilated, well lighted, clean, dry, adequately bedded using soft material. It is better to rear calves in individual calf pens. If room for individual pens is not available calves must be tied properly for 15 to 20 minutes after feeding.

Fixed House Design: In this method, the cows are always tied. For this reason it is very difficult to clean the cow house regularly. Common cow house are two types.

Table 1: Per animal housing requirement (in M²) :

S.No	Categories of animals (age wise)	Feeding place area at manger (m ²)	Standing place or covered area (m ²)	Open area (M ²) / (Loose housing)
1.	Up to 4 to 6 months	0.2 - 0.3	0.8 - 1.0	3 - 4
2.	6 to 12 months	0.3 - 0.4	1.3 - 1.6	5 - 6
3.	1 to 2 years	0.4 - 0.5	1.6 - 1.8	6 - 8
4.	Adult cow	0.8 - 1.0	1.8 - 2.0	11 - 12
5.	Pregnant cow	1.0 - 1.2	8.5 - 10.5	15 - 20
6.	Bull (separate place for each bull)	1.0 - 1.2	9.0 - 11.0	20 - 22



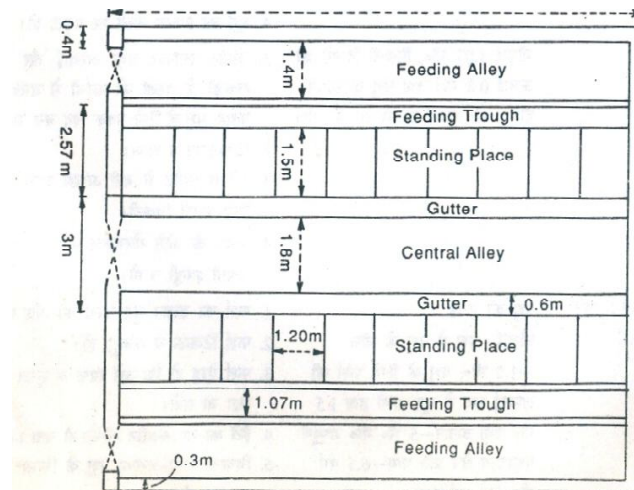


Fig. 1: Tail to tail housing system

h) Keeping farm record: Records are useful in analysing the profit or loss of dairy. Records of herd, calves, birth and death record, breeding, milk records, feeding register, sales and treatments records are necessary. For proper management, first of all set the targets. ..

7.1 Key Drivers of Stainability of Model Dairy Farming

Sustainable dairy farm management practices are critical for ensuring the profitability of dairy farms. This will help in keeping low cost of quality milk production and providing milk to consumers. The following key drivers impact the sustainability of dairy farms and are essential for making it globally competitive.

- Sincerely care of breed improvement
- Good soil and forage management
- Good young stock management
- Good nutrition and feed management
- Timely disease prevention and control
- Good reproductive system and timely heat detection
- Staff skill development training
- Proper farm waste management
- Value addition of milk
- Market and entrepreneurship skill

Feed and Fodder Management: Feed is one of the critical components in ensuring good milk yield and also constitutes approximately 60% to 70% of the operating expenses. With the shrinking of agriculture lands and pastures, availability of good quality feed and fodder for animals is becoming a challenge. There is 34% current deficit level of green fodder and concentrates.. The alternate strategies to fill this deficit is maximization of the usage of crop residues and leguminous forages, promotion of balanced feed rations, integrated watershed development, approaches for encouraging fodder production and training to farmers in hay and silage.

Breeding and Health Care Management: Lack of awareness amongst the dairy farmers in India on technical skills regarding breeding practices including record keeping and progeny testing is the key deterrent for improving herd quality. It can be addressed through expansion of artificial insemination (AI) network and extension services provided by research institutions, SAUs/SVUs through their Krishi Vigyan Kendras and involvement of private sectors. Breeding services using superior quality, disease free germplasm with artificial insemination will be helpful in addressing dressing these issues. Timely diagnosis and treatment of diseases and use of preventive measures such as vaccines will be helpful for better livestock health that will further improve quantity and quality of milk.

8. SKILLS REQUIREMENT FOR DAIRY FARM BUSINESS / ENTREPRENEURSHIP

Dairy farming is much more complex and needs to be managed scientifically. Dairy farmer / manager managing such dairy farm requires broad knowledge, wide variety of multi-tasking skills and keen business acumen.

Requirement of multiple skill activities of Dairy Farmer (Manager):

To a dairy farmer/ manager, should spend 50 percent of time in Management of the Dairy herd and remaining time in supervising employees, ration preparation and feeding, raising of replacements, milking, upkeep of facilities, grounds and equipment's, pasture and herd management etc. He should also spent 30 percent of his time in herd Health and reproduction like treatment and care of sick animals, managing dystokia with the help of veterinarian heat detection and breeding of animals. Another important task is replacement of employees, who are sick or on leave. He should also spend 20 percent of his time in Office Work and procurement and record keeping like herd health, production, reproduction inventories, monthly inventories, order supplies, repairing the damaged infrastructure

Knowledge and Skills Required: A commercial dairy farmer/ manager should be well educated in farm operations and trained in providing first aid treatment of general illness and injuries. He should have sound knowledgeable in dairy animal feeding schedule, farm operations, record keeping, motivational and communications skills etc.

Skill of Feeder: Feeder should spend 70- 80 percent his work time in feeding and caring for all the livestock. Keep the animal areas, lots and barns clean and free from manure and extraneous objects. Dung is very dangerous in dairy animals. The dirty animal shed attract the pathogen and flies that will lead to diseases in dairy animals. Check all lots at least five times per day (dry cow, heifer and calf areas) to be certain cattle are not under stress due to weather conditions allow the production of a high quality product and promote animal well-being and comfort.

Feeding Responsibilities: Check all animals on a timely basis (three to four times per day) to be certain they are receiving adequate feed and *ad libitum* water. Feed cows and calves in a timely manner. All the equipments at dairy farm should be maintained as prescribed by manufacturer's suggestions. If there is any difficulty in working order of any farm equipments, then report to the concerned person or dairy manager directly. Regular testing of feed and fodder for nutrient testing should be done in good laboratory. Be certain all pastures and fencing are maintained, if not repair these items as per need.

Treatment: It should be done on top priority under the supervision of veterinarian. Routine deworming and vaccinations of animals is necessary for maintain the sound health of animals. Assist in any special projects or routine maintenance of farmstead in coordination with the manager.

Skill of Milker: He should spend 70 percent to 80 percent work time to perform the duties of milking and related activities for lactating cows.

Milking Responsibilities and Procedures: Prepare milking equipments, buckets and bulk tank for milking. Then, bring the dairy animals for milking or help other employees bring in cows if needed or requested. Wear gloves when milking to help prevent spread of mastitis-causing organisms. Always follow the recommended pre-milking preparation like washing of teats and udder of animals, hands of milkers before milking. Milking should be performed in an orderly, proper and consistent manner. If the animals is under treatment and as per drugs prescribed, there is some withdrawl period, then it should be properly followed so that the milk from treated animal is not put into the bulk tank. Milk from mastitic animals or suffering from

zoonotic diseases should not be mixed with bulk tank. If the milker found any case of mastitis, then immediately report to concerned staff engaged in animal health, so that proper treatment can be started as early as possible. . After completion of milking, keep all the machinery and equipments sanitized as per the manufacturer's specification and Grade A Standards of the Public Milk Ordinance.

Milking Related Activities: The other milking related activities like bring in and out the cattle to milking shed, maintain milk records, animal identification by tags and other activities as directed by farm manager, is also required. These responsibilities may include, but are not limited to the following responsibilities:

- Care of springers and animals at the time of calving
- Feeding and care of calves
- Feeding, cleaning and care of milking herd
- Maintenance of free-stalls
- Heat detection, Artificial Insemination
- Record keeping
- Cleaning and maintenance of office building
- Maintenance of grounds, pasture, fences
- Maintenance of vacuum pumps

Selection of site for dairy farming:

Farmers should consider greatly for selection of sites to build the dairy farms with new structures. He should be aware of location of the dairy farms such as nearby neighbours and public areas, environmental issues like water quality, odours and flies, litter management, electrical supply etc. and laws and regulations that affect farming operations.

Criteria for site selection: Some of the parameters like soil type, elevation, topography, sunlight, protection from wind, marketing, durability, labour, accessibility and surrounding etc should be considered before the establishment and construction of a new dairy farm. .

9. SUMMER MANAGEMENT AT MODEL DAIRY FARM

Due to high ambient temperature, productivity and efficiency of dairy animals goes down drastically during the summer season particularly

in northern parts of India.. This will become more important in case of buffaloes..

Heat stress: This type of stress occurs in animals when there is imbalance between heat production (thermogenesis) within the body (gain) and heat dissipation (thermolysis) from the body i.e. impaired thermoregulation. Increase in environmental temperature may cause increased gain in comparison to heat loss from the body and ultimately cause heat stress. Heat is also produced within the animal body due to metabolism (production of milk, eggs, meat, offspring etc).. This heat stress will affect the high yielders that that of low yielders. Hence utmost considerations must be taken to protect the high yielders from heat stress.

Signs of heat stress:

The common clinical signs of heat stress are restlessness, lethargy, reduced appetite, (to minimize metabolic heat production), increased thirst and more crowding around the water tanks, decreased activity, crowding under shade, usually more animals remain standing rather than lying down, increased respiration, body temperature, sweating and panting to lose more heat. Other common signs are increased salivation, reduction in heart rate and maintenance requirement may increase by 20-30% in animals under heat stress.

Tips for summer management: Animal shelter should be constructed in east west orientation so as to avoid maximum solar radiation during summer.

Nutrition- Offer the high amount of feed during the cooler period of the day such as early morning or late evening. Feeding 60 to 70 percent of the ration between 8 pm and 8 am has successfully increased milk production during hot weather. Feeding bypass protein (fish meal) and bypass fats and reducing the amount of fiber in the diet is helpful in minimizing the metabolic heat production. Soaking of concentrate in equal amount water for 20-30 minutes helps in better utilization of nutrients and reduces dustiness in concentrates. Supplementation buffer sodium bicarbonate and magnesium oxide help to maintain rumen pH in summer season. Feeding of antioxidants like vitamin A D and E, Zinc etc reduce heat stress and prevent mastitis

Water- Always provide unrestricted access to cool, fresh and clean water to dairy animals especially during summer season.

Heat stress alleviation- high producing cows required more attention. There are so many tools to overcome this problem through shades, fans, fog misters and sprinklers are used to alleviate heat stress. High velocity blast fans

mounted on side walls can also help in reducing heat stress during July to September.

Fogger system-Sprinkling water with air draft or wind from fan on heat stress vulnerable animals helps to decrease their body temperature and respiratory activity.

Other Managemental strategies: Avoid transporting livestock in hot weather. Reduce biting flies populations (with improved sanitation, repellents and traps) which tend to cause cattle to bunch together. Reduce parlor walking distance. Reduce time in holding area. Improve ventilation. In areas of extreme heat, it is even more important for cows to give birth in good body condition because after parturition their dry matter intake will be lowered by heat stress, as well as the usual low intake immediately after calving. Under these conditions dairy farmers must go for artificial insemination rather than using natural service of heat stressed bulls. Teat dipping with germicidal dips is recommended. Handling cattle can elevate their body temperature by as much as 3.5°F. Therefore, avoid unnecessary handling of animals during intense heat.

10. WINTER MANAGEMENT AT MODEL DAIRY FARM

Production performance of the animal will also be affected when it is too cool because increased proportion of energy will be consumed in maintaining the body temperature and productivity depends on the ability of the animal to keep normal and stable body temperature.

Protective measures to prevent the effect of cold stress:

Increase barn temperature- Calves are more susceptible for winter. Supply of heat during winter will be helpful in keeping the calf healthy, less chances of calf pneumonia, diarrhea and reducing the calf mortality. Reduce humidity to ensure better ventilation, preventing excessive moisture in sheds, roof dripping and ground freezing phenomenon. Ventilation should be carried in afternoon. Less water should be used in winter barn to wash the ground and dry cleaning should be followed. In the afternoon sunlight cattle should be kept out of the barn. Bedding should also be provided to animals for their protection from the cold floor. Waterers or water tanks should not be frozen. Provide lukewarm water to the animals for drinking purpose. Cold weather increases feed needs of cows. Hay provides more heat during digestion than concentrate feeds.

Cows need dry, draught-free resting area. During winters, provision of dry, clean bedding keeps the animal dry and insulates the udder against cold

temperatures and pathogens. Having dry teats when the cow leaves the parlor is important. One way to lessen the risk is to dip the teats, allow the dip of about 30 seconds and then blot dry using a paper towel. Protect the animal from frostbite. Such practice helpful in mastitis control also.

Effect of cold stress on calves: calves born in winter and early spring as well as wet and cold calves are more prone to cold stress or hypothermia. Precipitation adds to the negative effect on calf survival when temperature drops, so it is important to combat cold stress (hypothermia) in newborn calves.

Signs of cold stress: Rectal temperature is the most accurate method of determining if a calf is experiencing hypothermia.

- Mild hypothermia- Body temperature drops below 100°F; Severe hypothermia- Body temperature drops below 94°F.
- Vital organs are cold and impaired brain function results.
- Calf shivers to increase heat production and shunt blood from body extremities to the body core.

Protective measures: These include warm water bath, warm air or heat lamps and warm blankets. Blankets are most useful for calves less than 3 weeks of age that are not yet eating grain. Warm blankets should not be so hot that they cause skin burns or sweating during the day. Thick, dry straw or sawdust at resting area should be provided for better insulation. Wind drafts must be avoided because they encourage heat loss. Young dairy calves have very little stored fat they can use for warming themselves. So, extra energy by feeding fat rich diet is necessary to cope with cold stress. Additional amount of feed (starter, milk replacer, or milk) that a calf would need to eat to compensate for extra energy used to keep warm during cold weather. Repeated changes in the calf's diet should not be done. Calves less than 3 weeks of age require extra energy, thus increase the amount of milk or milk replacer to provide extra energy. Calves that are eating starter, especially those over 3 weeks of age and can more easily cover their increased energy needs by voluntarily eating more grain is beneficial in terms of generating heat. In cold weather, provision of warm water three times per day for a minimum of 30 minutes each time in order to ensure calves have ample opportunity to drink.

