Training Manual is also available on www.aedsi.org

21 Days National Training Course

On

Opportunities in Agriculture, Animal Husbandry & Allied Sectors for Sustainable Entrepreneurship & Livelihood Security

July 01-21, 2021

Venue: By virtual mode (Zoom Video Conferencing App)

Training Manual

Organized by

National Bank for Agriculture and Rural Development (NABARD) (https://www.nabard.org/)

Centre for Agribusiness Incubation and Entrepreneurship, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (Madhya Pradesh) India (www.rvskvv.net)

Agro Environmental Development Society (AEDS), Majhra Ghat, Rampur, India (www.aedsi.org)

Editors

Chhatarpal Singh

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Md. Nadeem Akhtar

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Chief Patron-21 Days National Training Course

Message

It is immense pleasure that "Centre for Agribusiness Incubation and Entrepreneurship", RVSKVV, Gwalior is going to organize 21 Days National Training Course On **"Opportunities in Agriculture, Animal Husbandry & Allied Sectors for Sustainable Entrepreneurship & Livelihood Security"** along with Agro Environmental Development Society (AEDS), Rampur, India&National Bank for Agriculture and Rural Development (NABARD) Gwalior.The idea to host the 21 Days National Training Course by CAIE, Gwalior along with AEDS, Rampur is to bring together farmers, researchers, scientist, academician, scholar and students in the area of agribusiness. A lot of research is going on at various stage of agribusiness i.e. technology innovation, value-chain development, role of ICT, farm automation, weather forecasting, Innovation in packaging etc.

As we know, India is an agriculture-based country, where more than 50% of population is depend on agriculture and it structures the main source of income. The commitment of agribusiness in the national income in India is all the more, subsequently, it is said that agriculture in India is a backbone for Indian Economy. There are lot of scopes in agricultural and its allied sectors to provide self-employment opportunities to millions of educated youths of our nation if they trained properly.

I convey my best wishes for the successful completion of this training course and I wish the organizing committee and whole team of AEDS society all the best and hope the event concludes with its grand success.

[Prof. Surapaneni Koteshwara Rao]

Dr. Sudhir Singh Bhadauria
Nodal Officer
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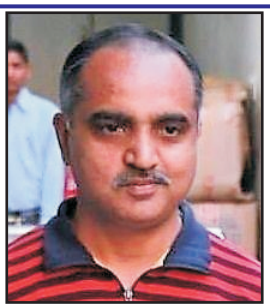

Message

It is a matter of great pleasure that Centre of Agribusiness Incubation and Entrepreneurship, RVSKVV, Gwalior is organizing 21 Days National Training Course On **"Opportunities in Agriculture, Animal Husbandry & Allied Sectors for Sustainable Entrepreneurship & Livelihood Security"** along with Agro Environmental Development Society (AEDS), Rampur, India&National Bank for Agriculture and Rural Development (NABARD) Gwalior. The quest for knowledge has been from beginning of time but inherent knowledge provide the valuable inputs which disseminated to the different beneficiary. It is hoped that the training course will provide the platform to collect and disseminate the latest knowledge in recent emerging areas of agriculture. Through this platform researcher, stakeholders and entrepreneurs will able to discuss and share the new findings which may applicable practically. It is also expected that they will understand the current scenario of the market and able to face challenges raising at the different level of business. New start-ups have great potential to succeed either in term of contributing in GDP and generating the employment. Agri-entrepreneurs are able to grab the opportunities due to conductive environment provided by the Government through various schemes.

I congratulate the organizers and other associates for kind support during the training course to make this event a grand success.

[Dr. Sudhir Singh Bhadauria]

एग्रो एनवायर्नमेंट्ल डेवलपमेंट सोसाइटी (ए.ई.डी.एस.)
Agro Environmental Development Society (AEDS)
Majhra Ghat, Rampur-244922, Uttar Pradesh, India
(Registered under the Society Registration Act XXI, 1860)
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Message

I warm welcome to all the committee members, speakers and participants of 21 Days National Training Course On **"Opportunities in Agriculture, Animal Husbandry & Allied Sectors for Sustainable Entrepreneurship & Livelihood Security"** is going to be organizedby Agro Environmental Development Society, Majhra Ghat, Rampur, Uttar Pradesh (India), National Bank for Agriculture and Rural Development (NABARD) Gwalior, M.P. & Centre for Agribusiness Incubation and Entrepreneurship, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (Madhya Pradesh) India, during July01-21, 2021via virtual mode. Throughout the training course, many ideas and issues related to sustainable development will be deliberated in the field of Agriculture, horticulture, animal husbandry and allied sectors and training will be very productive to all the participants specially in the perspective of inclusive and sustainable development and I am very grateful to all those who are going to join this training course in huge numbers.At present AEDS is associated with the various national and international institution and playing important role to motivate students, young researchers and encourage entrepreneurship as well as sustainable development in the field of agriculture and allied sectors so far asagriculture is the backbone of our country.

We are seeing that in spite of different research and technology, the production of agriculture is falling. Since, we need to understand that whatever technology & research is coming how to be sustainable in the agriculture and allied fields.

Therefore the 21 Days National Training Course On **"Opportunities in Agriculture, Animal Husbandry & Allied Sectors for Sustainable Entrepreneurship & Livelihood Security"** will provide innovative ideas of entrepreneurship in the field of agriculture and allied sectors to all the participants.

[Dr. Chhatarpal Singh]

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Message

It was a matter of great honor for me that Agro Environmental Development Society, UP, India has organized the National Training Course on "21 Days National Training Course On "Opportunities in Agriculture, Animal Husbandry & Allied Sectors for Sustainable Entrepreneurship & Livelihood Security" by online mode during 01-21July, 2021.

It was little bit tedious work for me to assemble all the stake holders that was from different backgrounds on a common platform but by the time it get easy with the help of other organizing team members and off course the esteemed resource persons from different backgrounds. I am very happy to present all the lectures of resource persons and blending in one garland in the form of a training manual so that it may help all the stakeholders in future also.

I sincere thanks to all the members of various committees for their invaluable support and suggestions to make this National Training Course a grand success.

I am again delighted to thanks all the trainees to make this training a great success by your patient following the lectures and great discussion with resource persons and wish you all a great future endeavor in your carrier.

[Md. Nadeem Akhtar]

Contents

Chapter - 1

Importance of Farmers Producer Company for livelihood wellbeing of small farmersAnirban

Mukherjee[1], Shreya Anand[2], Kumari Shubha[1], and Ujjwal Kumar[3]

[1]Scientist, ICAR-RCER, Patna-800014 Scientist, [2]Ph.D. Scholar, Agricultural Extension, Visva-Bharati University, Santiniketan, West Bengal,[3]HoD, Division of Socio-economics and Extension, ICAR-RCER, Patna-800014

There is a rising concern that the farmers organizations can act as a potential driving force for agricultural and rural development. Farmers' organizations are working as 'engines' of development that can uphold the pennon of development even ahead of local level, offering benefits to the rest of society. The Farmers' Producer Company concept has emerged as a new generation farmer's organization in India. It was introduced in 2002 by introducing a new part IX A into the Companies Act 1956 under the chairmanship of economist Y. K. Alagh (Alagh, 2007). Since then Indian farmers got a new opportunity to leverage farming towards livelihood sustainability. The first producer company was registered in 2004 and afterwards it has been a long journey to reach the number of 1048 up to 2017. It has flourished in almost all sectors in agriculture viz. crop, dairy, poultry, horticulture, fishery and many more. As per the companies act, 2002, section 58 1B, the main objectives of Producer Company are procurement of inputs, production, harvesting, grading, pooling, handling, storage, marketing, selling or exporting the primary produce of the company members or import of goods or services for them in addition, processing of produce of members, manufacturing, sale or supply of machinery, consumables, conducting training and awareness programme, insurance of crop and livestock and providing guidance for efficient natural resource management etc to members (ASA, 2009).

Any ten or more individuals, with each being a primary producer and or any two or more primary producer's institution can form a Farmers Producer Company (FPC) by registering it under Indian companies Act 2002, and hence the name ends with “Producer Company Limited”. The membership and ownership of the company is held by only primary producers. Members equity cannot be traded, however, it can be transferred with the permission of board of directors.

The Farmers Producers' Company enables farmers to organize as collective, provides a business outlook to agriculture and links to market. The cooperative experience in India has not been a very pleasant one, as cooperatives have largely been state promoted, with a focus on welfare rather than business on commercial lines (Dabas, 2003). Even though several states have introduced parallel cooperative laws, and the union laws, too, have been made more liberal, the pace of reform has been far too slow. Several states have resisted all efforts at reforms. There appears to be a growing awareness among policy makers that supply side solutions to agriculture (in the form of additional units of credit, seed, fertilizers, price incentives, technology supply etc.) must be balanced with investment on the demand side i.e. in the capacity of farmers to build and manage institutions of their own, which can then develop locally relevant strategies to address problems and challenges. Farmers Producer Companies (FPCs) have emerged as one class of institutions that hold tremendous promise in fulfilling this role.

Table 1: Comparisons of existing groups and organizations with Farmers Producer Company

Factors	Cooperatives	Private Company	Farmers Producer Company (FPC)	Farmers group (SHG, FIG, JLG)
Registration	Cooperative Societies Act	Indian Companies Act	Indian Companies Act	No formal registration required
Membership	Any ten or more individuals not belonging to the same family, cooperatives	Two or more individuals Need not be a primary produce	Any ten or more individual, group, association, must be producer of the goods or services	Any ten or more individuals
Objective	Single objective	Multiple objectives	Multiple objectives	Multiple objectives
Area of operation	Limited to villages, districts, maximum to state level	Can operate across the country	Can operate across the country	Limited to villages, maximum up to districts
Role of registering authority	Significant	Minimal	Minimal	Minimal
Voting rights	One member, one vote, but government and registrar of cooperatives hold veto power	Governed by the Article of Association	One member, one vote, members not having membership cannot vote	No formal voting decision taken based on open meetings
Reserves	Created if there are profits		Mandatory to create every year	Mandatory to create every year
Scope of business tie -ups with other organizations	Mandatory to make business agreements with the same type of organization	Has business flexibility as per their Article of Association and not restricted by law	The company can make agreements with any other business organization on national or international level	Limited
Share	Non tradable	tradable	Not tradable but transferable limited to members on par value	Not Applicable
Borrowing power	Restricted	Full freedom lies on board of directors	More freedom and alternatives	Full freedom on members
Government control	Highly patronized to the extent of interference	Minimal, limited to legal requirements	Minimal, limited to legal requirements	Minimal

Source: Authors compilation from ASA, 2009, Murray, 2009

Advantages of Farmers Producers Company

- FPC utilizes economies of scale which reduces the cost of production
- Better negotiation and bargaining positions of members farmers are reported in FPCS (Murray, 2009; Venkattakumar et al., 2017).
- Capacity building of members are one of the important moto that followed in majority of FPCs
- Vertical and horizontal coordination and value chain management are key activities enhancing income of farmers
- Enhance producers share in consumer's rupee by means of reducing the length of value chain.
- Risk mitigation through cooperative risk sharing mechanism.
- Diminish cost of seeking information
- Empowering small and marginal farmers economically and socially (Trebin, 2016, Venkattakumar et al., 2017).
- Provides technical help in production and creation of social capital.
- FPC has tremendous potential to protect small farmers from ill effects of globalization

Services provided by Farmers Producer Company

Fig 1: Services Provide by Farmers Produce Company to the farmers

The Farmer Producer Companiesare providing several services to its member farmers (Fig 1). The services are production, organization, financial help, technological services, social services, educational services, marketing, resource management, general well being and policy advocacy etc. In case of production, the FPChelp in providing the inputs like seeds, inputs at the doorstep at the right time even at lesser than the cost of market to the member farmers which help in produce the commodities in a well planned manner. It helps in organization of farmers and does several activities to make a healthy organizational environment which encourages free flow of ideas of agri-businesses from the farmers' members for the betterment of the organization as a whole. It also helps in financial services particularly in case of taking loans from banks because generally bank prefers disbursing group loan than individual loans. It also provides several technological services in crops, animal husbandry, fishery and other enterprises that the FPC holds.Furthermore, it helps in social awareness and general well-being of farmers by arranging several health and awareness camps.Some companies take role in educational development of the member farmers and their family by helping them to admit in good schools and colleges and helps in providing educational loans. The marketing is most important part of FPC where the CEO, appointed by the company, helps in marketing of the produces/products which interns fetch a good amount of money as a profit to the company.The profit is distributed to the members as a bonus or dividend at the end of the years.It also helps human resource development through need based training for farmers in several Research and educational organizations like ICAR institutes, state agricultural universities, KVKs etc.

Livelihood wellbeing through FPCs:

Livelihood is defined as the all round development of person which includes development means of securing the basic necessities -food, water, shelter and clothing- of life. Livelihood is defined as a set of actions execute to live for a given life span, involving securing food, shelter, clothing and the capacity to acquire above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity.