Closing air inlets restricts the ventilation rate and causes moisture to accumulate in the shed. As moisture accumulates, it will begin to condense on cold surfaces, and if the surfaces are below freezing, frost will form. In

severe cold weather and during blizzard conditions, air inlets can be partially closed to reduce airflow blowing into the barn. The minimum inlet opening during severe cold weather is one-half inch for each 10 feet of building width. (There should be an inlet on each long side of the building.). When normal winter weather conditions return, eave inlets should be reopened to the standard one inch per 10 feet of building width on both sides of the building. Of course, eave inlet adjustments are much easier if the inlets have been designed to be adjusted. Boards on hinges are the most common type of adjustable eave inlet.

11. OTHER ROUTINE MANAGEMENT PRACTICES AT MODEL DAIRY FARM

In a dairy farm, the primary objective is to produce the quality milk and sell the same with profit. Therefore, routinely some activities or operations are carried out to meet this primary object.

Weaning- Weaning is defined as the separation of young calves from their mother after birth. In dairy animals, weaning may be followed either just after birth called as weaning at birth or zero day weaning, or after colostrum period i.e. 3-4 days after birth. Weaner calves are fed milk @8-10% of their body weight.

Milking practices- Milking is the most important daily routine activity in dairy farm. Milking is done commonly twice in most dairy farm morning and evening. However, if milk productivity of animal and labour availability is more then go for three times milking per day i.e. early morning, at noon and evening in high yeilders keeping the duration of milking interval equal. Milking should be conducted gently, quietly, quickly, cleanly, completely and at regular intervals.

Feeding- Feeding activity is most important daily routine operation and proper understanding of nutrient requirement and feeding management will reduce the expenses. Dairy animals are generally allowed for free access to roughages but measured amount of concentrate is given based on body weight for maintenance, milk yield, milk fat percent, pregnancy and growth. The roughage and concentrate are generally given separately; during milking only concentrate is given. The daily requirement of dairy cattle and buffaloes are calculated based on daily dry matter intake. Cattle generally eat @2-2.5 kg dry matter per 100 kg body weight. As a thumb rule up to 4-5 liter milk yield no concentrate is needed if sufficient green fodder is available. If a cow giving 10 lit milk with approximately 400 kg body weight then give 20-25 kg greens, 3-4 kg dry fodder and 5 kg concentrate.

Exercise in dairy animals- In conventional housing management where animals are tied throughout the day and night, exercise is compulsory. Exercise should be recommended daily at least once during morning just after milking for ½ to 1 hour.

Washing- Washing in dairy animals is generally followed to remove the dirt and loose hairs before milking for clean milk production. Washing of flank, udder and tail are washed with clean water followed by drying with a clean towel/cloth.

Weighing- Young growing calves are commonly weighed at weekly interval as their growth is much faster than the Adults. However, in adult animal weighing is followed at fortnight intervals or monthly interval depending on the labour availability. Regular weighing of dairy animals is essential for the optimal dairy farm management.

Marking/Identification- Marking of animals soon after birth for easy identification is important managerial practice in dairy farm. In cattle and buffaloes ear tagging is done using either self piercing or non-piercing plastic or non-rousing tags. Under branding, hot iron branding using hot branding iron or cold branding using branding iron dipped in liquid nitrogen is vogue. Now-a-days for easy and automatic identification, electronic identification of animal is done using either electronic ear tag or neck collar.

Debudding and Dehorning- Debudding is the process of removing horn bud in young calves before its attachment to skull within 3-5 days after birth. On the other hand dehorning is the removal of horn after it has attached to the skull in older calves. However, in most dairy farm debudding is practiced instead of dehorning as later is more painful and difficult. *Chemical dehorning-* Dehorning may be practiced by chemical cauterization using caustic soda, caustic potash or Silver nitrate sticks. Debudding may be done mechanically using red hot iron or electrical dehorner pressing on the horn bud. *Electrical dehorning-* Electrical dehorning is best as it requires only 10 minutes and less hazardous compared to chemical or hot iron method.

Grooming- Grooming or brushing of body hair coat is an important daily farm activity, which keeps the body of animals clean and healthy. For grooming blunted type brush is used, if not available then use coarse rope made from paddy straw, coconut coir or dried grass. In India, grooming generally practiced before milking along with washing to improve the clean milk production.

Castration- Castration is the unsexing of both male and female, and during castration there is removal of testis and ovaries, respectively. However,

surgical removal of testes produces pain to the animals. Moreover, castration with burdizzo castrator is most commonly used bloodless castration, where the testicles are not removed rather the spermatic cord is crushed and separated from each testicles.

Burdizzo castration method-Castration is generally preferred at young age preferably within 1 year. Castration should be performed during cold season and strictly avoided in rainy season.

Hoof trimming- Hoof trimming is a routine procedure in dairy farm which corrects the hoof problems or lameness and extent the productive life of cows. The foot trimming in animals practiced at 6 month interval and cut only the extra grown hoof otherwise if excess than causes pain and bleeding.

Record keeping- Record keeping is an important daily farm activity, helpful for the evaluation of individual performance of cow and economic assessment of dairy farm as a whole. Daily farm record data entry is a challenge with rewards. The different types of record maintained in a dairy farm are birth register, body weight register, herd register, production register (milk yield register) death and disposal register, feed and fodder register, breeding register, treatment register, health care register, expenditure and income register, labour records etc.

Calves feeding management: Reticulo-rumen is non-functional in calves and hence feeding of calves should be treated as non-ruminant and they are not equipped to utilize cellulose. The calves cannot utilize roughages containing higher amount of cellulose. To encourage the early development of rumen and reticulum the calves should be fed with good quality leguminous hay and other roughages. Urea should not be included in calves ration because the calves have little capacity to utilize non-protein nitrogenous compounds. B complex vitamins also are dietary essential for calves in addition to vitamin A and D.

12. REPRODUCTION MANAGEMENT AT FARM

A sound reproductive program is essential to the financial health of the dairy. A fundamental goal should be to breed cows back in a timely manner so that daily milk production remains high and a steady supply of new heifers is available for replacements or sale. It is not advisable to use artificial hormones for breeding or to treat the animals with reproductive problems. Good dairy farm should follow the measures that pertaining to heat cycle detection and natural alternative treatments that will help to increase the fertility of the farm.

Best practices for improvement of dairy farm:

Observation of standing heat is the best way to judge the time to inseminate or breed a dairy animal. Some farms may use some heat detection devices or other physical methods but nothing beats observing the animals for heats twice daily.

Observation of standing heat: Animal bellow, stand to be mounted, discharge through vulva, thickening of vulval lips are major signs of heat. Cows ovulate about 12 to 16 hours after a standing heat so most of the farmers have a habit of “Morning- Evening” rule for breeding. If a farmer observes a cow in standing heat in the morning, he/she will breed her that evening; if a cow is observed in standing heat in the evening, she/he will be bred in the morning.

Reproductive problem and its solution-There are so many reproductive problems at a farm among these are major like silent heat, anoestrous, repeat breeding, utero-vaginal prolapse, subclinical endometritis, retention of placenta, abortion and dystocia etc.

13. CLEAN MILK PRODUCTION AT FARM

Clean milk production following good hygienic practices is an essential pre requisite for obtaining whole some and superior milk quality. Clean milk may be defined as “Milk drawn from the udder of healthy animals, which is collected in clean dry milking pails and free from extraneous matters like dust, dirt, flies, hay, manure etc. Clean milk has a normal composition, possesses a natural milk flavor with low bacterial count and is safe for human consumption”. There are many advantages of clean production like prevention of milk spoilage in short period. Increase the quality and shelf life of the milk and its products. It controls the spread of infectious disease through milk.

Steps for clean milk production:

1. **Animal shed and environment:** The floor of the milk shed should be swept with clean water, and disinfected with one-percent bleaching powder solution to arrest cross contamination and spreading of undesirable odours.
2. **Animal:** The animal itself is one of the most significant sources of contamination, care and management of the animal and its health is therefore the starting point for clean milk production. Milk from diseased animals should be kept separate and disposed of safely. Animals suffering from any contagious disease, including mastitis,

should be segregated from the healthy ones.

3. **Milking method:** In hand milking, the danger of contamination coming from the milker's hand is higher as compared with machine milking. The milker should therefore be free from contagious diseases. Nails should be well trimmed; she/he should wear clean clothes and should wash her/his hands with soap and water before milking, then dry with a clean towel. In modern dairy farms, the milking is done with the help of milking machine in very hygienic way without hand touch. The operation of milking is very fast and the quality of milk also superior.
4. **Utensil cleaning:** Utensil must be thoroughly cleaned with water followed by hot water rinsing. Dirty milking equipment is one of the main sources of infection of milk. About 15 minutes before milking, milking equipment should be rinsed with a sanitizing solution.
5. **Personnel hygiene:** The Milk handlers need to wash their hands thoroughly with cleaned water followed by hot water rinsing or sanitization with sanitizing agent to avoid physical and biological contamination.
6. **Milk handling and testing:** Milk needs to be handled hygienically without spillages, while transferring. Milk needs to be filtered in order to be free of dust and foreign particles. All the filled milk cans are to be kept in organized way in very clean and hygienic way in a shade without direct exposure to Sunlight. The milk is susceptible to get deteriorated and develop oxidized flavours, if kept exposed to direct sunlight. The milk samples to be drawn using an appropriate and cleaned sample device as per the quality control guidelines.
7. **Transportation of milk:** The Milk cans to be transported in a covered/protected hygienic milk vans.

14. MANAGEMENT AND UTILIZATION OF DAIRY FARM WASTE

Animal manure is rich in nitrogen, phosphorus and potassium. Manure has several beneficial effects on soil properties, in addition to providing supplemental nutrients for crop growth. Composting is a sustainable waste farm management practice that converts a large volume of accumulated organic waste into a usable product. When organic wastes are broken down by microorganisms in a heat-generating process, waste

volume is reduced by almost 50%, many pathogens and weed seeds are destroyed, and a useful, potentially marketable product is produced. Major component of dairy farm waste are cattle manure, spoiled hay and feed, bedding of animal etc. There are various techniques used like composting, biogas production (anaerobic fermentation), aerobic oxidation in ditches/Lagoons/lakes, direct application in field. Use as fish feed in fish ponds and growing algae (diluted slurry) at a farm.

Composting: In composting pile of solid waste is collected in pit 1.5 m deep and 3×4 meter dimension or large as per requirement (3 cubic meter/adult animal units) as per (Allnutt design described by R.G. Linton). This design has two pits with walls on all three sides covered on top with temporary roof to prevent desiccation, and alternative filling and emptying has been suggested. The front side should have a gutter which should be filled with cresol and water to control fly breeding and the front side should have a vertical sliding shutter to prevent debris falling into the gutter. The manure should be dumped and well packed in each compartment separately. While one is filled and packed, fermentation and decomposition occurs in the other which was filled earlier. The manure should be turned periodically to ensure uniform decomposition; this also enhances the destruction of larvae of parasites that are normally present in the dung. During composting frequent mixing of waste is required. The manure from other livestock farms like sheep, goat, pig and poultry can be decomposed in the similar manner. After piling within 24 hours temperature rises to 50°C and within 3-8 days it reaches to 70°C. Thereafter it falls to 50°C. C: N ratio and moisture are important in this process.

Biogas Production (Anaerobic fermentation): In this process organic matter is converted into volatile fatty acids which is in turn by the action of anaerobic bacteria (methanogenic bacteria) is converted to CH₄ and CO₂. The slurry is valuable product for using in fields.

Aerobic Oxidation: Slurry can be disposed by keeping it in shallow ditches, lagoon, and lakes. BOD (Biological oxygen demand) per acre is generally 20 for proper oxidation. Large areas are required and periodically solid sludge has to be removed. Upper water is used for irrigation after mixing with fresh water or directly also.

Liquid Form by Means of Lagoon: Lagoon is a body of water like a small pond where in liquid manure is discharged and digested by bacterial action. In this method fertility value of manure is wasted but helps in saving of equipment and labor which may compensate the loss. Pens are scraped and washed daily with water under pressure 75 lbs./sq" inch and 500 gallons

water per hour. This is run into lagoon which should hold at least one week accumulation of manure @ 20 kg/cow/day.

15. VACCINE AND VACCINATION PRACTICES

1. ***Vaccine purchase-*** Consultation with veterinarian before purchasing vaccine is helpful in determining the vaccine required in dairy farm. Check expiration dates, cold chain of the vaccine at the time of purchase or receiving the vaccine. Purchase vaccine in small-dose vials to minimize wastage.
2. ***Storage of vaccination-*** Read and follow label instructions. Discard any vaccine that freezes or expired. Store vaccine that will expire first near the front of the refrigerator and use it first. Do not overstock vaccine and most important is train employees, family members and others on proper vaccine handling.
3. ***Handling of vaccine at field level-*** Pre-cool the cooler for at least 1 hour prior to placing the vaccine inside. Use enough ice or cold packs to maintain a steady temperature, 35-45°F. Take enough vaccine for the morning or for afternoon, not for both. Keep the cooler out of sunlight. Identify any leftover unopened bottles of vaccine and use them first the next time. Do not use the same vaccine gun for different vaccines. Do not mix modified live vaccines if won't be able to use them within 1-2 hours reconstituting them. Discard bottle of killed vaccines that have been opened for more than 2 days because vaccine can be contaminated by repeated introduction of air and needles.
4. ***Injection of vaccine-*** Give injections in front of the shoulder in the middle neck region. Avoid giving injections in the nuchal ligament of the neck region. Remove air from syringes or guns prior to injecting vaccine. Use the correct gauge and length of needle as specified by the label. Change needles every time before filling the syringe or vaccine gun. Change needles that become blurred, bent, or broken. Never straighten and reuse a broken needle. Space multiple injections 4 inches apart on the animal to avoid mixing different products. Use a new needle each time syringes are filled.
5. ***Disposal of vaccine-*** Follow if any disposable instructions provided on the label. Do not place the unused vaccines on water sources. Unused or empty vaccine container should be banned either through burn barrels or incinerators.

Vaccine schedule- Follow the standard vaccination schedule for dairy animals as provided by local animal husbandry department at your places.

Table 2: Vaccination schedules for cattle and buffaloes

Sr. No	Name of Disease	Age at first dose	Booster dose	Subsequent dose
1	Foot and Mouth Disease (FMD)	4 months and above	1 month after first dose	Six monthly
2	Haemorrhagic Septicaemia (HS)	4 months and above	-	biannually in endemic areas.
3	Black Quarter (BQ)	4 months and above	-	Annually in endemic areas.
4	Brucellosis	4-8 months of age(Only in female calves)	-	Once in a lifetime
5	Theileriosis	3 months of age and above	-	Once in a lifetime. Only required for crossbred and exotic cattle.
6	Anthrax	4 months and above	-	Annually in endemic areas.
7	IBR	3 months and above	1 month after first dose	Six monthly (vaccine presently not produced in India)
8	Rabies (Post bite)	Immediately therapy only)	4th day after suspected bite.	7, 14, 28 and 90 (optional) days after first dose.

Deworming schedule for dairy animals- Regular deworming of animals is required in dairy farm. The various worms like trematodes, cestodes and nematodes are common in dairy animals under the field conditions. Therefore, follow the below mentioned schedule:

For Round worms (nematodes): First dose at 10 days of age and thereafter at monthly interval up to 6 months. Thrice a year in animals above 6 months of age

For Liver Flukes (trematodes): Twice a year in prevalent area (before and after monsoon)

For Tape worms (cestodes): Twice a year (January and June in prevalent herds)

16. CALF REARING SYSTEM:

Calf rearing section is very important nursery at dairy farm. Calf rearing system varies with the facilities available at dairy farm. They may be reared indoors or outdoors or semi-intensive system. In humid tropics, it may be desirable to keep the calves indoor in day time and outdoor at night. This will reduce parasitic infection also. Thus, it is advantageous to keep new born calf in individual pen for the first 3-4 weeks of age. Calves that are running in batches often suckle or lick each other after feeding and it is a good practice to keep them in their pens for some time after milk feeding. Hair swallowed by the calves after suckling each other often forms a hard ball in the abomasum and this is a constant cause of digestive disturbances and death. Cleaning the mouth of the calves after each milk feeding is a sanitary practice. The calf pens should provide comfort and easy cleaning.

Management practice up to six months age of calves:

Clean nostrils and mouth of calf after birth, which helps the calf to breathe better and help in preventing the future breathing problems. Allow the mother to lick the calf clean which promotes circulation within the calf's body and prepares the calf to stand up and walk. Tie the naval cord with a thread at a distance of around 2 inches from the base and cut the remaining cord with a clean instrument. Dip the navel (a simple smearing will not serve the purpose) in 7% or higher tincture of iodine solution and repeat after 12 hours. (Do not use teat dip or weaker iodine solutions). A poorly maintained navel is the gateway to *E. coli* and other pathogens particularly causing navel ill or joint ill.

Scientific principle and management of new-born calf:

A new born calf should be given 2 litres of colostrum within the first 2 hours of birth and 1-2 litres (based on size) within 12 hours of birth. Many calves do not nurse adequate amounts of colostrum from their dams within the first few hours of life, and thus they may not receive adequate immunity. Feeding colostrum after 24 hours of birth may not help the calf to ward off infections. A calf must receive adequate colostrum to protect it from diseases for the first three months of its life. Colostrum is the calf's "passport to life". Hand-feeding new-born calves are therefore recommended so that the farmer is sure about the amount of colostrum an individual calf receives. Provide fresh, clean water all times, particularly when milk feeding is induced discontinued. If muconium (first faecal matter) is not voided out, mild enema by dissolving soap in a litre of warm water should be given.

1. **Weaning:** If weaning at birth is followed, care should be taken to see that adequate colostrum is fed for the first 3-4 days. If weaning is practised 4 days after calving, then further ration has to be fed as per the schedule described.
2. **Health management:** De-worming should be done within 10-14 days of age subsequently on a monthly basis upto the 6 month. When the animal is 3 months old, consult the veterinarian for vaccination.
3. **Calf pen-** Calf pen should be close to cow shed. Pen should provide sunlight; good ventilation floor should not be slippery. After 6-8 weeks, calves may be grouped according to age, sex etc. The feed boxes and watering equipment should be provided in the pen.
4. **Identification mark-** Giving of identification mark which is necessary for keeping proper records, proper feeding, better care and management. There are following methods as given below:
 1. **Branding:** brandings are mainly two types as Cold Branding and Hot Iron Branding. There is uses a metal instrument to burn or freeze a mark on the animal's hide.
 2. **Ear Tagging:** Use special pliers to attach pieces with numbers on them and easy to read from the front view in herd.
 3. **Tattooing:** Uses a special tool to put inked numbers in an animal's skin. This is Permanent, Simple and relatively painless. But hard to read from a distance.
5. **Dehorning the calves-** Dehorning or disbudding: Disbudding is carried out either by the use of hot iron, caustic sticks and electrical dehorning cone. Both the buds are destroyed at the early age (within 3 to 10 days).
6. **Castration-** Castration of bull calf: At age of 2-3 months, bull calves should be castrated suitably. Bloodless method of castration are Burdizzo, Elastrator, Calicrate bander, Short-scrotummed, Chemical castration.
 - a. **Burdizzo method of castration-** Restrain the animal, Do one at a time, Push testes down into scrotum and over to the side. Place the lips of the instrument over the cord 1/2 the distance between the testes and abdomen. Push handles together until the cord is crushed.

- b. Elastrator method of castration:* Restrain the animal, Place the rubber band over the prongs, Spread the rubber band and push both testes down through it, Release the band above the testes, Check later for the scrotum to fall off and disinfect.
 - c. Invasive method of castration :* Restrain the animal, Examine the calf to see if testes have descended in to the scrotum, Disinfect equipment, hands, and scrotum, Grab the end of the scrotum with one hand and pull down. Cut off the lower 1/3 of the scrotum, Pull testicles down one at a time / scrape if necessary. Trim excess fat and membrane carefully, Disinfect the area again, Incision method is performed much the same way, but make an incision on each side of the scrotum first, then pull down each testicle through the incision.
7. **Record keeping:** Add record keeping of newborn care, when calf was moved from calving area, navel dipped, fed colostrum, which provided care.

17. GREEN FODDER PRODUCTION

Production of fodder plays a major role in feed of milch animals, thereby providing required nutrients for milk production and health of the dairy animals. Green fodder production provides the better option of feed buying alternative for farmers who are planning to go for dairy farming. It provides best way of nutrients for animals and has beneficial effects on their growth and health. It also reduces the cost of animal feeding. The green fodder can be utilized for making the silage. Most of the fodder varieties are perennial, thus can get more fodder cultivation for each year. Cultivation and maintenance cost is low compared to other feed ingredients. According to various agro-climatic zones there are so many cropping system in our country. Therefore, we need area specific fodder crop rotation.

18. ENTREPRENEURSHIP

Entrepreneurship is major part of any business because farmers can produce but cannot sale their produce properly. Therefore, the focus on marketing the produce is very important Dairy farmers must have knowledge about the dairy project reports, availability of bank loan, insurance facilities of animals and marketing management etc. Above all he/she should have idea about the retail marketing of milk and its products after value addition.

Cattle Insurance

It can be applicable to indigenous, cross breed and exotic cattle owned by/ belonging to private owners or financed by the various financial institutions i.e. bank-, military dairy farms, Co-operative/Corporate dairies etc. Cattle means and Include - Milch cows and Buffaloes, Calves/Heifers, Stud Bulls, Bullocks/He buffaloes and Mithuns.

Age Group

- a) Milch cows 2 years or age at first calving to 10 years
- b) Milch Buffaloes 3 years or age at first calving to 12 years
- c) Stud bulls 3 years or earlier age at sexual maturity to 8 years
- d) Bullocks/He buffaloes 3 years to 12 years
- e) Calves/Heifers 4 months upto date of 1st calving

(No relaxation in upper age-limits is allowed)

Valuation- Valuation based on market value as on date and place and to be decided on the basis of recommendations of the local veterinary surgeon.

Scope of Cover-The policy shall give indemnity only for death of cattle due to:

- 1) Accident (inclusive of fire lighting, flood/inundation, cyclones, tornado, tempest, storm, hurricane, famine) or any other fortuitous circumstances (Fortuitous means accidental in origin).
- 2) Diseases (Inclusive of Rinderpest, Black Quarter Haemorrhagic Septicemia, Foot and mouth disease subject to vaccination against these diseases).
- 3) Surgical operations.
- 4) Strike, Riot and Civil Commotion risk & Terrorism
- 5) Earthquake

Exclusion

- 1. Theft or clandestine sale, missing of insured animal.
- 2. Malicious or willful injury or neglect/ intentional slaughter.
- 3. Transport by air or sea or beyond 80 km by rail or road.
- 4. Partial disablement of any type, whether permanent or temporary.

5. Accident happened/Diseases contracted prior to commencement of risk.
6. War & allied perils.

Points to be noted: *15 days waiting period*- The company is not liable to pay the claim in the event of death of insured animal due to diseases occurring within 15 days from the commencement of risk. *No tag no Claim*- In the event of death of animals covered under the policy, claims shall not be entertained unless the ear tags are surrendered to the company. In the event of loss of ear tags, it is the responsibility of the insured to give immediate notice to the company and get the animal retagged. *Service tax*- Exempted for IRDP Scheme policies but time to time may change.

19. MARKETING

Marketing: Marketing of dairy products is not a problem in India. There is huge demand of these products throughout the year in India. One can easily find the suitable market for selling these products in almost every places of the country. The activities involved in transporting products from producers to consumers includes product exchange, physical and auxiliary activities. These activities can be further divided into buying and selling as exchange activities; storage, transport, processing and standardizing as physical activities; and financing, risk-bearing and market intelligence as auxiliary activities.

Marketing chain: The flow of commodities from producers to consumers that brings in economic agents, who perform complementary functions with the aim of satisfying both producers and consumers.

Marketing node: Any point in the marketing chain where an exchange and/or transformation of a dairy product takes place. A marketing chain may link both formal and informal market agents.

Marketing agents: Individuals, groups of individuals or organizations that facilitate the flow of dairy products from producers to consumers through various activities, such as production, purchasing, processing and selling. Examples of market agents include farmers selling dairy products, retailers, wholesalers, dairy cooperatives, importers and exporters.

Milk producers: Rural subsistence farmers, rural market-oriented farmers, commercial dairy farmers and urban and periurban milk producers.

Emerging Dairy markets

Food service institutional market – It is growing at double the rate of consumer market.

Defence market – An important growing market for quality products at reasonable prices.

Ingredients market – A boom is forecast in the market of dairy products used as raw material in pharmaceutical and allied industries

Parlour market – The increasing away-from-home consumption trend opens new vistas for ready-to-serve dairy products which would ride take credit on the fast food revolution sweeping the urban India

Challenges for marketing of milk

- Majority of the market is still unorganized
- Acceptability of the consumer base
- Less penetration to the rural market
- Lack of transparent milk pricing system

Solution to overcome the challenges for dairy marketing

1. **Dairy cooperatives:** One of the most successful producer organizations is the Indian dairy cooperative, which was started in 2005 and has had a network of more than 100,000 village level dairy cooperatives with 12.3 million members. National Dairy Development Board (NDDB) covers 1,40,227 village level societies and 14 million farm families of which 4 million are women. It has a daily procurement of 22 million litres of milk. With the contribution of Amul Pattern of dairy cooperatives, India has progressed from a milk-deficit country to the largest milk-producing country, globally. In this model, millions of days of employment have been generated for the rural poor and this further improved their socio-economic conditions.
2. **Contract farming:** Contract farming has a potential to help the small and marginal farmers overcome constraints in accessing inputs, credit, extension and marketing. The problem of the higher cost of contracting with small producers is overcome by contracting with a single person in the village often an agent who acts as an intermediary between the processor and producers. The country's dairy sector is dominated by small holders, and contracting with a

large number of them involves transaction costs for the processors. The processors do not have much choice but to take milk from smallholder producers.

3. **Self Help groups and group approach:** The women's self help group (SHG) movement particularly SHG-bank linkage programme has spread all over the country. These programme's interventions and processes have resulted in a sustained process of women member's empowerment. The real power of the SHG-bank linkage model (SBL model) lies in the economies of scale created by Self Help Group (SHG) Federations (comprising 150-200 SHGs each). This is evident, for example, in bulk purchase of inputs (seeds, fertilisers etc.) and marketing of outputs (crops, vegetables, milk, NTFPs etc). Government of India has now started National Rural Livelihoods Mission (NRLM) in 2011. There is a clear understanding that the SBL programme can only be successful if it is tied up with livelihood programmes such as improved agriculture, dairying, marketing etc.
4. **Retail Milk Market:** The retail milk market in India is mostly unorganized. There is no supply chain management perspective. An overwhelming proportion of the Rs 4,00,000 crore retail market is unorganized. In fact, only a Rs. 20,000 crore segment of the market is organized. **Retailers:** Milk shops, peri-urban farmers, rural subsistence and market-oriented farmers and retail shops. **Unorganized milk retail chain:** Milk producers directly supply milk to the consumer or through a marketing channel. Milk producers supply milk to the consumers through the intermediaries like middle men. **Organized milk retail chain:** Milk producers supply their milk to primary cooperative society, which further supplies to secondary cooperative. The milk after processing, reaches consumers via marketing channel either directly or through apex cooperative. Industry based milk retailing opportunities are also available in our country and growing at faster rate.

Conclusion: Hence farmer choose organized milk retail or industry based retailing chain for improving their status as well as Indian economy

19. VALUE ADDED MILK PRODUCT:

Value added dairy products: Dairy farmers can add value to their milk by processing and marketing their own products, such as cheeses, yogurt,

butter, ice cream, and flavoured milk. Many consumers are willing to pay a premium for locally produced, high-quality and farmstead dairy products. India's demand for milk and its value added products is increasing twice as fast as the production of milk. The market is also witnessing a consumer shift towards healthier products such as UHT milk, probiotic drinks, processed cheese, curd, butter, milk and ghee etc.

Classification of Indian traditional dairy products:

1. Heat and acid coagulated milk products: *Paneer* is an unaged, acid-set, non-melting farmer cheese made by curdling heated milk with lemon juice or other non-rennet food acid, and then removing the whey by pressing result into a dry unit. *Chhena* is like paneer, except some whey is left and the mixture is beaten thoroughly until it becomes soft, of smooth consistency and soft but firm *Sandesh* is a confection made from chhena mixed with sugar then grilled lightly to caramelize, but removed from heat and molded into a ball or some other shape. *Rasagolla* is confection made from mixture of chhena and semolina rolled into a ball and boiled in sugar syrup.

2. Fat rich dairy product: *Ghee* - Ghee is prepared by simmering butter, which is churned from cream (traditionally made by churning yogurt), skimming any impurities from the surface, and then pouring and retaining the clear, still liquid fat, while discarding the solid residue that settled on the bottom. *Malai* - It is made by heating non-homogenized whole milk to about 80°C (180°F) for about one hour and then allowing to cool. A thick yellowish layer of fat and coagulated proteins forms on the surface, which is skimmed off. The process is usually repeated to remove most of the fat.