Here livelihood development or well being has been calculated through a structured index. The index was made by including the several parameters such as natural capital, physical capital, economic capital, human capital, social capital and political capital. In case of natural capital land and other natural assets were taken for account (table 2). The physical capital was assessed through the assets of households like cattle, vehicles, machines etc. In case of economic capital income generation activities, increase in businesses, savings, bank balance etc were measured.Changes in human capital were measured through number of training attended by the farmers, family health status changes and changes in the educational pattern of the farmers wire observed in case of social capital social interactions among the farmers social Cohesion and increase in social contacts are measured in case of political capital participation in village building activities and other development activities are the members wire participated actively and shared his or her opinion for the development of society was counted

Table 2: Livelihood wellbeing parameters and its components

Livelihood wellbeing parameters	Components
Natural Capital	Land and other natural assets
Physical Capital	Cattle, house, vehicles, machines
Economic Capital	Income generation activities, business, savings, bank balance
Human Capital	Training, family health, education
Social Capital	Social interactions, cohesions, contacts
Political Capital	Participation in village building activities

The results indicated that (Fig 2) the FPC has significantly influenced social capital, followed by political, human and economic capital. Whereas there is no such significant difference were found in case of physical and natural capital.

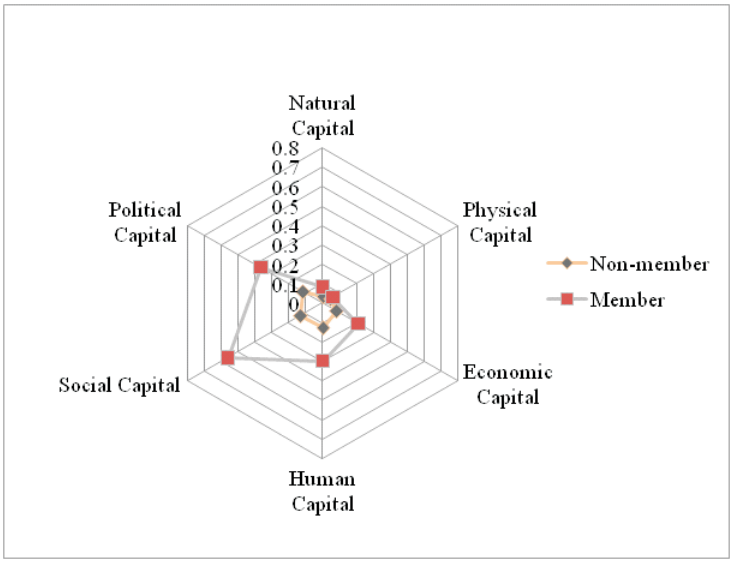

Fig 2: Comparison of livelihood wellbeing between FPC member and non FPC member farmers

Conclusion

Farmers produce companies are the best amalgamation of private company with cooperative. It has chosen the best functions from these two organization having market outlook with the motto of all-round empowerment of farmers. The company id own by the farmers run by the farmers and working for development of the farmers. Small and marginal farmers are being highly benefited through the Farmers Producer Company.

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Chapter - 2

Strategy for profit making Agriculture business and Entrepreneurship development

Anirban Mukherjee[1], Kumari Shubha1, Shreya Ananad[2]
[1]Scientist, ICAR-Research Complex for Eastern Region, Patna, Bihar; [2]Ph.D. Scholar, Agricultural Extension, Visva-Bharati University, Santiniketan, West Bengal

What is entrepreneurship?

- Entrepreneurship is the creation or extraction of value.
- Entrepreneurship is viewed as change, which may include other values than simply economic ones.
- Entrepreneurship as the process of designing, launching and running a new business
- Entrepreneur is an entity which has the ability to find and act upon opportunities to translate inventions or technologies into products and services

"The entrepreneur is able to recognize the commercial potential of the invention and organize the talent, capital, and other resources that turn an invention into a commercially viable innovation".

Phase of entrepreneurial Growth

There are mainly five phases of entrepreneurial growth. Idea, conception, commitment, validation and scaling are the five phases. In the idea stage a new concept /product is identified to solve a particular problem. Like UBER find the problem of whole day booking of taxi for a small trip. And they found the concept of shared taxi, similarly OYO found problem of trusted luxury room availability in cheap price etc. The next phase is conception in which the product, partnership and process are worked out. Then commitment phase where the idea is implemented in a small scale. In next phase it validated by the way of its performance and customer's feedback and acceptance parameter. Based on that scaling is done. The scaling is most important phase of entrepreneurship where investment is required technology is required and efficient management is required.

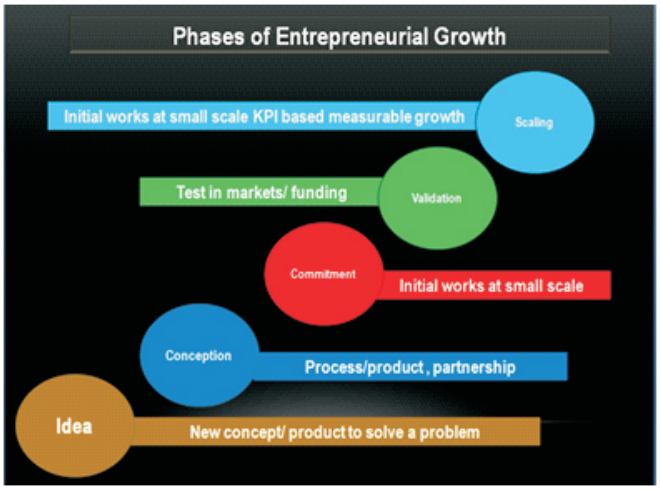

Fig 1: Phases of Entrepreneurial Growth

Traits of successful entrepreneurs

1. Passion

This is the most significant characteristic that every entrepreneur has, and for obvious reasons. They are successful because they love what they do. These entrepreneurs put all the extra hours they have into the business to make it successful and flourish. It is a pleasure for them to see the results of their labor, which goes well beyond the money received.

People like this are always researching and reading things to find strategies in how they can make their business better.

2. Strong work ethic

Entrepreneurs who are successful make sure that they are always the one who is first to the office and the last one to leave.

These people are those who ensure that they come to the office during their off days, if needed, just to ensure that the outcomes meet their expectations. The successful entrepreneurs are those who always have their mind in their work, even if they are not in their workplace.

3. Strong people skills

A successful entrepreneur is someone who has excellent communication skills for selling the products to customers and motivating the employees. Yes, most entrepreneurs who have the power to motivate their employees can see their business grow within no time. These entrepreneurs are also great at instructing others to be successful and highlighting the advantages of any situation.

4. Determination

The successful entrepreneurs are never greatly impacted by the defeats they encounter. For them, failure is like an opening for a success story, and hence, they try again and again just till they get the success they are expecting. Moreover, these entrepreneurs are not wired to believe that some things are not possible and cannot be done.

5. Creativity

One of the main aspects of creativity is the ability to find a relationship between two unrelated situations or events. They usually come up with the solutions of these problems that are a combination of other things. These people normally re-purpose the items for marketing them to new industries.

6. Competitiveness

The number of companies formed are increasing every month and every year, as every entrepreneur feels that they can do a much better job than others. They run with the aim that they need to win at the sport they play and win the business that they are creating or have created. It is an entrepreneur that highlights the track record of success of their company.

7. Self Starter

Every successful entrepreneur knows that if something has to be done, it needs to be done by themselves. Parameters are set by them, and they ensure that the projects are following that path. They do

not wait for someone to permit them and are highly proactive.

8. Open Minded

For those entrepreneurs that are successful or are following others who have been successful, understand that each situation and event is a business opportunity. There are new ideas that continually come out regarding new potential businesses, people skills, efficiency, and workflows. These people have the capability to see all that is around them and direct the focus towards their objectives and goals.

9. Confidence

A successful entrepreneur never asks the question or keeps doubts in their mind about if they can succeed or if they are even worthy of success. They are normally confident enough that their knowledge and their know-how will help them make their business idea a success. And they radiate this confidence in everything that they do for the business.

10. Disciplined

Successful entrepreneurs always focus their energy on making the business work, and for eliminating the distractions or obstacles to their goals. Their overarching strategies help them to reach the goals they have while they outline the plan to achieve the final outcome. Moreover, entrepreneurs become successful as they are disciplined to always make new steps every day towards the accomplishment of their goals.

Process and techniques of market search

Here is a streamlined process guide.

Make a plan: Without a plan, you'll waste the time of your potential customers and they will get frustrated. A general plan will look much like the following:

Write out the goals and objectives of the Market research, and a detailed description of the research technique.

Market Research for entreprenureship

- Define recruitment criteria for interviewees.
- Develop supporting content (e.g. discussion guide, landing page, online survey, etc.).
- Recruit subjects.
- Run the research program.
- Digest results, next steps.
- Of these items, the discussion guide is often the most overlooked for its value. You should constantly update it.
- The sourcing process requires creativity, but here are some ideas to help you generate leads:
- Physical watering holes: While digital watering holes can be convenient, you need to get out of your office and interact directly with people.
- LinkedIn or Facebook groups: You can usually find a group that is tied to your target customer.
- Blogs or online discussions.
- Industry groups and membership lists.
- Ads: Advertise on Google or Facebook, targeted at specific demographics, for as little as $20 to get the names of interested people. If no one responds, that is important information too.
- Read publicly available information: When you do your secondary research, you will likely run across some names linked to your market. Write those names down and contact them.
- The last question: Your last question at the end of each interview should be "Who else do you know that I should speak to? Would you be willing to make an introduction?"

Agriculture Business categories

Agriculture Business can be divided into three broad categories :

1. **Productive Resources:**feed, seed, fertilizer, equipment, energy, machinery etc.
2. **Agricultural Commodities:**raw and processed commodities of food and fiber.
3. **Facilitative Services:**credit, insurance, marketing, storage, processing, transportation, packing etc.

Conclusion

For a successful business set up under agricultural sector, the entrepreneurs should follow the phases very crucially. It is very much important to find out the problem first. It is evident from different case studies that the enterprise has become very successful when it was efficient in solving the problems of customers as well as market. Therefore all the budding Enterprise should follow the phases entrepreneurship development starting from the ideation to conception then commitment to most importantly validation and scaling.

Market research is one of the most important steps in entrepreneurship development. Because without marketresearch, it is impossible for a product to become sustainable for long term. It is the customers, who are the real judges for the product. The performance of an entrepreneur should depend on the sales volume and popularity e there for market research is very important and for which in this modern day's social media marketing can be helpful.It is cheaper and can reach to millions of people in very short time frame. An entrepreneur should explore that too for success.

Chapter - 3

Entrepreneurship development of women farmers in Horticulture Sector

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Horticulture sector plays an integral role in development of Indian agriculture. Presently, the sector contributes around 30 % of the country's agricultural GDP from 8.5 % of total cropped area. The diverse agro-climatic conditions and rich biodiversity of the country facilitates the production of wide range of horticultural crops. The sector encompasses a wide range of crops viz., fruits, vegetables, flowers, spices, plantation crops, medicinal and aromatic plants. India contributes significantly worldwide in the production of horticultural products, contributing around 11% of and 15% of world's vegetables and fruits production, respectively. The sector is well known for its prospective to enhance the farm income, ensure livelihood security and earn foreign exchange. It is expanding at an enormous rate in terms of area expansion and quantity production. Even the consumption of fruits and vegetables has increased at a rate of 18-23 % and 10-20% in rural areas during the last decade (Jhaet al, 2019), however there exist a gap between the actual per capita availability of fruitsi.e., 95 g/day and the ICMR recommended per capita intake i.e. 120 g fruits /day. This ascertains that the sector is developing at a faster pace with a wider scope of sustained profitability in a long run. Horticultural sector also accounts for about 37% of the total exports of agricultural commodities, thus contributing immensely in earning foreign exchange for the country. Besides, it also provides employment opportunities to several stakeholders. As the Government of India has proposed to double the farm income by 2022, the horticulture sector has an enormous role to play in economic upliftment of farmers, sustaining their livelihood and improvising entrepreneurship scope for all its stakeholders.

Considering the potential of the sector, it is imperative to state that the sector has immense scope for growth of all associated stakeholders including the women farmers, who are closely associated with development of Indian agriculture. Women farmers contribute significantly in both farm and non-farm activities. However, they lack access to technological interventions that can strengthen their livelihood due to several social, cultural and economic constraints. Horticulture encompassing its on-farm production to postharvest operations has many innovative interventions that are women friendly and can be promising in strengthening the livelihood opportunities of women farmers. Some of the profitable technologies which can promote entrepreneurship development among women farmers include planting material production i.e. nursery raising activities along with vegetable seed production, high value vegetable production including precision farming & off-season farming, improved quality commercial fruit production and value addition.