3. Cultured dairy products: Yogurt and Dahi are dairy foods that are used and consumed widely. A notable difference between these two is that yogurt is prepared by pasteurizing milk, whereas Dahi is prepared by boiling milk, then cooling it to room temperature, and finally adding the previous day's mild acidic curd to it. Mishti doi is dahi (Indian Yogurt) mixed with sugar. Shrikhand is strained yogurt mixed with sugar, and often flavourings such as cardamom, saffron, or fruit.

4. Heat desiccated products: Kulfi is made from slowly freezing sweetened condensed milk. In comparison to ice Cream, kulfi is not whipped or otherwise aerated. Khoa or Mawa is made by reducing milk in an open pan over heat. Rabri is a sweet, condensed-milk-based dish made by boiling the milk on low heat for a long time until it becomes dense and changes its color to pinkish. Sugar, spices and nuts are added to it for giving it flavor. It is chilled and served as dessert. Basundi is a sweetened condensed milk

made by boiling milk on low heat until the milk is reduced by half.

FIRST AID FACILITIES AT MODEL DAIRY FARM:

First aid: First aid includes any emergency care given to an injured or ill patient before medical assistance arrives. Due to the often hazardous nature of farming and isolation, all the people working on the farm should be trained in basic first aid.

Basic supplies: Basic supplies to this first hand kit include: adhesive medical tape, antibiotic ointment, antiseptic solution, gauze in assorted sizes, bandages including elastic wraps, cotton balls, instant cold packs, duct tape, plastic bags for disposal of contaminated items, sterile eye wash, thermometer, scissors (for cutting bandages or clothing), tweezers, soap or instant hand sanitizer, latex gloves and a first-aid manual.

Emergency contacts: A card inside an emergency kit should include numbers for an ambulance, hospital or fire department and have written directions on how to get back to the farmstead, field or work area. Numbers for poison control and emergency road service should also be included.

Additional safety measures: Check the farm safety kits every three months to make sure supplies are not expired and that they fit the current season. Safety kits are important tools to have on the farm, but additional training could also be beneficial in responding to emergencies. Consider getting training in first aid or other important topics to assist when first responders can't be on the scene immediately.

Individual needs: Make sure the kit includes personal medications and medical information for those who require special attention. Drugs to treat allergic reactions and any other personal medications that don't require refrigeration should be included. The name and a phone number of the family doctor should also be included.

20. TOP TEN DAIRY COMPANIES IN INDIA

- 1) **Amul Industries Pvt Ltd:** Amul Industries Pvt Ltd was founded in the year 1946 and its headquarter is located in Anand, Gujarat, India. It is one of the top dairy companies in India. It is offering a product range includes paneer, butter, cheese, ghee, ice-cream, chocolate, milk powders etc. The leading dairy company is managed by the co-operative body, the Gujarat Co-operative Milk Marketing Federation Ltd. It is one of the leading food brands in India. Amul apart from being Asia's largest milk brand is a vehicle for economic

and social development through which farmers manage their own resources. Amul is also developing wide range of products to meet future demand, including calcium fortified milk, flavored yoghurt, frozen yoghurt, sugar free ice-cream and pro-biotic products.

- 2) **Andhra Pradesh Dairy Development Cooperative Federation Limited:** Andhra Pradesh Dairy Development Cooperative Federation Ltd is one of the leading dairy companies in India. It is offering a wide range of products prepared from milk. Its product range includes curd, butter milk, ghee, paneer, doodh peda, and butter. The leading dairy company is also growing product range to meet the changing customer needs. It has the huge share in the daily use of dairy products.
- 3) **Karnataka Co-operative Milk Federation:** Karnataka Co-operative Milk Federation is one of the top dairy companies in India. It is offering a range of products like paneer, curds, pedha and milk. The entire system works through the chain of farmers. The company has reached into even rural areas of Karnataka. It is known for its quality products that it distributes into even remote areas.
- 4) **Kwality Ltd:** The company was started in the year 1992 as Kwality Dairy. It is one of top private sector dairy companies in India. It is offering a range of innovative products and currently enjoy the huge presence in Northern India. It has the manufacturing unit in leading Indian states. It is committed to fulfilling all quality standards. It is one of the top companies in the Institutional segment.
- 5) **Mehsana District Co-operative Milk Producers Union Ltd (Dudhsagar Dairy):** The company was founded in the year 1963 with headquarter in located in Gujrat. It is one of the top dairies in Asia. It is the member of state level Gujarat Co-operative Milk Marketing Federation.
- 6) **Mother Dairy Fruit and Vegetable Pvt Ltd:** Mother Dairy Fruit & Vegetable Pvt Ltd was founded in the year 1974 with its headquarter in Noida, Uttar Pradesh. It is offering the wide range of products including ice-cream, ghee, paneer, pickles and many other products under the one umbrella brand Mother Dairy Fruit & Vegetable Pvt Ltd. In starting phase, the company was mainly focused on Delhi and NCR. Later on, it has spread its business into other cities.

- 7) **Schreiber Dynamix Dairies Pvt Ltd:** Schreiber Dynamix Dairies Pvt Ltd was started in the year 1945. It is headquartered in Green Bay. It is producing cream cheese, yogurt, process cheese.
- 8) **Tamilnadu Co-operative Milk Producers Federation Ltd:** It is one of the top dairy companies in India, currently located in Tamil Nadu.
- 9) **The Kerala Cooperative Milk Marketing Federation Ltd (Milma):** The company was founded in the year 1980 and headquartered in Thiruvananthapuram. The company product range includes milk products and cattle feeds.
- 10) **The Orissa State Cooperative Milk Producers Federation Ltd:** The Orissa State Cooperative Milk Producers Federation Ltd was founded in the year 1985. Company's product range includes milk & milk products, horticulture products, kandhamal organic products, cattle feed. Its headquarter is located in Bhubaneswar, Orissa.

Table 3: Largest milk producers in India:

S. No.	Dairy Industry	Production ('000 liters per day)
1	AMUL	2500
2	OMFED, Odisha	1950
3	AP Dairy Development Cooperative Federation Ltd	1500
4	Haryana Dairy Development Cooperative Federation Ltd	1450
5	Dynamix Dairy Industries Ltd., Maharastra	1000
6	Mother Dairy, Delhi	1000
7	Vasundhara Dairy, Nagpur	1000
8	Dudhsagar Dairy, Gujarat	950
9	Hatsun Agro, Chennai	800

Farmer / Entrepreneur

Some other private dairy industries are:

- Kwaliti Dairy Ltd.
- Amrut Industries Ltd.

- Anmol Dairy Ltd
- Britannia Industries Ltd
- G R B Dairy Foods Pvt Ltd
- Haryana Milk Foods Ltd
- Indian Dairy Specialities Ltd
- Industrial Progressive (India) Ltd
- Mahaan Foods Ltd
- Milkfood Ltd
- Nikumbh Dairy Products Ltd
- Ashmi Milk

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BEE KEEPING AND ITS PROMOTION FOR ENTREPRENEURSHIP

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1. INTRODUCTION

The human being knows usefulness of beekeeping since time immemorial by the introduction and establishment of Italian honey bees (*Apis mellifera. L.*) during 1960's. It has gained momentum for commercial beekeeping in north western states of the country. Honey bees are main flower visitor of crops and useful in cross pollinated crops. They collect nectar from flowers for the production of honey. They also collect pollen from the flowers for protein, where as some nectar serves as carbohydrate source to honey bees and their brood. Apart from collecting pollen and nectar bees also render crops pollination services. Thus play a vital role in enhancing the productivity of vegetables, fruit, plantation and field crops to the extent of 20-25 percent. According to FAO, 2010, Honeybees are mainly known for the production of honey, which is unparalleled natural product both medically and nutritionally.

Though, its composition is well known, it has not been synthesized in any part of the world. Honey composed of vital minerals like potassium, iron, copper, manganese, phosphorus, protein, vitamins enzyme and natural sugars were absorbed and assimilated directly into blood streams. Honey has got count less medicinal use in Indian homes. It is a good laxative, a blood purifier and an antiseptic and has been extensively used in 'Ayurvedic' and Unani system of medicines for the cure of various ailments. It is used as a preventive measure against cold, cough, fever and curative for sore eyes, ulcers, sore throat and burns. The wax is extensively used in candles,

cosmetic and pharmaceutical is also a bee product. Apart from these, beekeeping is also important for the production of royal jelly, venom, propolis and pollen.

In India beekeeping has been mainly forest based. Several natural plant species provide nectar and pollen to honey bees. Thus, the raw material for production of honey is available free from nature. Bee hives neither demand additional land space nor do they compete with agriculture or animal husbandry for any input. The beekeeper needs only to spare a few hours in a week to look after his bee colonies. Beekeeping is therefore ideally suited to him as a part-time occupation. Beekeeping constitutes a resource of sustainable income generation to the rural and tribal farmers. It provides them valuable nutrition in the form of honey, protein rich pollen and brood. Bee products also constitute important ingredients of folk and traditional medicine. The establishment of Khadi and Village Industries Commission to revitalize the traditional village industries hastened the development of beekeeping. During the 1980s, an estimated one million bee hives had been functioning under various schemes of the Khadi and Village Industries Commission. Production of apiary honey in the country reached 10,000 tons, valued at about 300 million rupees.

The major regions of honey production are the forests and farms along the sub-Himalayan tracts and adjacent foothills, tropical forest and cultivated vegetation in Rajasthan, Uttar Pradesh, Madhya Pradesh, Maharashtra and Eastern Ghats in Orissa and Andhra Pradesh.

Macro benefits of Beekeeping include:

- Excellent source of employment for the rural unemployed: currently an approximate of 250,000 farmers in India are employed through beekeeping.
- Provides an excellent source of income for the landless farmers: since beekeeping is migratory in nature, even the landless farmers can take up this profession.
- No farm land is wasted as apiaries are kept on the boundaries and non-cultivable land.

2. BEE KEEPING IN AGRICULTURE AND RURAL DEVELOPMENT

Production of honey has been the major aim of the industry. Modern beekeeping also includes production of beeswax, bee collected pollen, bee venom, royal jelly, propolis, as also of package bees, queen bees and nucleus colonies. All these are possible only with a proper management of bees,

utilizing the local plant resources and adapting to the local climatic conditions. Modern beekeeping makes heavy use of beekeeping equipment and honey processing plant. This results in high efficiency and also ensures the quality of the processed honey. Seasonal management of bee colonies varies in different parts of the country although the basic management methods are the same. Flow management, dearth management, provision of feeding, control and cure of bee disorders, bee diseases, pests and enemies, are some of the routine measures to keep bee colonies healthy and strong. There are special management techniques like queen rearing, migration for honey production or for colony multiplication, which the beekeeper takes up after he gains sufficient knowledge and experience in handling bee colonies.

Benefits brought about by beekeeping

- Beekeeping is of vital importance in rebuilding and kick starting rural economic activity, especially that of women and youth. An enhanced economic activity would address socio-economic problems such as HIV/Aids, unemployment and poverty.
- In beekeeping, a diverse range of by-products is produced apart from the main product-honey. These are beeswax, propolis, royal jelly and bee venom. These products are not only rich in carbohydrates, proteins and vitamins, but also have medicinal (healing) properties.
- In arable farming, bees are also known to improve crop yields through increased efficiency in pollination.
- Beekeeping diversifies agriculture as it can be integrated with other agricultural activities like arable and pastoral farming, as well as agro forestry. Furthermore, bees do not compete for resources with other agricultural enterprises. Bees obtain their food from the wild, cultivated and wasteland areas.

3. BEEKEEPING AS A SOURCE OF INCOME GENERATION

Specializing in Selling Local Honey, Beeswax, Lip Balm, Candles, Pollen, Pollination Service, Swarm Catching, etc. For many of us making some extra money on a regular basis can make a big difference in our everyday lives. Aside from simply enjoying the benefits of having your own honey supply, there are a number of ways to make money by keeping honey bees.

Creation of employment

Selling your excess honey from your home or at small local stores. You can get a higher price than what it is sold for in your nearby supermarket because it is locally produced honey. Many people believe that eating local honey is very helpful to reducing the negative effects of allergies as it has minute particles of pollen in it from flowers in the area.

Excess beeswax can be used to make candles. Package them attractively wrapped by the pair with an attractive ribbon. These can be sold to friends and neighbors or through a local store. Recipes are available on the internet for making your own lip balm using beeswax and a couple of other easily obtainable ingredients. You can melt beeswax and make small bars of pure beeswax. Some people just like the feel and smell of the beeswax but it also can be used as a lubricant for the bottom rails of bureau drawers. You can buy small molds and use these to make any number of beeswax knickknacks. One can make a number of beeswax animals, etc., to sell.

Some folks collect pollen from the bees to sell in jars as a health food. The equipment to do this is available at any number of beekeeping equipment supply companies. Another big opportunity, if you are so inclined is to make yourself available to deal with swarms of bees. Collect a healthy swarm and bring it home to start a new beehive relatively free of cost. Packages of honey bees used to start new bee hives are sold by beekeeping supply companies for about \$65 per a three pound box. Removing bees from inside house walls or ceilings affords a great opportunity to add one's income as a beekeeper. There is also the opportunity presented by raising, packaging and selling Queen Bees.

Advantages of beekeeping as an income generation activity

- Bee keeping requires less time, money and infrastructure investments
- Honey and beeswax can be produced from an area of little agricultural value
- The Honey bee does not compete for resources with any other agricultural enterprise.
- Beekeeping has positive ecological consequences. Bees play an important role in the pollination of many flowering plants, thus increasing the yield of certain crops such as sunflower and various fruits.

- Honey is a delicious and highly nutritious food. By the traditional method of honey hunting many wild colonies of bees are destroyed. This can be prevented by raising bees in boxes and producing honey at home.
- Beekeeping can be initiated by individuals or groups
- The market potential for honey and wax is high

4. PRODUCTION PROCESS

Honey bees can be raised in boxes at the farm or home.