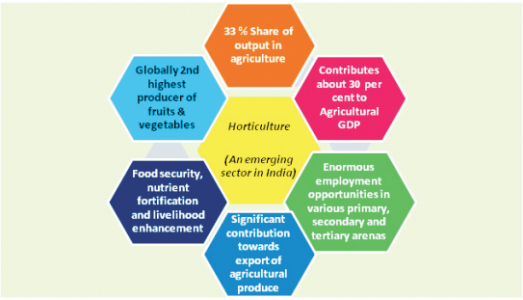

Fig 1: Scope and prospects of Horticulture Sector

Community based nursery raising activities:

Assured quality planting material is the most important critical input to initiate any plantation. To ensure supply of quality planting material, the Govt. of India has imposed stringent regulations in accreditation/ recognition of the nursery through issue of certificate of recognition to the nurseries by National Horticulture Board. Mostly there are Government and private nurseries, community-based nursery can be a popularized as a profitable enterprise for small villages/ communities at a larger scale. The enterprise can be successfully initiated by village communities, having organized plantations of established varieties of fruit crops which can be used as mother blocks/ orchards. The nursery activities are mostly women centric, which involve filling of polybags, raising of rootstocks, care and maintenance of grafts along with other nursery management practices. However, the communities are required to be supported with financial assistance in form of Govt. schemes & subsidies, skill based training & capacity building programmes for initiating the grafting and budding activities, rural infrastructure facilities in form of mother orchards, rootstock raising and grafting areas, sale outlets and storage rooms etc. Linkage of community with market channels for easy, timely and profitable disposal of their grafts and other planting materials is highly crucial for sustaining profitability of the system.

Vegetable seed production:

India accounts for 0.07 % of the total vegetable seed imports by volume in 2016 and the total import of vegetable seed is estimated to be 3.94 thousand MT by volume and USD 82.64 million by value (India Vegetable Seed Market-Segmented by Type-Growth, Trends, and Forecast 2018-2023). Seed one of the critical inputs has also become an expensive input due to involvement of several multinational companies in its production and distribution system. This in return has devastated the farming community who are completely dependent on private companies on timely availability of vegetable seeds for successful farming. Realizing the high investment in procurement of vegetable seeds, the concept of vegetable seed village can be popularized among the farming community with special focus on landless women farmers, who can be successfully involved in the local seed network for strengthening the supply of ample quantity of quality vegetable seeds at grass root level. Vegetable seed production at their homestead areas can proof effective in ensuring livelihood security to farm families.New technologies of vegetable grafting, which is easy, cost-effective and viable is required to be popularized among the farming community to ensure that they get quality seeds and planting materials at their vicinity and at a cheaper rate. Optimum quantity of high-quality seed will be available to the farm community at appropriate time at reasonable prices. Capacity building and skill enhancement of women farmers will boost their confidence in field of vegetable seed production. This may trigger the women groups primarily engaged in seed production to evolve as successful entrepreneurs by forming women groups and producer companies. There will be tremendous growth in seed production at farmers' field thereby reducing the dependency on private seeds thus making vegetable farming more sustainable at present and profitable in near future. However, some of the major challenges in this sector include lack of rural infrastructures for optimum processing and drying of vegetable seeds and market linkages. Complexity of seed production process, lack of soil testing information, optimum plant protection measures and timely irrigation are some of the constraints for successful seed production at village level.

Good Agricultural Practices:

Quality production has become essentially important on account of growing consumers' demand due to increase in purchasing ability, awareness and health consciousness. Due to lack of quality production of horticultural commodities in the country, its share in global market is insignificant, it accounts for only 1.7 % of global trade in vegetables and 0.5 % in fruits. Sufficiency in horticulture production and productivity has been attained but quality production is doubtful on account of poor management practices by growers. Concerns about food safety and quality, environmental protection, worker safety and welfare have gained importance. In this context, Good Agricultural Practices (GAP) is essential to address the harvest quality in terms of maturity standards, residues of pesticides and other contaminants, microbial loads, etc. The concept of Good Agricultural Practices (GAP) has emerged in recent past to ensure quality production to meet the requirements of global markets in the scenario of a rapidly changing and

globalizing food concerns and in keeping up commitments of a wide range of stakeholders in relation to quality food production, food safety and in maintaining environmental sustainability. According to the Food and Agriculture Organization (FAO), GAP is the application of existing knowledge to address environmental, economic and social sustainability for on-farm production and post-production processes resulting in safe and healthy food and non-food agricultural products. Many farmers in developed and developing countries already apply GAP through sustainable agricultural methods such as integrated pest management, integrated nutrient management and conservation agriculture. The country has enhanced its horticultural production but it's high time for the horticultural growers to secure entry of their farm products in global markets by upgrading their produce quality to meet international standards. In this context, the farmers should orient themselves into Farmer Producer Groups (FPOs), adopt Good Agricultural Practices of their crops in a larger scale and ensure the timely export of their consignments to international markets. The farmers groups with special focus on specialized groups of female farmers can be skilled on organic farming, permaculture, precision farming and off-season protected cultivation practices to enhance their produce quality for catering the demands of diverse group of consumers.

Value addition:

Food processing coupled with allied interventions including post-harvest management, cold-chain, logistics & distribution are integral component for ensuring efficient food supply chain for any country. With change in life style, there has also been shift in consumer's preferences for processed food products on account of busy scheduled life style, change in dietary habits, and increase in purchasing capacity of middle-income group. On one hand there is a need to feed the expanding population by increasing food production and in other hand there is a challenge to reduce post-harvest losses. At the same time there is also a need to create livelihood opportunities for vulnerable communities. Post-harvest management and processing of horticultural crops can be one of a sustainable approach to bridge the gap between supply and production of Horticultural produce along with ensuring income opportunities for the poor landless farming communities. Post- harvest losses of fruits and vegetables accounts to be 30 %. Value addition has ample scope in sustaining livelihood. There is always availability of raw materials in bulk quantity during its season of production, which often renders the growers or gatherers to end up with distressed sale, while a huge quantity is wasted due to poor transportation and cold storage facilities. These wastes can be diverted into wealth by integration of suitable location specific, economically viable and consumers' preference aligned post-harvest technologies. Besides, the commercial horticultural crops, the country is also blessed with wide varieties of under-utilized fruits and vegetable crops which can also be processed into several value-added products. It has been observed that women form the bulk of the labour force in the horticultural processing units, but they are concentrated in unskilled and low-paying jobs. They are often considered as temporary workers or have casual employment status. Women are not involved in commercial level of processing, as they lack technical knowledge and skill (Vermaet al. 2014). Post-harvest handling and processing to produce value added horticultural products can be a sustainable livelihood option for many landless women farmers and rural youth with suitable institutional support, appropriate hand holding and with an assured market.

Challenges in the horticulture sector:

There exist several challenges in the sector, which include fragmented supply chain of quality inputs viz. seeds, planting material and other critical inputs, high transportation cost, inadequate storage facilities, cold storages etc., lack of cold chain facilities i.e. provision of refrigerated vans, poor marketing channel, fluctuating market prices, poor quality produce, huge post-harvest losses, poor value addition, lack of processing infrastructure facilities at production sites and several others which have increased the risk of investment by poor farmers in the sector. There is a steady growth in the sector, however, the progress in the sector can be hastened and a regular flow of substantial income to the growers can be assured with suitable Govt. schemes and policies. There is a need to create better infrastructure facilities at village level for promoting protected cultivation, mechanized & precision farming. The quality production of horticultural crops should be strengthened through supply of quality inputs and training on Good Agricultural Practices. Encouraging community-based nursery raising activities, promoting post-harvest operations

& processing activities through provision of suitable post-harvest infrastructure facilities in rural areas are challenging aspects in terms of overcoming the socio-cultural, economical and logistic constraints. As the demand for horticultural commodities in increasing at a faster pace on account of consumers' rising income and growing interest in a variety of fresh fruits and vegetables, the sector has ample scope, avenues and enormous space to encompass a wide population of rural women and youths thus enabling them in stabilizing their farm income and enhancing their livelihood options.

Fig 2: Socio-cultural, economic, environmental and technological constraints of women farmers

Conclusion:

Horticulture sector has several avenues to sustain livelihood and promote entrepreneurship among the farming community. To facilitate the benefit of the sector, there are several policies and schemes. Women farmers are one of the major stakeholders of the sector and play a predominant role in various on-farm and off-farm activities. Strengthening the women farmers with appropriate technologies will empower them and motivate them to develop as successful entrepreneurs. It is essentially required to enrich their strengths, work upon their weaknesses, provide them with ample opportunities and mitigate their threats. A strong collaboration of all the R&D stakeholders is necessary to provide the required front-ended and back-ended support in agriculture and marketing to women farmers. For successful entrepreneurship sustenance among women farmers, adequate market support and industrial linkage is also vital. In the changing agricultural scenario, where conventional farming has transformed to commercial agro-enterprise, it is crucial to alter the roles of women farmers from meagre agricultural workers to successful agri-entrepreneurs.

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Chapter - 4

Agriclinic and Agribusiness Centers for Rural Youth Employment

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Agriculture remains the mainstay of Indian economy and provides the underpinning for our food, livelihood security and support for the economic growth and social transformation of the country. Nearly half of Indian population is still dependent on agriculture and allied sector for its employment and It also contributes almost 18% of GVA (Gross Value Added) in Indian Economy at current prices (Economic Survey of India 2016-17). Agriculture today faces many challenges which include globalisation and market liberalization, food price crises, natural resource depletion, climate change, rapid urbanization, changing production and consumption patterns, demographic changes etc. More recently, market driven agriculture production is need of the hour since marketing has become a challenge for small farmers. Quality product has to be produced in order to fulfill demand of modern generation and for remaining highly competitive with the world. Agripreneurship development can be key in this scenario. Agripreneurship refers to entrepreneurship in agriculture. Entrepreneurship is a concept that encompasses transforming an idea or vision into a "new business or new venture creation, or the expansion of an existing business, by an individual, a team of individuals, or an established business" (Reynolds et al. 1999). Entrepreneurship has traditionally been defined as the process of designing, launching and running a new business, which typically begins as a small business, such as a start-up company, offering a product, process or service for sale (Yetisen et al. 2015). Entrepreneurs are usually creative, take opportunities and accept risks, and can quickly change business strategies to adapt to changing environments. They are often innovators (Kahan, 2012). As per Butler (2006), an entrepreneur is a complex combination of some interacting factors. For instance,

- Personality: In terms of possessing resilience, tenacity, opportunity spotting, and risk taking;
- Attitude: Having awareness of the importance of customer focus, the application of creativity and imagination, defined personal standards and values, the perception of enterprise as a positive activity;
- Skills: such as the ability to network, to think strategically, to gain access to resources, business knowledge and acumen, interpersonal skills and people management capabilities;
- Motivation: personal drive and ambition, the desire to make an impact, the need for achievement or self satisfaction, a desire for status, to create and accumulate wealth, and social responsibility

While usually being innovative and creative, farmers often lack experiences, access to services, people, or markets, and skills to have realistic chances to succeed as entrepreneurs (Wongtschowski et al. 2013). Each year, nearly 17000 agri. Graduates pass out from different State Agricultural Universities and other recognised Universities. Out of these, nearly half get employed/goes for higher education and rest remain unemployed. Therefore, Ministry of Agriculture, Govt of India felt the need for utilization of this unemployed but trained manpower for providing privatized extension services to farming community. as well as providing them employment opportunities. In this backdrop, an innovative scheme called Agriclinic and Agribusiness Centre (AC & ABC) was launched by Govt. of India in collaboration with National Bank for Agricultural and Rural Development (NABARD) on 9th April, 2002. The overall responsibility of implementation of this scheme was given to National Institute of Agricultural Extension Management (MANAGE), Hyderabad. The scheme is aimed at development of Agri-preneurs through training, establishing agricultural ventures.

Basic Concepts

Agri-clinic: The ventures which provide expert services and advice to farmers on cropping practices, technology dissemination, crop protection from pests & diseases, market trends and prices of various crops in the markets and also clinical services for animal health etc. are called Agriclinic. Effective services of Agriclinic would

ultimately enhance the productivity of crops/animals.

Agribusiness Centres: These are the commercial ventures to provide input supply, farm equipments on hire and other services. The major aim is to provide employment to trained agriculture graduates.

In order to enhance viability of the ventures, Agriculture Graduates may also take up in agriculture and allied areas along with the Agriclinics/Agribusiness Centres under the AC & ABC Scheme.

Objectives of AC & ABC Scheme

1. To supplement efforts of public extension by necessarily providing extension and other services to the farmers on payment basis or free of cost as per business model of agri-preneur, local needs and affordability of target group of farmers.
2. To support agricultural development; and
3. To create gainful self-employment opportunities to unemployed agricultural graduates, agricultural diploma holders, intermediate in agriculture and biological science graduates with PG in agri-related courses.

AC & ABC Model and Stakeholders involved in implementation

The scheme is operated by different entities that perform their individual task to operate the scheme in a successful manner. Below is the diagrammatical explanation of the roles and responsibilities of each entity in the flow of the scheme.

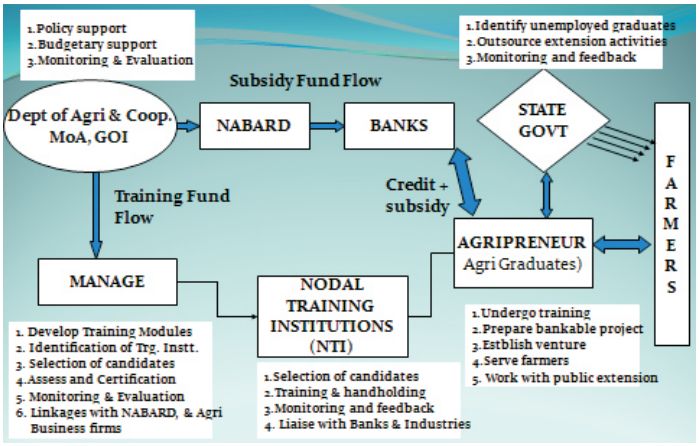


Fig.: AC & ABC Model with all stakeholders and their functions

DoAC & FW: Dept. of Agriculture Cooperation and Farmers Welfare, Govt of India provides the fund for this scheme through its extension division.