Equipment requirements for bee keeping

Bee Hive: Various types of bee hives are available for beekeeping. They are wooden boxes having two parts. Upper $\frac{1}{4}$ comb chamber and lower $\frac{3}{4}$ brood chamber. The following two types of bee hives are more popular in India

- Ghos box = 36 cm X 21.5 cm
- Newton box = 20.2 cm X 14.0 cm

Some other familiar boxes are as follows

- Langstroth box (American hive)= 42.2 cm X 31.1 cm
- Pant, Kanje and jeoli kote No.1= 42.2 cm X 12.3 cm
- Dadant box (Russian hive)= 47 cm X 15.2 cm
- Thompson box= 30.5 cm X 15.2 cm
- **Hive:** It is a simple long box covered with a number of slats on top. The rough measurements of the box should be around 100 cm of length, 45 cm of width and 25 cm in height. The box should be 2 cm thick and the hive must be glued and screwed together with entrance holes of one cm wide. The slats (top bars) must be as long as the hive is wide in order to fit across and the thickness of about 1.5 cm is sufficient to support a heavy honey comb. The width of 3.3 cm needs to be given to give the bees the natural spacing they need to easily build one comb to each separate top bar.
- **Smoker:** It is the second important piece of equipment. This can be made from a small tin. We use the smoker to protect ourselves from bee stings and to control the bees.

- **Cloth:** To protect our eyes and nose from stings at the time of work near the apiary.
- **Knife:** It is used to loosen the top bars and to cut off the honey bars.
- **Feather:** To sweep the bees from the comb.
- **Queen Excluder**
- **Match box**

5. MAJOR CONSTRAINTS IN BEEKEEPING IN INDIA

Beekeeping with *Apis cerana Indica* and *Apis mellifera*: The KVAFSU since 1952 promotes *A. cerana indica*, the Asian honey bee. The colony number of this bee in India is about 0.96 million which yielding 6300 metric tonnes of honey with an average yield of 6.7 kg per hive.

Using the Correct Species for Beekeeping: The Italian honeybee is acclaimed choice for commercial beekeeping, throughout world. However the controversy regarding the suitability of the species i.e. Asian honeybee, *Apis cerana indica* and the European bee, *A. mellifera* for beekeeping in India which has been going on for the last three decades gave a severe setback.

Availability of Genetically Superior Queens for Increased Honey Production: It is essential to have requisite infrastructure for the production of large volumes of genetically superior queens for supply to the beekeepers.

Lack of technical knowledge for efficient management of colonies for high honey yields: This is a major constraint. Beekeepers are not aware of international methods of efficient management.

Some of the wrong practices followed by beekeepers are: Few beekeepers use queen excluders. Further the excluders that are locally available get rusted and damage the bees. Efficient swarm control is not practiced by beekeepers and they are most unaware of these techniques. Most beekeepers just divide colonies to prevent swarming. Maximum yields from *A. mellifera* are obtained when the colonies go up to 3 to 4 chambers with populations of 50 000 to 70 000 bees. Beekeepers do not know the concept of the food chamber as a measure of colony build up and mostly maintain colonies on a single chamber leading to weak colonies that die in dearth periods. Few beekeepers change queens every season before the honey flow leading to loss of queens during the crucial honey flow. Some beekeepers even do not use full comb foundation sheets and only use strips

of wax sheets for the frames which lead to excessive drone comb construction besides wasting the time and effort of bees in making extra comb. Therefore there is a great scope for improvement.

Lack of Infrastructure at the grass roots and National level for Beekeeping:

There is no concept of beekeeping inspectors or trainers in beekeeping, at the village or even district level. Beekeeping by its nature has seasonal crises of disease management and so on. There should be a hierarchy of beekeeping experts and trainers in the village blocks, Tehsils, Districts and then finally in the universities to be able to have effective feed back to and from the beekeepers.

Marketing Constraints

You are most likely to get market constraints, whether you become an independent beekeeper or a trader after completing this course. Let us discuss these constraints in detail.

- Lack of access to suitable containers for storing, transporting and marketing honey.
- Poor diversity of retail packaging materials.
- Lack of roads.
- Lack of transport.
- Lack of communication possibilities.
- Lack of bargaining power.
- Lack of organizational support.
- Lack of training and technical advice or poor quality training.
- Poor market access.
- Lack of appropriately-trained support personnel or information materials.
- Low product prices.
- Few social linkages with other producers.
- Few social linkages with potential buyers

6. QUALITY CONTROL IN PRODUCTION OF HONEY

This is a very important aspect of beekeeping and needs to be stressed on. Some beekeepers extract honey from brood frames by which

damages the brood and the honey extracted is of poor quality. All beekeepers do not maintain separate super chambers for the production of honey. Many beekeepers do not use queen excluders. The queen lays eggs in the honey chamber thereby lower the honey quality. Honey only develops the flavor which is particular to each flower source if it is allowed to stay in the hive a little more after the bees seal the frames. Beekeepers do not use the technique of keeping supers in warm rooms with a forced airflow before extraction.

In case, unripe honey is extracted, it is high in moisture content and lacking in colour, flavor and quality. Honey is also poorly stored by beekeepers. The honey in contact with the old tin plate becomes blackish in colour and loses flavor. Food grade plastic containers need to be developed for storing honey.

7. HONEY BEE SPECIES OF ECONOMIC IMPORTANCE

Honey bees belong to Phylum- Arthropod, Class- Hexapoda / Insecta, Order- Hymenoptera and Family- Apidae. There are five species of honey bees which are of great economic importance.

- (i) *Apis dorsata* (Giant / Rock honey bee)
- (ii) *A. florea* (Little/ Dwarf honey bee)
- (iii) *A. cerana* (Indian/Asian / Eastern honey bee)
- (iv) *A. mellifera* (Italian/ European honey bee)
- (v) *Trigona iridipennis* (Stingless bee/ Dammer bee)

The first three species are indigenous, while the fourth species *A. mellifera* was introduced in India in 1962 from European country. *A. dorsata* and *A. florea* are wild bees as they construct nest in open and cannot be domesticated in wooden hives. *Trigona* sp. is wild but is rear in peculiar bee hive. Whereas *A. cerana* and *A. mellifera* are hive/ domesticated bees as they can be hived inside the wooden hives.

Castes of bees

Worker bees

- The workers are sterile females which developed from fertilized eggs.
- Workers are smaller than the drones and have yellowish and dark brown abdominal stripes.

- The workers are the main group in a colony, with 60,000 –70,000 in an *Apis mellifera* colony and 25,000 –30,000 in an *Apis cerana* colony.
- They have specialized structures, such as hypopharyngeal glands, scent glands, wax glands, and pollen baskets, which allow them to perform all the labors of the hive.
- All the work in a honeybee colony is performed by the worker bees, including honey and pollen collection, brood rearing, building combs, feeding the drones and queen, cleaning the hive, and defending the colony.
- The specific activities are defined by the age of the bee, with tasks inside the hive for the first 3 weeks after emergence (comb building, brood care, hive cleaning, thermoregulation, queen care, honey ripening) and then outside (foragers and scouts).

Under special circumstances, workers can perform any kind of task irrespective of age as per the need of the colony.

- When the colony is active in spring and summer, worker bee may live as long as 5- 6 weeks. During inactive period in winter a worker bee lives five months or more.

Queen bee

- Each colony has a single queen bee irrespective of the colony size.
- The queen bee is larger than the worker and drone bees, has a black and shiny cylindrical and longer body, and a round and comparatively small head.
- She is the only perfectly developed female and is the mother of the colony.
- Her primary function is reproduction. She produces both fertilized and unfertilized eggs. During peak production, queens may lay up to 2000-2500 eggs per day. One queen may produce up to 250,000 eggs per year and possibly more than a 10, 00000 in her lifetime.
- The second major function of a queen is secreting pheromone known as queen substance, required for the stability of the colony including ovaries inhibition of Worker bees.
- The average productive life span of queen is 2 to 3 years.

Drone

- Drones (male bees) are the largest bees in the colony and are blackish and hairy.
- A colony will usually have a few hundred drones.
- They develop from unfertilized eggs and complete their life cycle in 24 days.
- They lead a life of leisure, doing no work while being fed by the workers.
- Their sole purpose is to mate with a new queen and also useful to reduce the temperature of the colony by wing beating. They die after mating, or are expelled from the hive as winter approaches.

8. HONEY BEE PRODUCTS

Certainly you might have tasted delicious honey many times. But, do you know there are other bee products also which has many health benefits. Let us know about them:

(i) **Honey:** Honey is the natural sweet substance produced by honey bees from the nectar of blossoms, which honey bees collect, transform and combine with specific substances of their own, store and leave in the honey comb to ripen and mature. Bees normally take about 3-4 weeks for storing, ripening and sealing of honey in comb cells. The colour of honey varies from nearly colour less to dark brown. It also indicates quality, because honey becomes darker during storage or if it is heated. Honey contains a good amount of digestible sugar, minerals, vitamins, enzymes, water, etc. The aroma, taste and colour of honey are determined by the plants from which the bees have gathered nectar. For example, nectar collected from sunflowers give a golden yellow honey. Honey absorbs moisture very quickly and should be kept in air tight containers.

(ii) **Pollen:** When bees visit flowers, pollen sticks to the fine feather-like hair which covers the body. Bees remove the pollen from the hairs using the pollen comb; a structure on the hind legs. Then she forms the pollen into small pellets with the pollen press, and sticks it into the pollen basket to carry it back to the hive. Pollen is stored in cells immediately surrounding the brood nest where it is readily available for feeding brood and for consumption by the nurse bees.

(iii) **Beeswax:** It is a complex mixture of organic compounds secreted by four pairs of special glands on the worker bee's abdomen. It is used for

building wax comb. Beeswax can be secreted only at relatively high temperatures and after a large intake of honey or nectar. It is produced by 12 to 18 days old honey bees. A bee converts 15 kg of honey into 1 kg of wax. It is used in medicine, confectionery items, cosmetics and polish.

(iv) **Royal Jelly:** Royal jelly is the food produced by the young worker bees through glandular secretion. It is given to freshly hatched larvae. Royal jelly has many different components including proteins, sugars, fats minerals and vitamins. It contains many insect growth hormones and is valued as a medicine or tonic in various parts of the world. It reduces the aging process in human beings. The beekeepers remove the larvae and harvest the royal jelly for marketing. Royal jelly deteriorates quickly after harvest and must be kept frozen or freeze-dried during handling, storage, transport and marketing.

(v) **Propolis:** It is a gummy reddish brown substance gathered by the bees from resinous substance found on trees and buds of plants. It is also called 'bee glue' and is used to close small crevices in the hive. It is very sticky in warm weather and brittle in cold weather. Bees use propolis as building materials to decrease the size of nest entrances and to make the surface smooth for passing bee traffic and to varnish inside brood cells before a queen lays eggs in them, providing a strong, water proof and hygienic unit for developing larvae. It is used as an antibiotic and helps in curing the crack feet in human beings. It is used as an ingredient in toothpaste, soaps and ointments.

(vi) **Bee Venom:** It is present in the sting of honeybee and having medicinal value. Bee venom is clear, odourless, watery liquid having somewhat sharp and bitter taste and hydrolytic blend of proteins with basic pH. It is produced by venom glands associated with the sting apparatus of worker bees and used as a defensive agent against enemies specially predators. The worker bee injects the venom into the victim while stinging. A single worker has about 0.5 mg venom.

9. BEEKEEPING AS AN ENTREPRENEURAL ACTIVITY

Beekeeping is a labor intensive process and therefore, generates lot of employment opportunities for people. Most of the work in beekeeping includes processing of honey manually, hence emphasis is given on hands-on training. As a beekeeper, you have to perform the following major activities:

- Decide on the bee species to be kept.
- Prepare a business plan for beekeeping.

- Arrange all the resources required for setting up an apiary and order supplies such as equipment, raw materials etc.
- Plan the activities to be undertaken and estimate operating costs.
- Supervise various activities for beekeeping and make sure that the temperature, ventilation and other conditions are proper for honey bees.
- Build and maintain equipment and facilities to ensure health standards and high quality of bee products.
- Seek advice of experts.
- Observe and record the amount of produce, expenditure, sale, etc.
- Adjust practices to increase production and decrease expenditure.
- Manage the business.

10. DISEASE PREVENTION CONTROL AND ANALYSIS

This is one of the major constraint for the development of beekeeping in India. We need to have regional and also central bee disease analysis laboratories. There is lack of sufficient financial help from government and lending institutions for the development of beekeeping. Beekeeping requires long term loans at easy rates of interest. The bee colony produces honey only after almost a year initially and then seasonally. Beekeepers need help to be able to get finance for bee colonies and equipment. Insurance of bee colonies needs to be done at a reasonable premium so that beekeepers can recover their losses in case of disease or the loss of bees due to other factors. No Tax or other Monetary Benefits for Beekeeping. Beekeeping is neither considered an industry nor an agricultural activity and there is no tax benefit on beekeeping income. No Control on the Use of Pesticides by Farmers Leading to Death of Bee Colonies in Field Locations. The indiscriminate use of pesticides leads to the destruction of bee colonies in the field. There is no legislation restricting the farmer from the use of pesticides that are harmful to bee colonies.

11. CONCLUSION

Beekeeping is a profitable enterprise by doing it scientifically, a lot work needs to be done in this field. Honey is a good source of nutrition with medicinal property. As 80% of total population of the country lives in the

rural areas and out of which 63% is depend on agriculture. Honey, beeswax and products made from them, such as candles, wine and food items have cultural value in many societies and may be used in rituals for births, marriages, funerals and religious celebrations. Beekeepers are generally respected for their craft. Bees and beekeeping have a wholesome reputation. Images of bees are used as symbols of hard work and industry, often by banks and financial institutions. Beekeeping products such as pollen, propolis and royal jelly can be harvested and marketed, although special techniques and equipment are needed for some of these products. The doubling of farmers income by 2020 is only be possible when farmers will adopt bee keeping as a part of agriculture/ horticulture.

12. FUTURE PROSPECTS

Honey industry in the country becomes a major foreign exchange earner if international standards are met. Beekeeping is an age-old tradition in India but it is considered a no-investment profit giving venture in most areas. Of late it has been recognized that it has the potential to develop as a prime agri-horticultural and forest-based industry. Honey production is a lucrative business and it generates employment.

The informal sector is providing up to 70% of the honey & bees wax market in India. Indian honey has a good export market. With the use of modern collection, storage, beekeeping equipment, Honey processing plants and bottling technologies the potential export market can be tapped. The problem is one of quality honey production. From a buyer's point of view, quality honey is essential.