MANAGE: National Institute of Agricultural Extension Management, Hyderabad is the monitoring and overall implementing agency of this scheme. It is responsible for reviewing the performance of the nodal institutes; decide upon the training content, methodology and duration. Be a part of the selection committee for choosing the eligible candidates and set criteria for selection of nodal institutes.

Nodal Training Institutes (NTIs): These are institutes selected by MANAGE for conducting the training programmes for selected agriculture graduates and assist them in preparing bankable project. Once the project is over, it assist them in sanctioning of loan and successfully setting up of the ventures. There are a total of 140 NTIs identified by MANAGE which includes SAUs, State Govt. Institutes, NGOs, Agribusiness company, Institutes of Cooperative Management and Krishi Vigyan Kendras.

Banks: Banks could be nationalized/ commercial/cooperative and regional rural banks who would be the financing institution in the scheme. They are responsible for processing loan proposals and provide loans on approved proposals to the trained agriculture graduates. In addition to providing loan to the agripreneur, they are also responsible for implementing announced policy on providing credit to such proposals.

NABARD: National Bank for Agricultural And Rural Development is the nodal institute for banks who is responsible for monitoring credit support to Agri clinics through the above mentioned banks. It is also responsible for extending refinance support to the banks under the scheme.

Agripreneurs: Agripreneurs are the ultimate beneficiary of the scheme. They are agriculture graduates, post graduates and even doctorates who undertake training under this scheme and provide specialized extension and other services on fee-for-service basis and to supplement the efforts of public extension by providing economically viable enterprises in self employment mode.

Input Industries: Input industry is an allied industry which can provide dealership, input stocking support etc. to the agri-entrepreneurs thereby creating a regular source of income for them.

State Govt: Their participation comes in the form of providing priority to trained graduates in grant of license for agri-inputs; facilitate involvement of ACABCs in extension services.

Progress of the AC & ABC Scheme

The scheme is operational in India since 1st April, 2002. A lot of agriculture graduates have been trained and many of them started their business ventures. This has been a journey of nearly 17 years. Therefore, we need to look on the salient achievements of the scheme since its beginning.

Trainings conducted and Commercial Ventures Established: A total of 72,784 Agriculture graduates have been trained by different Nodal Training Institutes from 1st April, 2002 till 29th October, 2020. Out of these, 30,567 candidates established their business ventures in different areas of agriculture and allied sectors like animal husbandry, dairy, poultry, goatery, fisheries etc. It can be observed that overall, 42% of trained agri. Graduates started their enterprises while 58% did not started their ventures due to various reasons. States from Northern India and Souther India fared better as compared to other parts of the country. Maharastra, UP, Tamil Nadu and Karnataka were top four states where this AC &ABC programme was implemented successfully. States from North East fared very poor due to non cooperation of the bank.

Table 1: State wise progress report till 29/09/2020

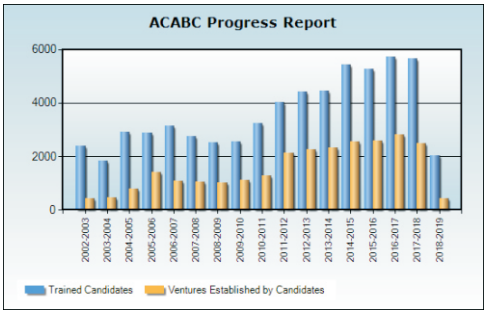
S. No.	State	Trained	Ventures established	Success %*
1	Andhra Pradesh	1373	333	24.25
2	Arunachal Pradesh	35	3	8.57
3	Assam	756	227	30.03
4	Bihar	4078	1398	34.28
5	Chandigarh	4	1	25.00
6	Chattisgarh	905	335	37.02
7	Delhi	37	6	16.22
8	Goa	13	7	53.85
9	Gujarat	2065	767	37.14
10	Haryana	721	235	32.59

11	Himachal Pradesh	422	108	25.59
12	Jammu and Kashmir	1491	191	12.81
13	Jharkhand	771	186	24.12
14	Karnataka	4152	1676	40.37
15	Kerala	239	51	21.34
16	Madhya Pradesh	4043	1561	38.61
17	Maharashtra	18222	9149	50.21
18	Manipur	472	128	27.12
19	Meghalaya	36	3	8.33
20	Mizoram	35	0	0.00
21	Nagaland	184	21	11.41
22	Orissa	625	114	18.24
23	Pondicherry	139	84	60.43
24	Punjab	666	218	32.73
25	Rajasthan	3833	1391	36.29
26	Sikkim	9	1	11.11
27	Tamilnadu	7894	3817	48.35
28	Telengana	1793	426	23.76
29	Tripura	5	1	20.00
30	Uttar Pradesh	16070	7672	47.74
31	Uttaranchal	506	162	32.02
32	West Bengal	1190	296	24.87
	Total	72784	30568	42.00

Source: http://www.agriclinics.net/OtherDocuments/state-wise.pdf * Authors calculation

Activity wise ventures established in the scheme

There were 32 activities related to agriculture and allied fields identified under this scheme for establishing business ventures by the trained agriculture graduates. These activities were framed in such a way that they can contribute in overall development of agriculture by providing extension services to farmers. The progress of establishing agribusiness ventures is given below:



Source: : http://www.agriclinics.net

Activities like AC& ABC, dairy, vermicomposting and crop production are amongst the most popular projects. The Agri-Clinics and Agri-Clinics and Agribusiness Centres together contributed 43.7% of total number of ventures established. The popularity of the Agriclinics projects is mainly because of low investment and low risk.

Table 2: Activity wise agro-ventures established under the scheme (till 29/09/2020)

Sl No.	Name of Activities	No. of ventures	Sl No.	Name of Activities	No. of ventures
1.	Agri-Clinics	5027	17	Value Addition	490
2.	Agri-Clinics and Agribusiness Centres	8334	18	Fisheries clinic	21
3.	Agro-Eco Tourism	21	19	Seed Processing and & Agri-business	388
4.	Animal Feed Unit	60	20	Soil Testing Laboratory	111
5.	Bio-fertilizer production and Marketing	177	21	Tissue culture unit	28
6.	Contract Farming	112	22	Vegetable production & Marketing	436
7.	Cultivation of Medicinal Plants	114	23	Vermi Composting / Organic manure	548
8.	Direct Marketing	171	24	Veterinary Clinics	945
9.	Farm Machinery Unit	831	25	Crop production	339
10.	Fisheries Development	399	26	Dairy/Poultry/Piggery/Goat etc	10327
11.	Floriculture	116	27	Rural Godowns	58
12.	Horticulture Clinic	181	28	Production & Marketing of Bio-Control Agents	34
13.	Landscape + Nursery	114	29	Agriculture Journalism	23
14.	Nursery	616	30	Sericulture	64
15.	Organic Farming	166	31	Mushroom Cultivation	140
16.	Pesticides Production and Marketing	72	32	Apiary	104

Source: www.agriclinics.net * Total no. of ventures established-30567

Reasons for non starting of project

A mid term evaluation of the project by Global AgriSystem Pvt. Ltd. During 2009 revealed that there were few main reasons for not starting any ventures by 57.5% trained graduates. It was observed that 25% of the trainees are graduates who go for further studies and they drop their plans to take up the ventures and 22% of the trained agri graduates go for an alternate job. Respondents have also attributed lack of finance, lack of bank support, non

marketability of their project concept and inadequate training as reasons for not starting the venture.

Concluson: This scheme is very good in terms of concepts and intention. If implemented properly, it can create a lot of employment opportunities to trained individuals. But Banks need to be sensitized, since many projects could not be started due to lack of finance from bank. One agri venture provides employment to many more people. Therefore, there is a need for pushing this scheme in North eastern states areas where there are many glitches. This scheme is a good option for development of entrepreneurs in agriculture and allied sector.

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Chapter - 5

Web Designing And Publishing For Agripreneur Successful Business

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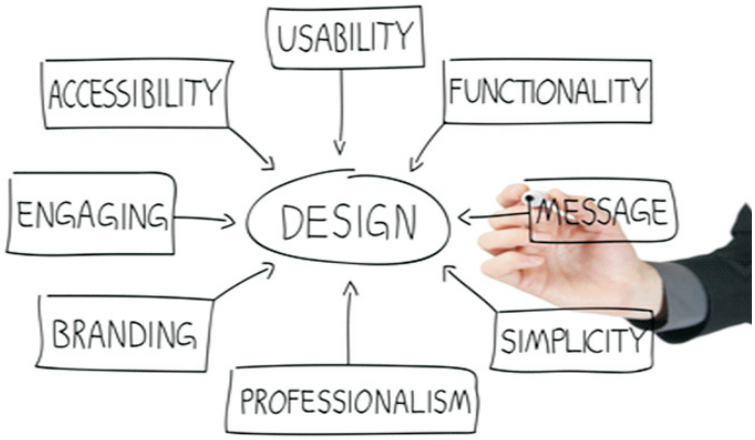
Introduction

Web design is the planning and creation of websites. This includes the information architecture, user interface, site structure, navigation, layout, colours, fonts, and imagery. All of these are combined with the principles of design to create a website that meets the goals of the owner and designer.



A web designer is a designer who designs content for media or software. The term is mainly used in web development. The duties of a content designer typically vary depending on the type of company and projects he or she is developing content for. Depending on the content format, the web designer usually holds a more specific title such as graphic designer for graphical content, writer for textual content, instructional designer for educational content, or a programmer for automated program/data-driven content. For most web designers, no matter what field of work they design for, it is likely that they create and draw up designs that are original pieces of artwork, by making their designs as relevant to what they are communicating as possible. In this industry, it is needless to say that the competitive fields of each type of design discipline, leave designers striving for higher positions, in order to increase their income. Take for example web developers, versus web designers. The difference between the two fields are that web developers deal with the non-design aspect of building websites, which includes coding and writing mark-up, and its hierarchy is as follows: client-side coding, server-side coding, and database technology. Web designers on the other hand must make decisions that affect the colour, layout and overall graphical appearance, which are influenced by the function in which they are designing it for, as well as the audience in which they wish to communicate it to.

Good web design includes typography, a distinct colour scheme, seamless navigation and the use of relevant graphics in order to make the consumption of content enjoyable, entertaining and easy for users. Content design really is a user's first point of contact with a given platform or publication. From the moment they first click to the site's homepage, web design determines what action a user will take and dictates the directional flow of their engagement. In other words, good web design helps to communicate what content is the most important, how a user should allocate their time and draws in readers while encouraging them to move to various locations on the site, increasing

engagement.

Where do I start?

Myriad roles and responsibilities typically covered under the umbrella term "web design" into four very broad categories: design, development, content strategy, and multimedia.

Design

The person calling herself the "Designer" often is responsible for more than one of these responsibilities viz.User Experience, Interaction, and User Interface design-

Often, when we think of design, we think about how something looks. On the Web, the first matter of business is designing how the site works. Before picking colors and fonts, it is important to identify the site's goals, how it will be used, and how visitors move through it. These tasks fall under the disciplines of Interaction Design (IxD), User Interface (UI) design, and User Experience (UX) design. There is a lot of overlap between these responsibilities, and it is not uncommon for one person or team to handle all three.

The goal of the Interaction Designer is to make the site as easy, efficient, and delightful to use as possible. Closely related to interaction design is User Interface design, which tends to be more narrowly focused on the functional organization of the page as well as the specific tools (buttons, links, menus, and so on) that users use to navigate content or accomplish tasks.

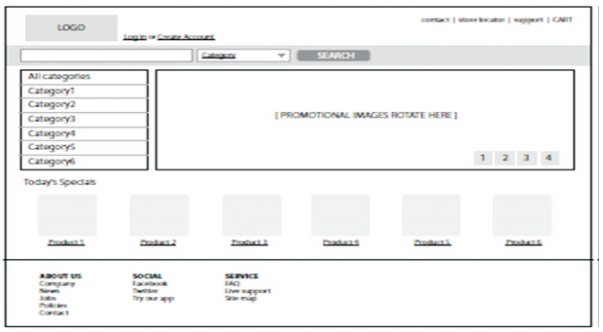
A more recent job title in the web design realm is the User Experience Designer. The UX designer takes a more holistic view—ensuring the entire experience with the site is favorable. UX design is based on a solid understanding of users and their needs based on observations and interviews.

User research and testing reports

Understanding the needs, desires, and limitations of users is central to the success of the design of the site or web application. This approach of designing around the user's needs is referred to as User Centered Design (UCD), and it is central to contemporary design. Site designs often start with user research, including interviews and observations, in order to gain a better understanding of how the site can solve problems or how it will be used. It is typical for designers to do a round of user testing at each phase of the design process to ensure the usability of their designs. If users are having a hard time figuring out where to find content or how to move to the next step in a process, then it's back to the drawing board.

Wireframe diagrams

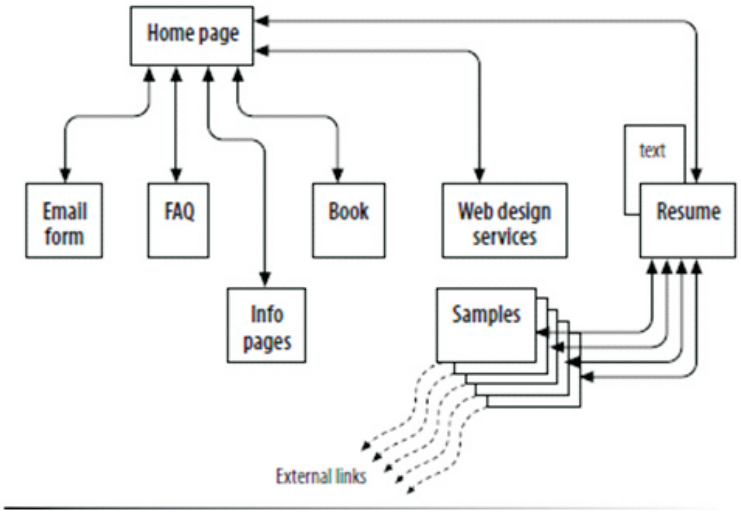
A wireframe diagram shows the structure of a web page using only outlines for each content type and widget. The purpose of a wireframe diagram is to indicate how the screen real estate is divided and indicate where functionality and content such as navigation, search boxes, form elements, and so on, are placed, without any decoration or graphic design. They are usually annotated with instructions for how things should work so the development team knows what to build.



Wireframe diagrams

Site diagram

A site diagram indicates the structure of the site as a whole and how individual pages relate to one another. Figure below shows a very simple site diagram. Some site diagrams fill entire walls.



Site diagram

Visual (graphic) design

Because the Web is a visual medium, web pages require attention to presentation and design. A graphic designer creates the "look and feel" of the site—logos, graphics, type, colors, layout, etc.—to ensure that the site makes a good first impression and is consistent with the brand and message of the organization it represents. Visual designers typically generate sketches of the way the site might look. They may also be responsible for producing the graphic files in a way that is optimized for delivery over the Web.

Development

The broad disciplines that fall under development are authoring, styling, and scripting and programming.

Authoring/mark up

Authoring is the term used for the process of preparing content for delivery on the Web, or more specifically, marking up the content with HTML tags that describe its content and function. If you want a job as a web developer, you need to have an intricate knowledge of HTML and how it functions on various browsers and devices. The HTML specification is constantly evolving, which means you'll need to keep up with the latest best practices and opportunities as well as bugs and limitations.

Styling

In web design, the appearance of the page in the browser is controlled by style rules written in CSS (Cascading Style Sheets).Cascading Style Sheets (CSS) is a style sheet language used for describing the look and formatting of a document written in a mark up language.

Scripting and programming

As the Web has evolved into a platform of applications for getting stuff done, programming has never been more important. JavaScript is the language that makes elements on web pages do things. It adds behaviors and functionality to elements in the page and even to the browser window itself.

Content strategy and creation

Anyone who uses the title "web designer" needs to be aware that everything we do supports the process of getting the content, message, or functionality to our users. Furthermore, good writing can help the user interfaces we create be more effective. Of course, someone needs to create the content and maintain it—don't underestimate the resources required to do this successfully. In addition, I want to call your attention to two content-related specialists on the modern web development team: the Content Strategist and Information Architect (IA).

When the content isn't written right, the site can't be fully effective. A Content Strategist makes sure that every bit of text on a site, from long explanatory text down to the labels on buttons, supports the brand identity and marketing goals of the company. Content strategy may also extend to data modelling and content management on a large and ongoing scale, such as planning for content reuse and update schedules.

An Information Architect (also called an Information Designer) organizes the content logically and for ease of findability. She may be responsible for search functionality, site diagrams, and how the content and data is organized on the server. Information architecture is inevitably entwined with UX and UI design, and it is not uncommon for a single person or team to perform all roles.

Multimedia

One of the cool things about the Web is that you can add multimedia elements to a site, including sound, video, animation, and even interactive games. You may decide to add multimedia skills, such as audio and video editing or Flash development, to your web design tool belt, or you may decide to go all in and become a multimedia specialist. If you are not interested in becoming a multimedia developer, you can always hire one. Web development companies usually look for people who have mastered the standard multimedia tools, and have a good visual sensibility and an instinct for intuitive and creative multimedia design.

What Languages Do I Need to Learn?

Which languages and technologies you learn will depend on the role you see yourself in within the web design process? However, I advise everyone involved in building websites to know their way around HTML and Cascading Style Sheets, and if you want to do frontend web development for a living, JavaScript know-how is pretty much a job requirement. More technically inclined web professionals may take on server configurations, databases, and site performance, but these are generally not frontend developer tasks (although a basic familiarity with the backend issues never hurts).

Hypertext Markup Language (HTML)

HTML (HyperTextMarkup Language) is the language used to create web page documents. There are a few versions of HTML in use today: HTML 4.01 is the most firmly established and the newer, more robust HTML5 is gaining steam and browser support. Both versions have a stricter implementation called XHTML (eXtensible HTML), which is essentially the same language with much stricter syntax rules. HTML is not a programming language; it is a markup language, which means it is a system for identifying and describing the various components of a document such as headings, paragraphs, and lists. The markup indicates the document's underlying structure. You don't need programming skills—only patience and common sense—to write HTML. The best way to learn HTML is to write out some pages by hand, as we will be doing in the exercises in this book. If you end up working in web production, you'll live and breathe HTML. But even hobbyists will benefit from knowing what is going on under the hood. The good news is that it's simple to learn the basics.

Cascading Style Sheets (CSS)

While HTML is used to describe the content in a web page, it is Cascading Style Sheets (CSS) that describe how that content should look. In the web design biz, the way the page looks is known as its presentation. That means fonts, colors, background images, line spacing, page layout, and so on and all controlled with CSS. With the newest version (CSS3), you can even add special effects and basic animation to your page.

CSS also provides methods for controlling how documents will be presented in contexts other than the traditional desktop browser, such as in print and or on devices with small screen widths. It also has rules for specifying the nonvisual presentation of documents, such as how they will sound when read by a screen reader.

Style sheets are also a great tool for automating production because you can change the way an element looks across all the pages in your site by editing a single style sheet document. Style sheets are supported to some degree by all modern browsers.

Although it is possible to publish web pages using HTML alone, you'll probably want to take on style sheets so you're not stuck with the browser's default styles. If you're looking into designing websites professionally, proficiency at style sheets is mandatory.

JavaScript/DOM scripting

JavaScript is a scripting language that is used to add interactivity and behaviours to web pages, including these (just to name a few):

Checking form entries for valid entries

Swapping out styles for an element or an entire site

Making the browser remember information about the user for the next time she visits

Building interface widgets, such as expanding menus

JavaScript is used to manipulate the elements on the web page, the styles applied to them, or even the browser itself. There are other web scripting languages, but JavaScript (also called ECMAScript) is the standard and most ubiquitous.

Writing JavaScript is a type of programming, so it may be time-consuming to learn if you have no prior programming experience. Many people teach themselves JavaScript by reading books and following and modifying existing examples. Most web-authoring tools come with standard scripts that you can use right out of the box for common functions.

Professional web developers are required to know JavaScript, however, plenty of visual designers rely on developers to add behaviors to their designs. So while JavaScript is useful, learning to write it may not be mandatory for all web designers.

How Website Design and Development Helps Enterprises to Make Profits

1.Saving on costs

Unfortunately, many startup and major company fail in their venture due to low profits. This is despite having great expectation of the investment made. Part of the failure is attributed to engagement of poor business tactics such as negligence of web services.

It should be known that website design and development is affordable. By properly structuring the content, the webmaster saves a lot of cost during web development. The cost saving aspect extends to the futuristic gains the website will bring to the business.

Furthermore, the website reduces the distance covered to reach out to the customers. If one was to physically talk to potential customers then it would be resource intensive. It is here that web services come in. Moreover, cutting such extra costs means that the business is accruing more profit.

2.Allowing ads on the website

Business owners must have come across the many ads been broadcasted on various website. Well, this is one of the intriguing ways a business venture can attract more profit. Basically, the company will be approached by other enterprises to have their ads run on the website.

As part of marketing and advertising, the host website will charge a certain amount to have the advert. Subsequently, it is important to come up with a unique and renowned website. By focusing on this, the webmaster gets to place the website on the limelight.The big winners here are those whose website attracts more enterprises and ads.

3.E-commerce

As stipulated before, precuts and services have shifted from the stores to online platforms. One of the profound online venues is the website.

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Chapter - 6

Importance of Ict In Agri-entrepreneurship Development

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Introduction

Entrepreneurship is one of the important factor for Agriculturaldevelopment. During an economic crisis, the importance of Agrientrepreneurshipdevelopment increases. Entrepreneurship has been linked to improvedgrowth, increased wealth and quality of life. In developing countries likeIndia, planning and implementation for development of entrepreneurialprogrammes are essential for raising the living standard of the vast majorityof the backward regions because of their over-dependence on agriculturefor employment (Uplaonkar and Biradar 2015). Thus, entrepreneurshipdevelopment appears to be the best substitute to find employmentopportunities, income generation, poverty reduction and improvements innutrition, health and overall food security in the national economy.

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 agrientrepreneurs 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.

Fig. 1 – Information Technology infusion in agri-entrepreneurship

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 sociotechnical 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.

Defining Enterpreneurship

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.

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 andconvert your farm into an agribusiness. This association of agriculture andbusiness promotes agrientrepreneurs who innovate, identify markets, andsatisfy needs by developing different ways. The term agri-entrepreneurshipis similar with entrepreneurship in agriculture and describes agribusinessestablishment in agriculture and allied sector (Bairwa et al., 2014a).

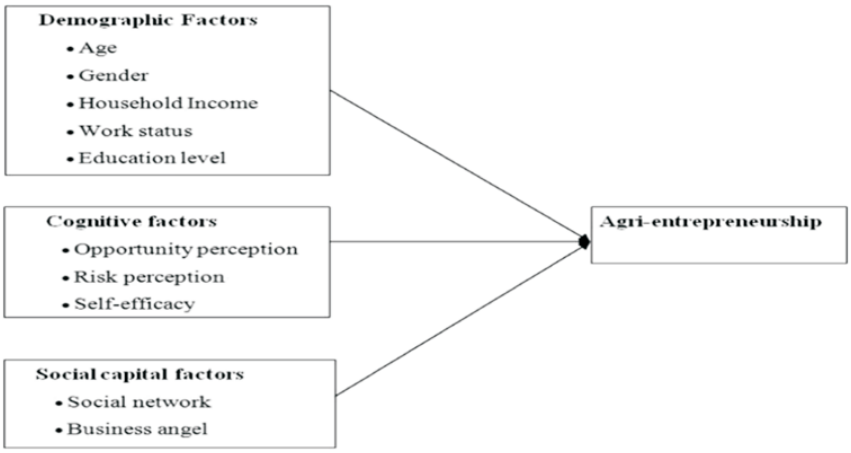


Fig. 2- Determinants of agricultural entrepreneurship

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

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 trainedAgri-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 highquality 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.

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 agribusiness 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 agripreneuership'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-

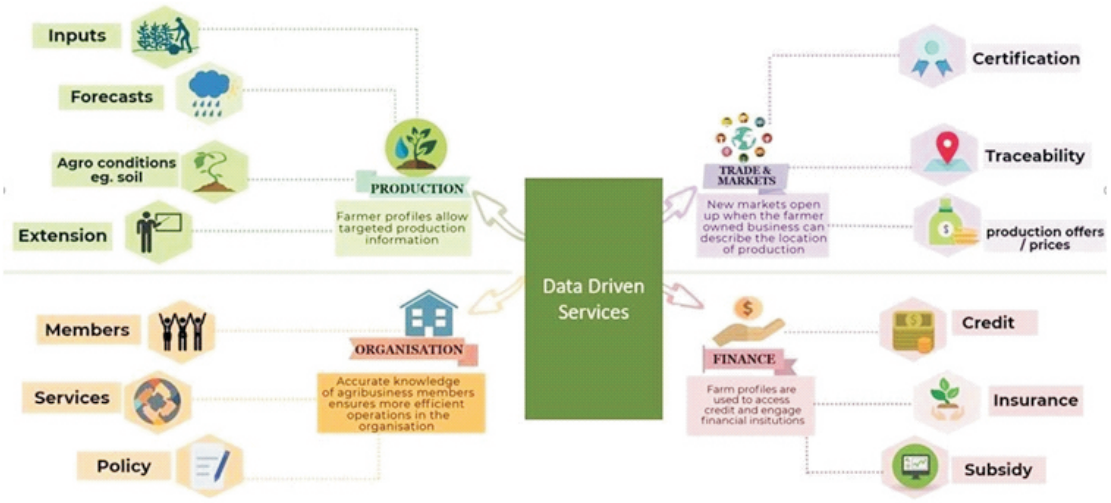


Fig. 3- Agriculture entrepreneurship: Challenges and Opportunities

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.