But India, he said, is lacking on that front. There is a need to look specifically at how to promote quality production and develop an export market. Indian honey offers tremendous export potential. For tapping its potential, there is need to chalk out suitable export strategy. Some of the points which merit attention of the policy makers in this respect include:

- Application of advanced technology for collection, and processing of honey
- Adhering strictly to the quality standards including health regulations laid down by markets such as the European Union, Japan and the USA
- Recognition of bee keeping as agro-industry
- Priority allocation and concessions to be made applicable for material needed for beekeeping, like wood for bee boxes, sugar for

supplementing feeds to bees and medicines for bees' diseases

- Campaigning abroad about quality of our honey
- Developing an efficient export marketing network to optimize the production and exports
- Creating an Indian logo as a joint effort of exporters, APEDA and the Ministry of Commerce and Industry, government of India. The brand equity thus created can be better marketed for higher sales realization.
- Timely implementation of the above steps is likely to pave the way for a quantum jump in the export of honey from the country in the coming years.

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ORGANIZATIONAL AND FINANCIAL SUPPORT FOR OFF-FARM ENTREPRENEURSHIP DEVELOPMENT OF WOMEN

Renu Jethi, Pratibha Joshi, Ankita Kandpal and Poonam Kashyap

1. INTRODUCTION

Agricultural sector alone is incapable of creating additional employment opportunities in the wake of increasing population, limited land resources and climate change. As a result, the impetus for achieving sustained development in rural areas has to focus on expanding the base off-farm activities. Many studies reported that income from rural off-farm enterprises greatly exceeded the value of farm wage income (Reardon et al., 2007). If such activities are encouraged and comprehensive planning approach can be evolved it could provide the solution to the problems of rural areas such as poverty, unemployment and out-migration of the rural work force. Obinna (2014) described off-farm activities to constitute of all the income generating activities that a farmer embarks on in addition to farming. Off-farm activities contribute to household food security by providing cash for food and other household purchases and equally, in agricultural assets acquisition. Babatunde et al (2010) also, reported that off-farm activities are risks minimizing strategies that safeguarded farmers against crop and market failures. Economic status of women is very weak and pathetic in rural areas of India and opportunities of earning are very less and risky. In this scenario, off farm entrepreneurship activities through formation of Self Help Groups (SHGs) can paved the way for economic independence of rural women (Sharma et al. 2012).

2. SHARE OF AGRICULTURAL INCOME IN TOTAL HOUSEHOLD INCOME

Table 1 represents various income sources of agricultural households in two periods, 2012-13 and 2015-16 in various land sizes. As can be seen in the table 1, total income of agricultural households have been increased in each land size category from 2012-13 to 2015-16. For marginal land holding groups (less than 0.01, 0.01-0.4 and 0.41-1 ha), the income coming from cultivation has a very less share in total income of agricultural households, while wages/salaries and non-farm sources occupy a major share in this group in both the period. However, for the higher land size groups (for 1.01-2, and more than 2 ha) the share of income from cultivation is highest followed by income from wages/ salaries, non-farm business and livestock rearing.

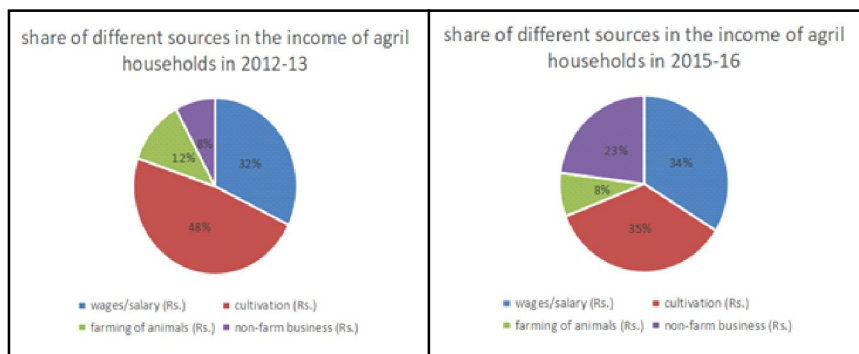


Figure 1: Share of various income sources of agricultural households in their total income in 2012-13 and 2015-16.

Overall, for all the agricultural households in the country, the share of cultivation is highest, though it has been decreased from 48 percent to 35 percent from 2012-13 to 2015-16 (Fig. 1). Similarly, share of income from livestock rearing also declined from 12 to 8 percent in this period. However, there has been increase in share of wages/salaries and non-farm business in the total income of agricultural households from 32 to 34 percent and 8 to 23 percent, respectively. This trend indicates growing importance of other sources of income for achieving better living conditions and livelihood security for farmers.

Entrepreneurship is a key factor for the survival of any small-scale farming in an ever-changing and increasingly complex global economy. Entrepreneurship plays a significant role in the economic development of a country and is a most powerful weapon to fight against poverty and

Table 1: Sources of income of agricultural households during 2012-13 and 2015-16

Sources of income	Wages/Salary (Rs.)		Cultivation (Rs.)		Farming of animals (Rs.)		Non-farm business (Rs.)		Total income	
	2012-13	2015-16	2012-13	2015-16	2012-13	2015-16	2012-13	2015-16	2012-13	2015-16
Year/ Size of land (ha)										
less than 0.01	2902 (63.63 %)	3508 (43.12 %)	30 (0.66%)	566 (6.96%)	1181 (25.89%)	1345 (16.53%)	447 (9.8%)	2717 (33.39%)	4561 (100%)	8136 (100%)
0.01-0.4	2386 (57.47%)	2932 (44.09%)	687 (16.55%)	1488 (22.38%)	621 (14.96%)	517 (7.77%)	459 (11.05%)	1713 (25.76%)	4152 (100%)	6650 (100%)
0.41-1	2011 (38.33 %)	3044 (37.25 %)	2145 (40.88%)	2501 (30.61%)	629 (11.99%)	624 (7.64%)	462 (8.81%)	2001 (24.49%)	5247 (100%)	8171 (100%)
1.01-2	1728 (23.52 %)	2777 (27.8%)	4209 (57.28%)	4485 (44.89%)	818 (11.13%)	763 (7.64%)	593 (8.07%)	1965 (19.67%)	7348 (100%)	9990 (100%)
More than 2	1751 (12.43 %)	3340 (22.75%)	10363 (73.57%)	7572 (51.57%)	1298 (9.21%)	978 (6.66%)	674 (4.79%)	2792 (19.02%)	14085 (100%)	14682 (100%)

Source: NSSO 70th round report (Key Indicators of Situation of Agricultural Households in India); NABARD's All India Rural Financial Inclusion Survey 2016-17

Note: Data in percentage in the parenthesis shows share of income source in the total income in various land size categories.

unemployment. A large percentage of micro enterprises are undertaken by women. **Sidhu** and Kaur (2006) revealed that entrepreneurship is the only solution for the growing un-employment among rural youth. It helps to generate employment for number of people within their own social system. This is more beneficial for women in rural areas as it enables them to supplement their family income while taking care of their home, farm and livestock. According to Obinna (2017), rural women entrepreneurs engaged in off farm activities greatly helps in reducing poverty by supplementing the meager income from subsistent farming. They have abundant opportunities and resources to take up an enterprise. In India, almost 70 percent of the population is still self-employed. 'Women entrepreneurship' became an important phenomenon in later half of eighties. According to Khanka (2000), a women entrepreneur is a confident, innovative and creative women capable of achieving economic individuality or in collaboration generates employment opportunities for others through initiating, establishing and running an enterprise by keeping pace with her personal, family and social life. Women are emerging an excellent entrepreneur and changing the face of the business of today. Women Entrepreneurs may be defined as the women or a group of women who initiate, organize and operate a business enterprise. Women entrepreneur is a person who accepts challenging role to meet her personal need and become economically independent. Government of India has defined women entrepreneurs as an enterprise owned and controlled by a woman having a minimum financial interest of 51% of the capital and giving at least 51% of employment generated in the enterprise to women (Gol 2006). Women participation in home, farm and other activities is dependent upon their social, cultural and economic conditions. It also varies from region to region and even within a region, their involvement varies widely among different farming system, castes, classes and socio-economic status. In spite of several restrictions, women of the low-income households are found working outside their home due to severe economic pressures, while women of the medium and high-income household seek employment in order to decrease self-dependency and to raise their standard of living. Now Indian women entrepreneurs are actively showing their presence in new areas like herbal marketing, food processing, handicraft making, readymade garments, tailoring etc. India envisions a future where women are independent and self-reliant. In Modern India, more and more women are taking up entrepreneurial activity especially in micro, small and medium scale enterprises (Dangi and Ritika, 2014). Women are more into technology than in the previous years. Digital media have also empowered them a lot more to come into entrepreneurship (Manshani and Dubey, 2017).

Rural women's access to financial services is a key factor of successful rural development strategies for inclusive growth. Designing appropriate financial products for women to be able to save, borrow and insure is essential to strengthen women's role as entrepreneurs. In the words of Former President APJ Abdul Kalam "empowering women is a prerequisite for creating a good nation, when women are empowered, society with stability is assured. Empowerment of women is essential as their thoughts and their value systems lead to the development of a good family, good society and ultimately a good nation." Pandit Jawaharlal Lal Nehru has remarked "When women move forward, the family moves, the village moves and the Nation moves". There are several factors which motivates women to initiate an enterprise like personal motivation, socio-cultural factors, urge for social identity, economic independence, availability of resources, government support and various women related schemes and a conducive business environment.

3. OFF FARM OPPORTUNITIES FOR RURAL WOMEN ENTREPRENEURS

Women in rural areas can choose different enterprises depending upon a number of factors ranging from landholding, subsidiary occupation, agro-climatic condition and socio-cultural characteristics of the rural women and her family members.

- **Vermiculture:** Vermiculture can become a prominent micro-enterprise for rural landless woman or women groups, as it requires very less investment. Women can utilize both her technical skills and raw materials from the farm and livestock to earn substantial income. Vermiculture as an enterprise is less expensive in terms of costs and provide relatively fair employment with less investment. Vermicomposting is an excellent technique for recycling food waste. It is environment friendly technology as it converts organic waste generated in farm and farms and households to productive plant nutrients. Rural women can play a vital role in vermiculture production, management and marketing.
- **Food, Fruits and vegetable processing:** Women have greater opportunities for adding value to raw commodities because of increased consumer demand and preferences. Rural women can start micro-enterprises in food preservation by getting some exposure to modern techniques in producing edible and preserved products such as pickles, jam, jellies and juices. Many women groups are also engaged in making dal using small and portable dal mills.

They can also develop skill in packaging, storing and marketing through occupation-based trainings. Women involved in this enterprise can fetch a large share of the food money by producing value added products instead for just producing raw commodity.

- **Ready to eat products:** Factors such as increasing working men and women population, busy work schedules and changing food habits are fueling the popularity of the ready to eat and packaged food sector in India. Women entrepreneurs and women groups can enter the business by understanding basics of food technology, food safety and demands of their target groups. Setting up of efficient packing unit is a major factor for food safety, easy transportation and distribution. This sector requires a good understanding of merchandising, logistics and cost control.
- **Small scale agro-processing units:** processing of food commodities is an essential step in value addition. Processed products have now become important because of consumer' preferences. Most of the women are now performing micro level food processing enterprises with very low start up capitals that usually affects the growth and sustainability of the agro-food processing enterprises. Women agro food processors lack entrepreneurial trainings. Therefore, there should be provision of credit facilities and entrepreneurial trainings for would-be small-scale women entrepreneurial in the food processing enterprise.
- **Boutique and beauty Parlor:** Many government organizations like KVKs, RSETIs, NGOs and private organizations are providing skill trainings to women through their different projects. Vedanta foundation are proving skill training courses in tailoring and beautician of 3-6 months duration. The foundation has aptly set up training centers across the country to reach out the needy women seeking a platform for developing skill offering them to livelihood opportunities. Through its Sakhi centers it offers training in skill keeping in mind the weak educational background of the targeted women.
- **Handicraft items:** Handicraft involves creation of wide range of objects including clothing, jewelry making, paper crafts, carpet making, paper craft, basket weaving, wood craft, embroidery materials etc. According to world bank report after agriculture, the most important source of women employment is home based work. It is the work of art, skill and internal talent which an uneducated

women also can do and can create new designs and items through imagination.

Considering the benefits of Entrepreneurship development in farm and off-farm sectors, various initiatives have been taken by the government of India through Industrial Policies and Five-Year Plans specifically focusing on the growth of small scale sector, setting up of Special Economic Zones (SEZs), setting up of Entrepreneurship Institutions, organizing Entrepreneurship Development Programmes (EDPs) and various Government Programmes and Schemes for the promotion of entrepreneurship. Responding to the increasing trend of women opting for entrepreneurship, many organizations have come up with the idea of special training for women interested in setting up their own enterprise. Government provides many types of incentives to entrepreneurs for motivating and increasing their productivity.

Implementation of various policies and programs for providing infrastructure and support services to small enterprises is undertaken through its attached departments such as Small Industries Development Organization (SIDO), statutory bodies and other organizations such as Khadi and Village Industries Commission (KVIC), COIR Board; a public sector undertaking, National Small Industries Corporation (NSIC), training institutes such as National Institute of Small Industry Extension Training (NISIET) Hyderabad, National Institute for Entrepreneurship (NIE) Guwahati and National Institute for Entrepreneurship and Small Business Development (NIESBD), New Delhi.

The primary responsibility of promotion and development of Micro, Small and Medium Enterprises is of the State Governments. However, the Government of India, supplements the efforts of the State Governments through various initiatives. The role of the Ministry of MSME and its organizations is to assist the States in their efforts to encourage entrepreneurship, employment and livelihood opportunities and enhance the competitiveness of MSMEs in the changed economic scenario. The schemes/ programmes undertaken by the Ministry and its organizations seek to facilitate/provide:

- i) adequate flow of credit from financial institutions/banks;
- ii) support for technology upgradation and modernization;
- iii) integrated infrastructural facilities;
- iv) modern testing facilities and quality certification;

- v) access to modern management practices;
- vi) entrepreneurship development and skill upgradation through appropriate training facilities;
- vii) support for product development, design intervention and packaging;
- viii) welfare of artisans and workers;
- ix) assistance for better access to domestic and export markets and
- x) cluster-wise measures to promote capacity-building and empowerment of the units and their collectives.