The Role of Agricultural Extension

According to IFPRI, agricultural extension (also known as agricultural advisory services) plays a crucial role in promoting agricultural productivity, increasing food security, improving rural livelihoods, and promoting agriculture as an engine of pro-poor economic growth.

Yet, the specific roles of agricultural extension services were enumerated here defined extension as aiming to,

- Improve the wellbeing of individuals and communities
- Change production systems so that they improve rural livelihoods and sustain the resource base
- Improve agriculture and the social, economic and political status of rural communities
- Improve the wellbeing of farm families
- Improve productivity and livelihoods for farmers
- Increase and improve farmers' incomes and productivity on a sustainable basis
- Enhance farmers' production
- Attain higher levels of efficiency in the farm enterprise
- Attain food security and improve rural livelihoods.

Definition of Information Technology: "Information Technology is a scientific, technological and engineering discipline and management technique used in handing the information, it's application and association with social, economical and cultural matters".

UNSECO:

Information technology is a systemic study of artefacts that can be used to give form to facts in order to provide meaning for decision making, and artefacts that can be used for organization, processing, communication and application of information.

Characteristics of Information Technology:Information Technology has the following Characteristics:

* Acquisition, Storage, management, transmission or reception of data or information.

* Real time access to information.

* Easy availability of updated data

* Connecting Geographically dispersed regions

* Wider range of communication media.

Communication Technology implies the knowledge, skills and understanding needed to exchange information verbally or non-verbally. It is processing of information in terms of accessing information, decoding information and sending it via a medium and changer to the receivers. Medium or channel can be written or oral or gesture form of information through speech, action or any electronic machine.

Information and Communication Technology(ICT): The term "ICT" describes the use of computer-based technology and the Internet to make information and communication services available to a wide range of users. The term is used broadly to address a range of technologies, including telephones. Central to these is the Internet, which provides the mechanism for transporting data in a number of formats including text, images, sound, and video. Additionally, ICT deals with the application layer, the systems that enable information to be collected and distributed, analyzed, and processed (Asian Development Bank,2003).

E-governance: E-governance is the application of information and communication technologies to transform the efficiency, effectiveness, transparency and accountability of informational and transactional exchanges with in government, between government and government agencies of National, State, Municipal and Local levels, citizen and businesses, and to empower citizens through access and use of information(Shah,2007).

Cyber extension: Cyber extension is an agricultural information exchange mechanism over cyber space, the imaginary space behind the interconnected computer networks through telecommunication means. It utilizes the power of networks, computer communications and interactive multimedia to facilitate information sharing mechanism (Wijekoon, 2003).

Information Communication Technology and Tools

Extension Function	Radio	TV & Video	Cell phones	Feature & Smart Devices	Computer & Internet
Identifying farmers' problems and opportunities – What do they need and want?					
Diagnose problems	Some potential if dealing with general problems, or if capacity for interaction and expertise available	Visuals are very helpful	Some potential if farmers can call or text in and sufficient expertise is available.	Additional potential to a simple cell phone as it enables web or App access to special diagnostic tools.	Good comprehensive diagnostic tools are available
Collect information	Some potential if capacity for interaction		Can use for data collection.	Good for data collection with GPS.	Some potential if internet available.
Promoting behavior change – What is practical and relevant to meet the needs?					
Raise aware of general opportunities or needs ; convince farmers to try something new	Very good especially with persuasive programming	Visuals are usually very helpful as "seeing is believing"	Is an option if users are registered to receive such messages (SMS)	Is an option if users are registered to receive such messages (SMS, email)	Is an option if users are registered to receive such messages (email)
Provide specific information needed for change. What is involved? What are the benefits/ Demonstrate or train?	Some potential – but limited information delivered. Can be enhanced with call in.	Good option as "seeing is believing	Potential if farmers can call or text in and sufficient expertise is available	Additional potential to a simple cell phone as it enables web access and plays videos.	Good option for intermediaries to seek information and videos.
Facilitate access to credit and inputs	Can be used to inform of available services, but one-way communicati on	Can be used to inform of available services, but one-way communicati on	Mobile banking and negotiate directly with the suppliers	Mobile banking and negotiate directly with the suppliers	Mobile banking and negotiate directly with the suppliers
Link farmers to markets	Good for providing general price reports		Access to price information (call in, subscription)	Can bring potential buyers and producers together; access price information	Can bring potential buyers and producers together; price info.
Collect feedback – How can each step be improved?					
Collect and respond to farmer feedback	Good if producers can call or text and sufficient expertise is available	Good if producers can call or text and sufficient expertise is available	Some potential if farmers can call or text in and sufficient expertise is available	Good option for intermediaries to seek information (if optimized for smart devices)	Good option for intermediaries to seek information

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.

ICT tools intervention in agricultural Extension are broadly-

a) Web Portal service

b) Mobile Apps based service

c) Mobile SMS & call service

d) Interactive Kiosk

a) Web Portal service -

I. mKisan portal:It waslaunched in July, 2013, where farmers can register to avail mobile based advisory services. The website reports delivery of more than 152 crore SMSs to 70 lakh farmers across the country since its inception. Farmers'quieriesare resolvedthrough SMS in a location specific, problem centered pattern in local languages.

II. Farmers portal:It is "One Stop Shop for Farmer" having nearly 50 lakh visitors since November, 2015. One can get information on various aspects of seeds, fertilizers, machineries, schemes and programmes, package of practices, credit, insurance, storage, etc. specific to their state upto their block.

III. National Agriculture Market Portal (e-NAM):Launched on 14 April 2016to enhance farmer's accessibility digitally to multiple numbers of markets & buyers.The Portal is managed by Small Farmers' Agribusiness Consortium (SFAC) and has been developed on the concept of "One Nation One Market" for agriculture produce. At present, it has integrated 1000mandis across 18 states and 3 UTs with more than 1.69 crore Farmers & 1.55 Lakh traders registered on e-NAM platform.

IV. Agricoop:Renamed in 2015 as The Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW) is one of the three constituent Departments of the Ministry of Agriculture & Farmers Welfare. It primarily formulates agricultural policies and monitors various agricultural schemes and programmes.

V. http://www.apeda.gov.in:The Agricultural and Processed Food Products Export Development Authority (APEDA) was established by the Government of India ad has marked its presence in almost all agro potential states of India. It has been providing services to agri-export community through its head office, 12 Regional offices.APEDA is mandated with the responsibility of export promotion and development of the various agricultural products.

VI. aAQUA (almost all questions answered):aAQUA is an online expert question and answer based community forum, developed by Media Labs Asia, KReSIT, IIT Bombay, for delivering information to the grass roots of the Indian community. It is an online, multilingual, multimedia, archieved discussion forum accessible using a web browser, allowing members to create, view and manage content in their mother tongue (Hindi, Marathi, etc.).

VII. AGRISNET:The Government has promulgated the Agriculture Information System Network (AGRISNET) in the country.AGRISNET envisages promotion of e-Governance by use of Information & Communication Technology (ICT). The objective of the programme is to provide IT enabled services to farmers and also for computerization of various offices in the States in agriculture & allied sectors. Funds under AGRISNET are provided to the State Governments/Union Territories on the basis of specific project proposals submitted by them. The States are given funds for software development, hardware (including system software) and other genuine ICT needs of the State upto district level.

VIII. ITC -e- choupal:ITC introduced the plan of connecting with the farmers and offering them a fair price through a system called e-chaupal. The aim of e-chaupal is to enlighten the farmers and provide knowledge regarding Crops, prices in market and a medium to sell to multiple buyers in the market.It is operational in Madhya Pradesh.

b) Mobile Apps based service

PUSA KRISHI	The app helps the farmers to find easy solutions to problems in their farm fields and get i nformation about weather and accordingly take measures to save crops. It also offers information related to new varieties of crops developed by Indian Council of Agriculture Research (ICAR), resource conserving cultivation practices as well as farm machine ry and its implementation will help in increasing returns to farmers.
KISAN SUVIDHA	The app provide information on various details such as weather, market prices, seeds, fertilizers, pesticides, agriculture machinery, dealers, agro advisories, plant protection and IPM practices *etc.*
SOIL HEALTH CARD	It aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilisers including secondary and micro nutrients in conjunction with organic manures and bio -fertilisers for improving soil health.
E-PANCHAYAT	e-Panchayat is an e -Governance initiative for the rural sector providing comprehensive software solution attempting automation of Gram Panchayat functions. It is a platform for panchayat representat ives to connect with rest of the world, which aims to bring out the local voices by empowering the local communities to showcase and share local social, cultural and economic practices, stories and challenges.
CROP INSURANCE MOBILE APP	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. It can also be used to get details of normal sum insured, extended sum insured, premium details and subsidy information of any notified crop in any notified area.

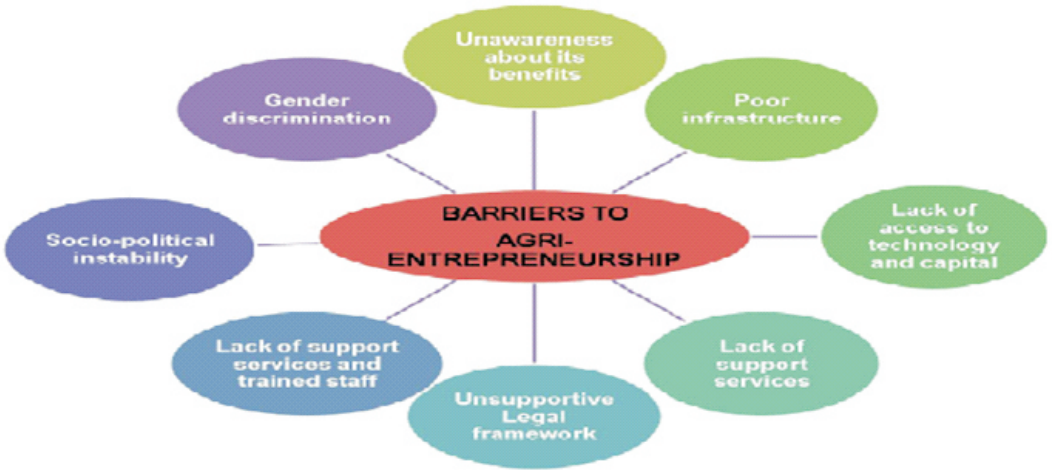
AGRIMARKET APP	The mobile application has been developed with an aim to keep farmers abreast with the crop prices and discourage them to carry -out distress sale. Farmers can get information related to prices of crops in markets within 50 km of their own device location u sing the AgriMarket Mobile App. This app automatically captures the location of the farmers using mobile GPS and fetches the market prices of crops which fall within the aforesaid range.
BHUVAN	It is a satellite based geo -platform by ISRO, reaching out i nto the rural people. It has three important applications, which have remote reach for use of rural population viz. *CHAMAN (Coordinated programme* on Horticulture Assessment and Management using geo informatics), FASAL(Forecasting Agricultural output using Space Agrometeorology and Land based observations) and NADAM(National Agricultural Drought Assessment and Monitoring System).

C. Mobile SMS & call service

- Kisan Call Centre
- Kisan Helpline of Bihar Agricultural University(BAU), Sabour
- Indian Metereological Department(IMD) Agromet Services
- Virtual Krishi Vigyan Kendra
- BSNL 'Mandi on Mobile' Service
- Kissan Kerala
- Rubber Market Price in SMS to farmers by Rubber Board, India
- Intelligent Advisory System for Farmers
- Fisher Friend Mobile Application-MS SRF

Barriers to Agri-Entrepreneurship Development

From the viewpoint of Uplonkar and Biradar (2015), agrientrepreneurship 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.

Strategy for Promotion of Successful Enterprises

Considering the present problems faced by the entrepreneurs engaged in agri-business, it is necessary to createa congenial atmosphere in the field. Some of the important conditions necessary for successful agri-business arepresented below:

- There should be a unanimous option among government officials and farmers about the need and benefits ofpromoting self-employed youth or private entrepreneurs to facilitate the farmers to enhance agriculturalproduction and profitability.
- The Government should discontinue the practice of providing free services in those sectors where the workhas been assigned to private entrepreneurs.

- The technical skills and ability of the entrepreneurs should be evaluated to ensure high standards. Thereshould be a monitoring agency to check the quality of the services and the charges collected from the farmersto avoid exploitation.
- To popularise the services of the entrepreneurs, the Agricultural Extension Agencies and FarmersOrganisations should give wider publicity about the services available to the farmers. Such publicity canenhance the credibility of the services provided by the entrepreneurs.
- The Government should encourage the entrepreneurs by introducing various concessions and incentives.

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. 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 agripreneurship and rural development in the entire world.

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Chapter - 7

How to develop your own business

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This article is an attempt to present the basics of starting a business by any individual or group. Here the necessary information related to business establishment id being presented in utmost practical and interesting manner. It is expected that this will benefit the readers in initiating their thought processes related to starting their own successful businesses.

Why your own business?

Following are the prominent reasons because of which people generally start thinking about their own businesses or entrepreneurship:

Independence / freeness

Better earnings

Growth Prospects

Legacy for generations

Compulsion

More propensities for social work

What is entrepreneurship?

Following is a very practical and easy definition which tries to capture the very essence of entrepreneurship:

Recognizing opportunity and mobilizing resources to capitalize upon this opportunity in form of an organization or venture.