4. RECENT POLICY REFORMS AND SCHEMES FOR ENTREPRENEURSHIP DEVELOPMENT

- **Support to Training and Employment Programme for Women (STEP)** - The Ministry of Women and Child Development introduced STEP scheme to generate employment opportunities to women. Under this programme women above the age of 16 are providing skill based training for self employment in the areas of Agriculture, Food Processing, Handlooms, Handicraft, Computers and others
- **Pradhan Mantri Kaushal Vikas Yojana (PMKVY):** Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is the flagship outcome-based skill training scheme of the Ministry of Skill Development & Entrepreneurship (MSDE). This skill certification and reward scheme aims to enable and mobilize a large number of Indian youths to take up skill training and become employable and earn their livelihood. The skill card is given to those certified under PMKVY which acts as authenticate skill certification. Under the scheme, monetary reward is provided to trainees who are successfully trained, assessed and certified in skill courses run by affiliated training providers. The objective of this Scheme is to encourage skill development for youth by providing monetary rewards for successful completion of approved training programs. Specifically, the Scheme aims to:
 - a. Encourage standardization in the certification process and initiate a process of creating a registry of skills
 - b. Enable and mobilize a large number of Indian youth to take up skill training and become employable and earn their livelihood. Increase productivity of the existing workforce and align the

training and certification to the needs of the country.

- c. Provide Monetary Awards for Skill Certification to boost employability and productivity of youth by incentivizing them for skill trainings

Various types of trainings are undertaken in PMKVY that includes self employed tailors, hand embroider, small poultry farmer, technician, stitching operator, carpenter etc. this is resulting in creation of new micro-enterprises resulting in creation of new micro-enterprises resulting in creation of new micro-enterprises by skilled and competent PMKVY trainees.

- **Prime Minister Employment Generation Programme (PMEGP):** The scheme is implemented by Khadi and Village Industries Commission (KVIC), as the nodal agency at the national level. At the state level, the scheme is implemented through State KVIC Directorates, State Khadi and Village Industries Boards (KVIBs) and District Industries Centres (DICs) and banks. The Government subsidy under the scheme is routed by KVIC through the identified banks for eventual distribution to the beneficiaries/entrepreneurs in their bank accounts with following objectives

- a. To generate employment opportunities in rural as well as urban areas of the country through setting up of new self-employment ventures/projects/micro enterprises.
- b. To bring together widely dispersed traditional artisans/ rural and urban unemployed youth and give them self-employment opportunities to the extent possible, at their place.
- c. To provide continuous and sustainable employment to a large segment of traditional and prospective artisans and rural and urban unemployed youth in the country, so as to help arrest migration of rural youth to urban areas.
- d. To increase the wage-earning capacity of artisans and contribute to increase in the growth rate of rural and urban employment.

Under the scheme, any individual above 18 years of age with VIII standard pass can apply for projects costing above Rs 10 lakhs in manufacturing sector and above 5 lakhs in the business/service sector. Self Help Groups, registered societies, cooperatives are also eligible for the scheme.

- **Make in India:** It was launched on 25th September 2014 to encourage multi-national, as well as domestic companies to manufacture their products in India. The major objective behind the initiative is to focus on job creation and skill enhancement in 25 sectors of the economy. The initiative also aims at high quality standards and minimizing the impact on the environment. Its focus is on sectors like automobiles, construction, defence manufacturing, electrical machinery, food processing, textiles and garments, leather etc.
- **‘Start-Up India’ Initiative:** It aims to encourage entrepreneurship among the youth of India. The ‘Start-up India: Stand up India’ promotes bank financing for start-ups and offer incentives to enhance entrepreneurship and job creation. This initiative aims to provide a new dimension to entrepreneurship and help in setting up of a network of start-ups in the country. Credit guarantee fund scheme, which has been launched under the standup India, had been designed to address the needs of the SC/ST categories along with women entrepreneurs. In this every branch of each bank will give loans and credit guarantee protection to at least two entrepreneurs under the scheme. Loan facilities between Rs 10 lakh and up to Rs 1crore will be made available for SC/ST and women entrepreneurs for non-farm venture.
- **Venture Capital Assistance Scheme (sponsored by Small Farmers’ Agri-business Consortium):** Venture Capital Assistance Scheme is a Central Sector Scheme for agri-business development implemented by Small Farmers’ Agri-business Consortium (SFAC). The scheme is designed in a way to provide financial assistance to entrepreneurs who are interested in setting up agri-business units for primary and higher-level value addition of agriculture produce and products. The financial assistance under the scheme is available to Individual entrepreneurs, farmers, companies/partnership/ proprietary firms, Farmers’ Producer Companies/Farmers Producer Organization/ Self-help groups or any units located in agri-export zones etc. SFAC provides financial assistance up to a ceiling of Rs.5 lakh depending upon size, location, activity and coverage for preparation of bankable Detailed Project Reports through empaneled consultants/institutions. Assistance is also be provided to State SFACs for undertaking promotional activities for agri-business development.

- **Raw Material Assistance Scheme (Sponsored by Ministry of Small and Micro Enterprises (MSME)):** Raw Material Assistance Scheme aims at helping MSEs by way of financing the purchase of Raw Material (both indigenous & imported). This gives an opportunity to MSEs to focus better on manufacturing quality products. The main objectives are:
 - a. Financial Assistance for procurement of raw material up to 90 days.
 - b. MSEs to help to avail economics of purchases like bulk purchase; cash discount etc
 - c. National Small Industries Corporation (NSIC) take care of all the procedures, documentation & issue of Letter of credit in case of imports.
- **Support for Entrepreneurial and Managerial Development of SMEs (Sponsored by Ministry of Small and Micro Enterprises):** The Scheme provides early stage funding for nurturing innovative business ideas (new indigenous technology, processes, products, procedure etc.) which could be commercialized in a year. The main objective is to promote development of knowledge-based innovative ventures and to improve the competitiveness and survival instincts of the Micro, Small and Medium Enterprises (MSMEs).
- **Info-mediary Services (Sponsored by National Small Industries corporation):** Information is becoming almost vital. National Small Industries corporation (NSIC) offers Info-mediary Services which is a one-stop, one-window bouquet of aids that will provide information on business, technology and finance, and also exhibit core competence of Indian SMEs. The corporation offers services through its Mart www.msmemart.com; which is a Business to Business(B2B) and Business to Customer (B2C) compliant web portal. Following services are available through annual membership.
 - Interactive Database of MSMEs
 - Global & National Tender Notices
 - Self web development tool
 - Centralized mail system

- Free mail boxes
- Payment Gateway for membership subscription
- Popular Products Section
- Unlimited global Trade Leads
- Trust Seal of NSIC
- Multi Product Cart
- Online Buying / Selling
- Multiple payment Option
- MSME Web Store
- Multiple Language Support
- Discussion Board
- Call Centre Support & Live Chat
- Other Value-added Services

5. ICAR INITIATIVES FOR ENTREPRENEURSHIP DEVELOPMENT

Indian Council of Agriculture Research is also promoting entrepreneurship development by capacity building and support farmers through motivation and entrepreneurship development. It also focuses on Government schemes and incentives for promotion of entrepreneurship through its various programs viz. Zonal Technology Management and Business Planning and Development Unit, **a-IDEA** and Student READY etc. Five ZTM - BPD Units are being set up in five zones of the country. The Institutes identified for establishing the ZTM - BPD are Indian Agricultural Research Institute (IARI), New Delhi (North Zone), Indian Veterinary Research Institute (IVRI), Izzatnagar (North Zone), National Institute of Research on Jute and Allied Fibres Technology (NIRJAFT), Kolkata (East Zone), Central Institute for Research on Cotton Technology (CIRCOT), Mumbai (West Zone) and Central Institute of Fisheries Technology (CIFT), Kochi (South Zone). ZTM & BPD unit's main objective is to do IP protection, showcasing, transferring and commercializing the ICAR institutes innovations. It also act as Agri Business incubator to Incubate new startup businesses.

a-IDEA:

a-IDEA (Association for Innovation Development of Entrepreneurship in Agriculture), is a Technology Business Incubator (TBI) hosted by ICAR-National Academy of Agricultural Research Management, Hyderabad (ICAR-NAARM) & Department of Science & Technology, Govt. of India (DST, GOI). a-IDEA has been housed in the Centre for Agri-Innovation at ICAR-NAARM for fostering innovation and entrepreneurship in agriculture in India. a-IDEA aims to help entrepreneurs ideate, incubate and accelerate their innovative early stage startups that are scalable to become competitive food and agri-business ventures through capacity building, mentoring, networking and advisory support.

Financial assistance from banking sector

- **MUDRA Bank :** Micro Units Development Refinance Agency (MUDRA) Bank has been set up on 8th April 2015 for development of micro units to encourage entrepreneurship in India and provide the funding to the non-corporate small business sector. Main objective is to provide loan to small businesses. MUDRA Bank provides refinance to Banks, MFIs, NBFCs etc. for loans to micro units having loan requirement from Rs 50000 to Rs. 10 lakh. Under MUDRA Yojana, MUDRA Bank has launched three products named Shishu, Kishor and Tarun to signify the stage of growth and funding needs of entrepreneurs.
- **Stree Shakti Package for women entrepreneurs:** This scheme is offered by most of the SBI branches to women who have 50% share in the ownership of a firm or business and have taken part in the state agencies run Entrepreneurship Development Programmes (EDP).
- **Bharatiya Mahila Bank Business Loan:** This loan acts as a support system for budding women entrepreneurs looking to start new ventures in the fields of the retail sector. Bhartiya Mahila Bank launched in 2013, offers loan against property, MICRO loans, and SME loans. The maximum loan amount under this loan goes up to ¹ 20 crores in case of manufacturing industries and also a concession is available to the extent of 0.25% on the interest rate and interest rates usually range from 10.15% and higher. Additionally, under the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE), there is no requirement of collateral security for a loan of up to ¹ 1 crore.

- **Dena Shakti Scheme:** under this scheme financial assistance is provided by Dena bank to women entrepreneurs working in the fields of agriculture, manufacturing, micro-credit, retail stores. The interest rate is also decreased by 0.25% along with the maximum loan amount being ₹ 20 lakhs for retail trade; education and housing whereas ₹ 50,000 under the microcredit.
- **Udyogini Scheme:** This scheme is offered by Punjab and Sind Bank to provide women entrepreneurs involved in agriculture, retail and small business enterprises to get loans for business at flexible terms and concessional interest rates. The maximum amount of loan under this scheme for women between the age of 18-45 years is ₹ 1 lakhs but family income is also taken into consideration and is set at ₹ 45,000 per annum for SC/ST women.

There are various hinderances in the success of women entrepreneurs like financial, marketing, working environment, social constraints etc. Efforts are done to remove some of the obstacles which were hindering success of women yet some still remains. Some of the major challenges faced by women entrepreneurs are as follows:

- **Lack of financial assistance:**

Sometimes the financial institutions are skeptical about the entrepreneurial abilities of women. Women lack easy access to funds due to their inability to provide tangible security to financial institutions. In rural areas of India, very few women have tangible property in their name. presently many institutions are coming up to extend their support to women in the form of incentives, loans and schemes etc. but most of the women are unaware about all these assistances provided by the institutions. Therefore, efforts taken towards supporting women entrepreneurs may not reach the women in rural and backward areas.

- **Lack of literacy and knowledge:**

Women in rural areas are ignorant about the new technology and are usually unskilled. Often, they are not able to get necessary training and are not able to do an initial research on new method of production and marketing.

- **Lack of raw material:**

In rural areas mostly due to poor road connectivity and remoteness, it is quite difficult for women to make raw material available round

the year. Raw material are important component as it affects final production. Women in rural areas really face difficulty in getting necessary raw material in required amount and in reasonable prices which drastically affects profitability of the enterprise.

- **Socio-cultural barriers:**

The traditions and customs prevalent in Indian societies towards women sometimes stand as an obstacle before them to grow and prosper. The conventional roles assigned to women in rural areas are often restricts their free mobility and freedom to think and work. Usually women have to face more challenges from their culture, society and family than their male counterparts. Women have more family and personal obligations which sometimes proves to be a great barrier for succeeding in enterprise career. Very few become successful by managing both home and business efficiently.

- **Cut throat competition**

Majority of the women entrepreneurs do not have perfect organizational setup. They have to face a tough competition with organized sector and male counterparts who have vast experience along with advance technology for managing their enterprises.

- **Limited managerial competence:**

As women in rural areas are less educated, they lack managerial skills like planning, organizing, controlling, staffing, directing, motivating etc. which are essential components for a successful entrepreneur.

- **Marketing problems:**

Women face marketing related problems due to restricted mobility. They are mostly confined to four walls of their houses. They usually have to depend on intermediaries for marketing and sale of products. Therefore, there are more chances that intermediaries take major part of the surplus or profit.

6. CONCLUSION

Rural households pursue a mix of activities for income stabilization and risk mitigation. There is now high involvement of women in diversification activities in farm and off farm sectors. In low income groups, economic pressure is forcing women to break away their traditional roles of housewives and move beyond the four walls of their homes. Today world is changing

very fast with technology development, modernization, industrialization, urbanization and education. Therefore, employment opportunities have increased for rural women. Entrepreneurship development of women will improve wealth of nation in general and family in particular. Rural entrepreneurship can be developed with proper skill training. Training Programme on management skill should be provided to women community. Effective steps are needed to provide entrepreneurial awareness, orientation and skill development programs for women in rural areas. Women entrepreneurs are coming forward with their innovative and creative ideas for successful startups and achieving their dreams and aspirations in male dominated society. Despite several hurdles like family obligation and funding issue, etc., women are successfully challenging the world and making their own identity. The role of Women entrepreneur in economic development is now being recognized and steps are also being taken to promote women entrepreneurship. The government agencies, other organizations, entrepreneurship promotion groups and bodies along with government and our society must also promote and encourage it. The recent policy reforms and schemes clearly reveal that government is leveraging on skill development of women for ensuring sustainable entrepreneurship development in the country. However, a proper supervision and monitoring mechanism should be set to analyze the outcome of these initiatives on periodic basis and to avoid the overlapping of activities performed by the newly established government agencies and programmes. Rural women should be encouraged to form cooperatives that will enable them access loans from banks.

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AGRICULTURAL STARTUPS FOR BEGINNERS UNDER STARTUP INDIA

Rajeev Ranjan, N. Ravisankar, A. K. Prusty, M. Shamim and
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1. INTRODUCTION

Agriculture is the primary occupation for most people in the country. 70% of its population depends directly or indirectly upon agriculture. India ranks second in the economic contribution of agriculture. The Green Revolution which started in India in the early 1960s, led to an increase in food grain production. This landmark agricultural revolution transformed the nation from chronic dependence on grain imports into an agricultural powerhouse that is now a net exporter of the world. Gross Value Added by agriculture, forestry and fishing is estimated at Rs 17.67 trillion (US\$ 274.23 billion) in FY18. This provides huge opportunity for new entrepreneurship opportunities in the sector. In this endeavor, Startup India is a flagship initiative of the Government of India, intended to build a strong eco-system for nurturing innovation and Startups in the country that will drive sustainable economic growth and generate large scale employment opportunities. The Government through this initiative aims to empower Startups to grow through innovation and design.

A startup is a newly established business, usually small, started by 1 or a group of individuals. What differentiates it from other new businesses is that a startup offers a new product or service that is not being given elsewhere in the same way. The keyword is innovation. The business either develops a new product/ service or redevelops a current product/service into something better. Any new company is considered as a startup company. It can be incorporated as either a Proprietorship Firm (Singly hold), Private

Limited Company or a Registered Partnership Firm or a Limited Liability Partnership. As per Government of India definition of startup for recognition in Startup India Scheme except Proprietorship Firm all other types of company are eligible like Private Limited Company or a Registered Partnership Firm or a Limited Liability.

2. STARTUP AS DEFINED UNDER STARTUP INDIA SCHEME

An entity shall be considered as a Startup:

1. If it is incorporated as a private limited company or registered as a partnership firm or a limited liability partnership in India.
2. Up to seven years from the date of its incorporation/registration; however, in the case of startups in the biotechnology sector, the period shall be up to ten years from the date of its incorporation/registration.
3. If its turnover for any of the financial years since incorporation/registration has not exceeded INR 25 Crores.
4. If it is working towards innovation, development or improvement of products or processes or services, or if it is a scalable business model with a high potential of employment generation or wealth creation.

3. BRIEF DETAILS OF THE STARTUP INDIA SCHEME

Startup India is a flagship initiative of the Government of India (launched January 2016), intended to build a strong eco-system for nurturing innovation and Startups in the country that will drive sustainable economic growth and generate large scale employment opportunities. The Government through this initiative aims to empower Startups to grow through innovation and design. In order to meet the objectives of the initiative, Government of India announced Startup India Action Plan that addresses all aspects of the Startup ecosystem. With this Action Plan the Government hopes to accelerate spreading of the Startup movement: The Action Plan is divided across the following areas:

- **Simplification and Handholding**
- **Funding Support and Incentives**
- **Industry-Academia Partnership and Incubation**

3.1 Action points under startup India initiative

Following are the 19 Action Points under the Startup India initiative:

Simplification and handholding

1. Compliance Regime based on Self-certification
2. Startup India Hub
3. Rolling out of Mobile App and Portal
4. Legal Support and Fast-tracking Patent Examination at Lower Costs
5. Relaxed Norms of Public Procurement for Startups
6. Faster Exit for Startups

Funding support and incentives

7. Providing Funding Support through a Fund of Funds with a Corpus of INR 10,000 crore
8. Credit Guarantee Fund for Startups
9. Tax Exemption on Capital Gains
10. Tax Exemption to Startups for 3 years
11. Tax Exemption on Investments above Fair Market Value
12. Organizing Startup Fests for Showcasing Innovation and Providing a Collaboration Platform

Industry-academia partnership and incubation

13. Launch of Atal Innovation Mission (AIM) with Self-Employment and Talent Utilization (SETU) Program
14. Harnessing Private Sector Expertise for Incubator Setup
15. Building Innovation Centres at National Institutes
16. Setting up of 7 New Research Parks Modeled on the Research Park Setup at IIT Madras
17. Promoting Startups in the Biotechnology Sector
18. Launching of Innovation Focused Programs for Students
19. Annual Incubator Grand Challenge

4. HOW TO PROCEED FROM THE SCRATCH

Suppose an individual plans to start a company then he should go for Proprietorship Firm and later once you find a good partner you can switch the company to Private limited or other mentioned type above. If you are a group, you can choose to form a partnership firm or a private limited or a Limited Liability Firm. In all cases, you need to contact a low cost CA firm from whom you can get a company registered. If you want to target to have a startup dedicated to CSR funds, you should register your company under section 8 with the help of your CA.

A private limited company can be registered in cost of approx 15000 INR inclusive of all documents like Memorandum of Association (MoA), Article of Association (AoA), Company's PAN card, GST number, Director Identification Number (DIN) and two electronic Digital Signature Certificates. Apart from registration cost, a bank account with minimum 100,000/- balance is required at the time of starting a company. You can choose the bank from public or private based on the facilities given to a startup firm. It's always advisable to choose a bank with which you or your family has good relationship.

Before proceeding for registering, one should firstly need to know what type of business he or she is registering. It is advisable to do adequate research to be sure of the type of business before registering a startup. Once this is done this, you can go ahead for completion of registration process and choose name for the startup.

5. REGISTERING A PROFILE ON STARTUP INDIA WEBSITE

Registering a profile on the Startup India website is a fairly simple process.

1. Simply click on 'Register' and fill in the details as required in the registration form. An OTP will be sent to your registered email address, post submitting which your profile will get created.
2. You will have an option to select your profile type. For 'Individuals', the profile goes live immediately, whereas for 'Startups', the profile goes under moderation for 24-48 hrs, post which you will be able to avail all benefits on www.startupindia.gov.in.

Registering a profile on www.startupindia.gov.in, helps in finding relevant mentors, investors, incubators, accelerators and relevant govt. and international bodies besides other startups one would want to reach out to, all under the 'Ecosystem' tab on the top of the page.

5.1 Documents required to be uploaded for registering as a startup in India

1. A letter of recommendation or support.

Any one of the following documents can be submitted, in PDF format:

- A recommendation, in the format specified by the DIPP, from an incubator established in a post-graduate college in the country;
 - A letter of support from any central or state government funded incubator to promote innovation;
 - A recommendation, in the format specified by the DIPP, acknowledging the innovative nature of business, from an incubator recognized by the central government;
 - A letter of funding of not less than 20 percent in equity by any incubation or angel fund/private equity fund/accelerator or angel network that is duly registered with the Securities and Exchange Board of India (SEBI) that endorses its innovative nature of business;
 - A letter of funding by the central or state government as part of a scheme that promotes innovation; or,
 - A patent filed and published in the Journal by the Indian Patent Office in areas affiliated with the nature of business being promoted.
2. Incorporation certificate or registration certificate in case of a partnership firm.
 3. Brief description of the innovative nature of the entity's product or service offering.
 4. Answer whether the entity is interested in availing tax benefits.
 5. Self-certification of conditions specified in the official definition – as mentioned above.
 6. Self-certification that the entity applying for startup status is not the result of splitting up from an existing business entity.

Once the application is uploaded, a recognition number will be immediately issued to the startup. The certificate of recognition will be

released upon the examination of all the documents submitted.

6. BENEFITS PROVIDED TO REGISTERED ENTITIES UNDER STARTUP INDIA SCHEME

The benefits provided to recognized startups under the Startup India initiative are:

1. ***Self-Certification:*** Self-certify and comply under 3 Environmental & 6 Labour Laws
2. ***Tax Exemption:*** Income Tax exemption for a period of 3 consecutive years and exemption on capital and investments above Fair Market Value
3. ***Easy Winding of Company:*** In 90 days under Insolvency & Bankruptcy Code, 2016
4. ***Startup Patent Application & IPR Protection:*** Fast track patent application with up to 80% rebate in filing patents
5. ***Easier Public Procurement Norms:*** Exemption from requirement of earnest money deposit, prior turnover and experience requirements in government tenders
6. ***SIDBI Fund of Funds:*** Funds for investment into startups through Alternate Investment Funds

7. HOW TO CHOOSE A SECTOR IN AGRICULTURE FOR STARTUP

There are many sectors in agriculture which you can select for your startup. Some of the key ones are Food processing, trading, Agritech, Agri Inputs, Agri-Machineries, Livestock Inputs, Flower business, Consultancies, Organic Agriculture, Agriculture based Skills and Livelihoods, Commercializing a developed technology or Commercializing your own technologies etc. Choosing a sector wisely based on you and your team strength is very important. You can also search for various technologies developed by a research institute in agriculture, livestock, dairy, CSIR institutes, IITs, State agriculture universities, agriculture technologies developed by DRDO, NIFTEM, CRIJAFT or any other research institutes. A developed technology by any institute should be chosen based on the market current and future demands. It is also not necessary that one should go for innovative technologies only, an entrepreneur can also define it own processes to solve the problem of the society and could startup a social startup in the region.

If you are an agriculture student you can start the discussion with your dean of the college on various prospects so that once you are in your final year, mobilizing towards the same can be done easily without wasting time

There are many resources and facilities which are made available to startups in agriculture and food sector. DARE/ICAR is running Zonal Technology Management (ZTM) in various ICAR institutes & Agrinnovate which is the commercializing handle for agricultural related technologies of ICAR. For deciding details of the technologies available, you should search them, get connected, get the list of technologies available, choose as per your expertise and future market demand, know the details of the licensing the technology. Every technology has its own prerequisites before licensing it to an entrepreneur, so try to give a personal visit to understand the details if you consider to license an existing technology for commercialization.

What's next?

It is advisable to connect to an agriculture incubator which is nearest to you as per the relevancy of your products or services. Some of the agriculture and social incubators are NAARM, MANAGE, NIAM, NIFTEM, IARI and other ICAR's Zonal Technology Management Units, Nexus (US Embassy), Xlr8AP, ICRISAT ABI, IITs Startup Cell, State Agriculture University's Incubators; Incubators under ATAL Innovation Scheme, State Departments and good universities in the states. After selecting few of them, talk and schedule a meeting to discuss in details and introduce yourself. It must be noted that, it is not a one way approach that an incubator selects a startup; it is a two way approach where you should also decide if the incubators is capable enough to guide and handhold you toward a successful venture. So you should ask all the questions in your mind. After than apply for an incubation support in 5-10 incubators till you may get selected in one or two based on the relevancy of your technologies. Once you are incubated and registered your company, go for Startup India recognition via online mode. Register your entity by filling the online form on the website. After submission in few days you will get the recognition certificate with allotted number from Dept. of Industrial Policy and Promotion (DIPP), Ministry of Commerce.

8. BENEFITS OF THE RECOGNITION UNDER STARTUP INDIA

There are many benefits which can be availed once you are registered under Startup India Scheme. Some of the benefits are subsidy in protecting your *intellectual property rights (IPR)* where government fast

tracks your patent application by subsidizing the cost and startup bears on the main fee. You also get benefits and relaxation in Labour and Environmental Laws where startups are provided with facility of self certification. The details for environmental laws can be read under various notifications in startup India portal. Startup also gets relaxation in norms of procurement in public sector companies or state/central government. Further the recognition certificate from startup India also helps in getting investment especially from the Funds of Fund and tax exemption to selected startups for three years.

9. RAISING FUNDS

The initial funding is mostly through you, friends and family. Later after receiving some business in your startup you can show the traction and growth of your organization to raise funds. Some of the source of the funds is government grants under various schemes of DST, DBT, CSIR, BIRAC, MSME etc. Apart from government other source of funds are private investors whom you or your family might know, angel investors, various funds under social initiatives run by various organization in the country. Public sector banks also provide finances under various startup schemes of Mudra or StandUp India or their own banks schemes. It's important to show confidence to the bank about your growth so that they are convinced to allot you funds for expansion of your business. MSME & NSIC is one place where a startup should meet the relevant nearest offices and discuss the various schemes which is relevant for your product marketing and promotion. They provide lots of marketing and promotion assistance which could be helpful to give your business a needed push. A startup should understand the entire ecosystem first, and then target the relevant institutions for fund raising.

10. ROAD AHEAD

India is expected to achieve the ambitious goal of doubling farm income by 2022. The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage. Furthermore, the growing use of genetically modified crops will likely improve the yield for Indian farmers. With recent technological developments in multi facet areas of agriculture coupled with policy support by govt. and private entities, the sector provides ample of opportunities for setting up startups opening avenues for entrepreneurship development.

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For Startup India Scheme visit www.startupindia.gov.in

For applying Export-Import Certificate visit dgft.gov.in/

For Marketing and Promotion read MSME, KVIC and NSIC website comprehensively

For self declaration visit <https://shramsuvridha.gov.in/startUp.action>

For government marketing-selling portal visit <https://gem.gov.in/>

For ICAR technologies www.agrinovateindia.co.in | <https://icar.org.in/node/130>

For ICAR - IARI www.ztmbpd.iari.res.in/

<https://www.india-briefing.com/news/startup-india-all-you-need-to-know-12076.html/>

Agri-Entrepreneurship

Challenges and Opportunities

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FOREWORD

Agriculture provides livelihood for about 58 % of India's population. Gross Value Added by agriculture, forestry and fishing is found to be Rs 17.67 trillion (US\$ 274.23 billion) during 2017-18. However, the agricultural sector contributes only 14 % of GDP. Further, agrarian distress is attributed to low profitability and it is observed that for an output of Rs. 100, the input cost is Rs. 64. Situations like these have made agriculture a low-profit enterprise in India. With respect to agricultural production India stands second but as far as export are concerned it is ranked 14th in the world. India's average agricultural production per hectare is only half of the of the world's average (50%), which indicates the need and potential for development.

Agripreneurship is the process of adopting new methods, processes, techniques in agriculture or the allied sectors of agriculture, for better output and economic earnings. Agripreneurship converts agricultural activity into an entrepreneurial activity. By adopting innovative ideas in agriculture and allied sectors, an agripreneur can drive the changes in rural economy. Several opportunities such as crop production, dairying, bee keeping, secondary agriculture, food processing, input production, market led agriculture etc exist in the field for entrepreneurship which offers scope for employment for youth, enhancing income and decent livelihood for the people associated with the sector. Some of the new schemes such as Start-up and Make in India are making inroads to agriculture-based entrepreneurship.

Start-ups are providing missing links in the agri-value chain and delivering efficient products, technologies and services to the farmers on one hand and the consumers on the other hand. Farm automation, weather forecasting, drone use, inputs retailing, equipment renting, online vegetable marketing, smart poultry and dairy ventures, climate smart agriculture, protected cultivation, innovative food processing and packaging are major focus areas for agri-pruners and start up. Therefore, the sector needs to be guided with proper knowledge on options available in Agriculture for Agri-pruners, process of establishment etc.

In this endeavour, details of agri-prunership options such as seed production, export oriented commodities, high value crops, protected farming, processing of perishable commodities, floriculture, bovines to equines, aquaculture, mushroom, bee keeping etc along with the process of establishment, financing and use of information communication tools are ascribed in this publication for agri-pruners which will be of immense value

to the progressive farmers, rural and urban youths for becoming Agri-pruner. I congratulate the authors for bringing out the publication on ***Agri-Entrepreneurship: Challenges and Opportunities*** and hope, this will be highly useful for all the stake holders involved in agriculture sector.

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