This definition has three critical components:

i. Recognizing opportunity

ii. Capitalize upon this opportunity

iii. Creating organization or business venture

These three components have important considerations for a successful entrepreneurial venture.

How of entrepreneurship?

Now after realizing the fact that we need to identify opportunity and capitalize upon that opportunity to create a business venture, we need to know how to do this?

We can plan our entrepreneurial venture in following manner:

Business acumen and implementation

We need to inculcate business acumen and learn the knowhow of implementation in order to become a successful entrepreneur.

Strategic statements (vision, mission, core values etc.)

Once we have transformed ourselves in accordance with business we need to give a detailed thought upon the strategic statements like vision, mission and core values of our business, this is very important because till the time we have these, we can't led our organization towards ultimate objectives.

Managerial functions

Prominent managerial functions includes sales and marketing, operations, production, finance, human resource etc. we need to learn about how to carry out these functions within our business.

Organization / team

Any business requires a strong and competent gelled up team. This we need to develop taking into considerations the organizational requirements and future needs.

Supportive Stakeholders (customers, vendors etc.)

Come what may, the important stake holders for any business like customers, investors, vendors, channel partners etc. should always be given priority and consideration and their interests be met in accordance with the interests of business.

Technical expertise

Many businesses require technical competencies which are not being possessed by the founder / owner furthermore once the business progresses we need to integrate technology for scaling it up. This is one aspect which should be given due consideration every time we are thinking about our business and a special team may also be hired for taking care of this aspect.

Important phases of business

Following phases are generally being taken care of for any type of business:

Planning

Execution

Correction

Re planning

Re execution

How to plan for your own business?

One of the most important aspects of entrepreneurship, following is the step by step procedure according to which we can plan our business:

Ideation

This refers to the generation of lucrative and viable business idea based on which business concept is developed and further planning is done.

Market feasibility / viability

This process assesses whether the idea generated is viable and feasible to be considered worth for further processing or should be dropped for any further considerations.

Business plan preparation

Most important aspect of planning for any business, this step required preparation of detailed document

which acts as a guide for implementation and controlling the business. This is majorly divided into operational and financial plan. It has different usages and has different layout and formats as well.

Mobilization of resources

Based on the detailed business plan we take inventory of the required resources for business like the capital costs and working capital, plant and machinery, human resource, energy requirement etc. these resources needs to be mobilized in order to start the business.

Incorporation of business entity

Once all the preparations necessary for business are incorporated we need to create a legal entity for business to start functioning.

How to execute your business?

After having learnt in details about the entrepreneurship and business above, it becomes pertinent to know how exactly to execute our business planning into real successful business. Following is the practically learnt and tested method for executing a successful business:

Stick to basics

Focus on customer and his expectations

Provide value preposition

Develop strong and competent team

Involve / immerse yourself

Consistent, perseverance, never say die attitude

Enjoy small wins

Always keep your eyes, mind and thinking hat open

(In case of any clarification, please feel free to contact the writer)

Chapter - 8

Benefits of PM FME Scheme

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Introduction to PMFME scheme

- This is an initiative under Aatmanirbhar Bharat Abhiyan
- opportunity for micro food entrepreneurs, FPOs/ SHGs/ Co-operatives to benefit from the `10000 crore Scheme
- This scheme aspires to formalize2 lakh Micro Food Processing Enterprises
- All India Centrally Sponsored Scheme over 5 years from 2020-21 to 2024-25
- The ODOP could be a perishable Agri-produce, cereal based product or a food product widely produced in a district

The scheme has four broad components addressing the needs of the food processing sector:

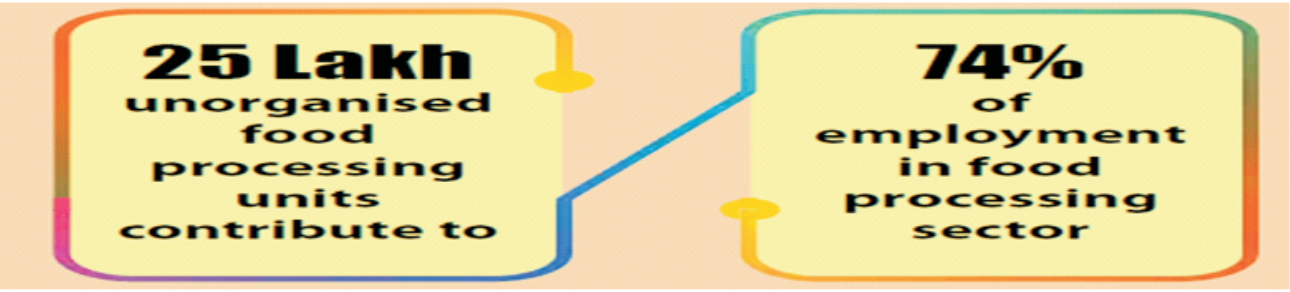
i) Support to individual and groups of micro enterprises;

ii) Branding and Marketing support;

iii) Support for strengthening of institutions;

iv) Setting up robust project management framework.

Focus of scheme



Importance of food processing in Indian context

Milk Production

- 1st in milk production
- 155.5 MT production in 2015-16
- Expected to grow by 13-15% CAGR in the coming years
- Offers huge opportunity for technology, automation, integration etc

Fruits & Vegetables

- 2nd largest global producer
- 254 MT production
- Processing levels currently ~ 2%

Cereals & Grains

Marine

- 2nd in fish production
- Processing levels of marine products at ~23%
- offers huge opportunity cold chain, export, packaging innovations, product differentiation etc.

Egg & Meat

- 3rd in egg and 5th in meat production
- Trends shifting towards processed, cleaned and frozen meat & poultry products

Objectives of scheme

The objectives of scheme are to build capability of microenterprises to enable:

i) Increased access to credit by existing micro food processing entrepreneurs, FPOs, Self Help Groups and Co-operatives;

ii) Integration with organized supply chain by strengthening branding & marketing;

ii) Support for transition of existing 2,00,000 enterprises into formal framework;

iv) Increased access to common services like common processing facility, laboratories, storage, packaging, marketing and incubation services

v) Strengthening of institutions, research and training in the food processing sector; and

vi) Increased access for the enterprises, to professional and technical support.

One district one product focus

The Scheme adopts One District One Product (ODOP) approach to reap the benefit of scale in terms of procurement of inputs, availing common services and marketing of products. ODOP for the scheme will provide the framework for value chain development and alignment of support infrastructure.

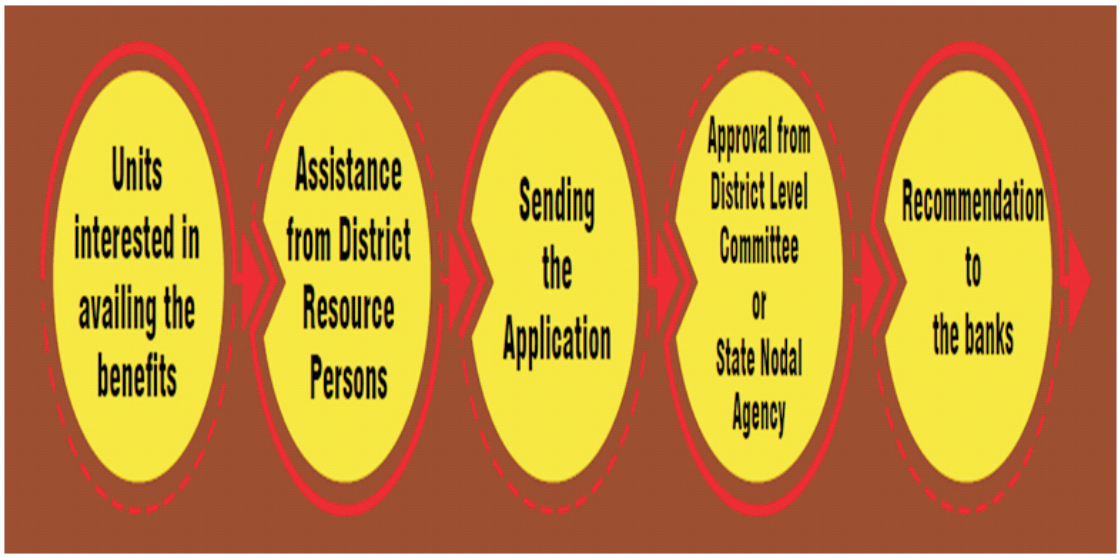
There may be more than one cluster of ODOP product in one district.

There may be cluster of ODOP product consisting of more than one adjacent district in a State.

Benefits which could be derived from this scheme

Following benefits are provided under this scheme:

- Registration of informal units into formal companies
- Hand holding support
- Preparation of DPRs and business plans
- Application for subsidies
- Banking Linkages
- Technology Up gradation
- Support to FPOs, SHGs and cooperatives
- Common facilities
- Branding & marketing
- The scheme would also support strengthening of backward and forward linkages, provision of, incubation centers, training, R&D, etc. provision of which would primarily be for ODOP products.
- It would also take benefit from the existing promotional efforts of the Government such as development of Agriculture Crop Clusters under the Agriculture Export Policy, cluster approaches of the Ministry of Agriculture and the Ministry of Rural Development etc.



Support to Food Processing Units

- Credit linked grant at 35% of the project cost with maximum grant up to Rs 10.0 lakh to existing un organized food processing units for up gradation
- Credit linked grant at 35% of the project cost to SHGs/FPOs/cooperatives for capital expenditure with maximum limit as prescribed
- Seed capital @ Rs. 40,000/- per member of SHGs to those engaged in food processing as a working capital
- Credit linked grant at 35% of the project cost for common infrastructure with maximum limit as prescribed
- Support for marketing & branding up to 50% of the expenditure with maximum limit as prescribed

Creation of Common Infrastructure

- FPOs/ SHGs/ Producer Cooperatives /State agencies or private enterprises would be supported for creation of common infrastructure including for common processing facility, incubation center, laboratory, warehouse, cold storage, etc. Credit linked grant would be available @ 35% with maximum limit as prescribed.

Branding and Marketing Support

- Marketing and branding support will be provided to FPOs/SHGs/Cooperatives or an SPV of micro food processing enterprises under the scheme following the cluster approach for developing common packaging & branding with provision for quality control, standardization and adhering to food safety parameters for consumer retail sale.
- 50% of total expenditure might be allocated as a support
- Cost of DPR preparation would be provided
- Capacity Building & Research

Chapter - 9

Entrepreneur Skills Development Through Commercial Production And Value Addition Of Grapes

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Introduction

Grape is one of the sweet, juicy and healthiest fruit available on the earth. Penalty minerals and vitamins are available in the grape required for human body growth. Grape is called as 'King of fruit' in 'Ayurveda' being a digestive property.

Grape cultivation is originated in Central Asia Region (from Black Sea and Caucasian Sea), after that, it spread to Europe and eastward to Iran and Afghanistan. In India Grape was introduced in 1300 AD by trespassers from Iran and Afghanistan.

India is among the first ten countries in the world in the production of grape. The leading producers of grape are Italy, France, Spain, USA, Turkey, China and Argentina. This crop occupies fifth position amongst fruit crops in India with a production of 2920.0 thousand tonnes from an area of 38.91 thousand ha. in 2018-19. (Horticultural Statistics at A Glance 2018)

The area under grape is 1.2 % of the total area of fruit crops in the country. Production is 2.8% of total fruits produced in the country. About 80% of the production comes from Maharashtra followed by Karnataka and Tamil Nadu. In India, Major grape producing states are Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh and Mizoram. Thomson Seedless, Sonaka, Anab-e-shahi, Sharad Seedless and Bangalore Blue are the varieties cultivated on large scale in India. Thompson Seedless and its clones are the major white seedless grapes grown on approximate 70% area.

Use of grapes

Grape leaves are astringent. Young grape leaves tea help to treat Dysentery. It helps to treat gout and jaundice, eliminate vomitand stop bleeding. It is effective in care of circulatory system disorders related to puberty and menopause times. Grape leaves tea is useful for treating varicose vein.

Un-ripe grape has medical benefits; it is a cold and astringent product based on Persian traditional medicine. It is useful in treatment of oral mucous edema and soft gums. Verjuice helps to treat obesity. Scurvy which is a disease resulting from a lack of vitamin C, can be treated by verjuice. Verjuice contains Potassium Tartrate which is very effective in treating Sciatica and acute rheumatism.Verjuice can boost liver function. It is useful in treating jaundice. Drinking verjuice causes girl puberty start younger and also menstruation occurs. It excretes heat and bile of the body and also disinfects the intestines. Gargling verjuice can help to relieve swollen throat.

Grape as fruit balances the body's temperaments, it is very healthy and nutritious, clarifies lungs and breast, it is effective in treatment of pulmonary tuberculosis and pertussis and is used to treat dysentery. It is useful for treating gout. Grape prevent from forming blood clot in arteries. It is useful for people with cardiovascular and nervous diseases and helps to treat constipation. Grape regulates blood sugar and people with low blood sugar level can eat the fruit several times in a day. Due to sugar level that there is in grape, some people assume incorrectly that it can cause of weight gain or increase in blood sugar level. However, people with diabetes are able to use the fruit together with other fruits in accordance with prescribed calorie.

Grape is the best fruit for people want to lose its weight and clean its body of uric acid, gallstone and chronic intoxication (lead and mercury poisoning). These people must only eat grape juice for two days per week and get grape

juice diet. So that they should just drink fresh grape juice for two days in each week. In each day, almost 2 kg grape must be used and they should not eat other foods during these two days. They can only drink water.

Raisin is a nutritious dried fruit and like other dried fruits can be found in all whole year. It is good source of iron, potassium, calcium and vitamin B. it can reduce urine and sperm secretion. It has high energy, low fat and low sodium. Therefore, eating raisin would be very useful for individuals with low sodium regimen.Raisin can boost body energy. Raisin can prevent a sharp reduction in blood sugar level and its fluctuations. It can increase people accuracy and concentration, especially in students at the exam time. Raisin is an antioxidant food which prevents cell destruction. It plays a crucial role in bones' health and also it can prevent osteoporosis. Therefore, it is useful for women before menopause. Raisin is a good source of vitamin D, estrogen hormone.

Grape skin has cold and dry nature in Persian traditional medicine. Grape skin burned; the obtained ashes will be used to treat many injuries,astringent and helps to treat diarrhea. Seed is used to treat tuberculosis. Burned grape seed is harmful for those which have poor bladder and kidneys. Grape seed extract contains pro prevent cell destruction resulting of free radicals. The antioxidant can repair and restore connective tissues and helps enzymes' activities.

Grape seed is anti-peptic ulcer disease. Grape syrup can improve and cure weakness in body. The syrup mix with milk and almond and take 2 to 3 cups daily by patients to gain their strengths.

Grape seed oilincludes tannin and anthocyanidin. It contains omega-6 which is an essential fatty acid. Grape seed oil can heat body; the oil is anti-tiredness and fatigue of muscles after sport. Grape juice as a face washing solution is very useful for women(Nejatian, 2013) and also useful for women before menopause.

Human resource and Entrepreneurship development grape cultivation

Human Resource Development enhancing quality of human resource is a pre-requisite for implementing and upgrading research programmes, developing technologies, evolving institutional arrangements to face challenges and harness opportunities. Maintaining global standards and enhancing competitiveness are equally important in agri-business and in technology development. Efforts will be therefore, made to enhance competence and develop state-of-the art infrastructure.

The fun part of starting a vineyard is the process of education and discovery to create something new and unique, but then someone has to put ideas into action and create a working vineyard. The quality of the grapes will depend on the successful translation of information into results, which is not always easy. Concepts can be complex and, as stated earlier, there is usually more than one way to do any task, interpret any data, or solve any problem. Labour issues are a challenge everywhere in agriculture. Skilled workers are hard to find. Language barriers exist. Misunderstandings abound. Employer-employee relations can be complicated and fraught with danger. But when a good team comes together to execute a sound viticultural plan, the results can be remarkably gratifying – both on the vine and in the bottle. Without exception fine wines are the result of good management and labor. Small, one-person operations are usually quite straightforward and easy to manage.

Lucie Morton estimates that one full-time person can take care of 4,000 to 5,000 vines, and that another full-timer should be added for each incremental increase of 4,000 vines. Assigning labor needs based on the number of vines rather than the number of acres makes sense, because it takes into account the variability in vine density in the vineyard. In the case of smaller vineyards that cannot afford to hire a full-time crew, pooling the available labor and getting a crew to work a number of vineyards is a viable option. (https://www.vineyardteam.org)

It is important to keep workers employed all year round or they will leave when they are not needed and may not come back. It is possible for more than one vineyard to share a crew and still get all their tasks done in a timely fashion. Small vineyards in the East often rely on family and friends for help, but there are obvious disadvantages to this strategy. Often, they will be good for a day or two but not more, especially if they find themselves working in the heat, rain or cold. And the availability of family and friends should not be allowed to determine the date of harvest – the

grapes make this decision. There are work cycles in the vineyard that flow with the seasons. Pruning is often slow and steady. But even for pruning, there are different approaches. One is to hire a big contract crew to come in and do the job very quickly, but this often means sacrificing the quality of work due to the unfamiliarity of the crew with the vineyard. Alternatively, a smaller permanent crew that knows the vines can move at a steady pace through the winter months and prune at a very high-quality level. Both will get the job done, but sometimes with different results.

Scope of entrepreneurship development through grapes

There is two way of develop entrepreneurship opportunities through grapes

(1) Though grape cultivation

(2) Though Value chain and processing sector of grape

(1) Entrepreneurship opportunities though grape cultivation

Grape cultivation is also a big entrepreneurship opportunity itself and beside this It's a type of backward linkages for Grape value chain. It includes the activities from nurseries, plantation up to harvesting. Nursery management, plant propagation, field preparations, plantation, intercultural operations, irrigation and fertigation, pest and disease management, record keeping, harvesting are the measure activities given priority inbackward linkages.

a. Nurseries for Grapes plant propagation

As the grape industry is grows very fast the vine propagation industry has not experienced the same degree of change. It remains largely an industry dominated by small to medium-sized family businesses and cooperatives and although the progress towards modernisation has enabled nurseries to increase production, the quality of planting material is not yet of a consistently high standard.

Until recently, there have been few comprehensive standards or assessment criteria for grapevine material and apart from choice of variety and rootstock, other important attributes of planting material have not always been taken into account by nurseries and grape growers. Consequently, inferior material has sometimes been planted and there have been numerous reports from around the world of vine failures and underperforming vineyards needing to be replanted within 5–10 years of establishment (Smart et al. 2012). Many of the failed or underperforming vines were found to be infected with trunk disease pathogens, or to have other defects that affect establishment, vigour and longevity (Stamp 2001; Waite et al. 2013).

GAPS observed in Nursery management/Propagation:

(1) At present, if we see lead producer of grape condition, there are around 30 big nurseries and around 50 small nurseries producing grape plants 2 to 2.2 cr plants per year. That means the planting materials requirement in the cluster is 2.5 to 2.7 cr per year and demand of good quality plants is increasing every year. Many farmers in the region have their own root stock plantation on their farms. They make the plants on their own by using skilled workers who are having good skills in grafting the plants. Such workers are called from Konkan region during the season. Around 30000 workers get temporary employment during the season. No record keeping is available for planting materials, root stock, varieties etc as on today, so costlier crop like grape famer may suffer hues losses.

(2) The nurseries are not standardized and there is no guaranty of good quality plants. Not a single nursery is accredited under NHB or any other scheme.

(3) Unorganized nurseries – The nursery business is completely unorganized without any record keeping. Mixing of plants is a big issue and rarely the farmers get the planting material in full quantity as he desires and expects. It is observed that the mixing percentage varies from 5% to 15% which is very high and it affects the production quantity thereby returns as well.

b. Selection and production of varieties

Commercial table grape production, the goal is to produce a consistent, high-quality product. Proper selection of varieties that fit both the planting site and local consumer preferences is important for the success of this enterprise. Thoroughly research the characteristics of the various table grape varieties that suit your production situation before choosing. Consider winter hardiness, time of bud break, and the requirements for proper ripening (it is critical to know the typical length of the growing season and cumulative growing degree days for your location). In addition, it is important to weigh both the positive and negative horticultural characteristics of the varieties you are considering.

The European customer demand of grapes is based on colour, size, and aroma, weight of berry and shape of berry. Red variety Flame fetches best rates in European market but no Indian grower has that variety to grow. Similarly, there are certain other varieties from the breeders of California, Israel and Spain those have a great demand in European market. Also, these varieties are pest and disease-free varieties with natural colour development and size and shape of the berry. Thus, these varieties do not require and sprays of growth promoters or hormones. Similarly, the cost of control of pests and disease is minimum as compared to present varieties cultivated in India. Thus, if Indian growers plant these varieties, possibly the production cost will be less as compared to existing one and returns through exports will be much higher thereby gaining huge profits.

GAPS observed in grapes varieties:

1. Though there are number of varieties of grapes available in market, very few varieties like Thomson seedless, Sharad seedless are popular and used by farmers.
2. No research for development of new varieties by research centres in India. Most of the variety developed in Indiaare not suitable for international market and hence not popular among the farmers.The farmers from Chili, South Africa, Spain etc. are producing different varieties those having good demand in European market and thus Indian growers are not able to compete these countries. Hence though the export volume from India is increasing every year, Indian growers do not get good prices and expected returns.
3. By planting of new fancy varieties, the income of the farmers will be nearly double with same or less investment. Also, GOI will get more foreign revenue through grapes export.
4. The quarantine process for new imported varieties in India is very lengthy and tedious. It is needed to simplify the norms of quarantine procedure so that the farmers will get the new varieties in time.

In India, 90 percent of the grape production is of table variety. Grape farming is a highly profitable venture for farmers, but it is also highly risky as farmers have to invest heavily for production. In case of a price crash, farmers face huge losses leading to an additional debt burden along with the initial high investments. Despite the challenges, the grape sector has a lot of potential. Being a high-value commodity, it is one of the largest foreign export earnings. To address the farmers' concerns and capitalize on the market opportunities, the state and central government agencies, farmers' organizations and other parastatal organizations and institutions have undertaken various initiatives to support processing, exports and marketing of grapes

Agri-export zones (AEZs) for grapes have been set up in Maharashtra and Andhra Pradesh. The objective of these AEZs is to promote the crop so that abundant raw material be available at low cost; AEZs integrate various assistance programmes of central and state government agencies. The zones provide fiscal incentives to exporters, integrating all the activities till the produce reaches the market. The AEZs are implemented through public and private sector participation. The Indian Council for Agricultural Research (ICAR) has set up the National Centre for Grape Research at Pune to cater to the research and 11 extension needs to develop new varieties keeping in mind the need for processing and exports. Extension support is provided to extend the findings to the farmers. APEDA has developed the “GrapeNet”, a web-based software that will help trace export of grapes from India to the European Union. This initiative was aimed at reducing the export rejects due to high pesticide residues. The GrapeNet tracking system will help to monitor pesticide residue and achieve product standardization, thus boosting grape exports to the European

Union. If there are any complaints concerning pesticide residues being present in grapes, the software will be able to indicate the farms from where the grapes originated.

c. Grapes rootstock production

Adapting any new technique is a positive sign in improving the efficiency of agriculture. This could be seen in recent viticulture in India. The production yield of grapes in India is declining because salt concentrations in soil as well as presence of chlorides in water. To fight with this challenge, there is a need of adaptation of rootstock alternative in grapes vineyards.

Rootstock Vineyard cultivation is more remunerative than Own Root vineyard in terms of profit. Rootstock vineyard also resolved the soil and water problems found in Own Root vineyard. Rootstock is not only a potential tool to combat soil and water problems but also for manipulating growth and productivity of grapes. Rootstock grape has much demand in export market. This is the golden opportune movement for farmers to make viticulture as a business endeavor through rootstock vineyard cultivation. (Shinde, 2016)

d. Pruning

Pruning is one of the most important cultural operations in grape production because it regulates both vegetative growth and fruit production.To properly prune a vine, grower should know something about its growth and fruiting habit.

Proper pruning is essential for producing a better yield of high-quality fruits and maintaining a balance between vegetative and reproductive growth. Pruning controls, the size and structure of the vine, maintains balance between vegetative and reproductive growth, maximizes the yield potential and promotes the health of the plant. Pruning should take place when vines are dormant (January to early March) or the crate dormancy in tropical areas by spry ethrel 35 Ml / 15 lit of water and pruning practiced two time in a year April pruning and October pruning.

For this practice very skilled person must be required and they take Rs 6-8 per vine. For tropical zone the pruning season starts from September to November and in subtropical and temperatezone the time of pruning is January to early March. So this back linkage will provide good business opportunity to youth.

2. Value chain and processing sector of grape industries

Value chains in grapes cultivation provide an alternative for the diversification of grape industries in view of high income, employment, foreign exchange earnings and a new method to combat challenges of food security. These products have high income elasticity of demand. Whenever and where-ever income of the population goes up, demand for these products also goes up mainly in the middle-income groups of developing countries. The rise in income and stress on quality has influenced the demand side while new technologies and trade agreements have the potential to influence the supply side.

a. Raisin production: Raisins are a type of grape that has been dried for around three weeks. Grapes darken as they dry, which gives raisins their dark brown colour. A range of grape varieties is used to make raisins. The size, taste and colour depend on the type of grape used. One way to add value to raisins is to remind customers of their versatility. Raisins can be substituted in many recipes that call for other dried fruit. They can also be added to savoury dishes, creating a more balanced flavour profile (California Raisin Marketing Board – Recipes, 2015).

Raisins are highly acceptable product and have huge market in selective environment. Export market is even good in terms of profitability, if produced with international standard quality. For establishment of an entrepreneurship development project, initially should be focused on developing credibility in domestic market and then after maturity, there should be focus on export market. The main feature of the project would include hygienically produced raisins (dehydrated grapes up to 80-85%). Value addition will be done is form of quality processing, i.e. washing, drying, sorting & standardized packaging.

In view of entrepreneurship India raisins industry is fastest growing industry of the world with 263% but still we have area to improve in raisin production because India stand 11th rank in raisin production and we are more then 10 time behind from small country like turkey which stands 1st in

This industry has lots of potential because of its huge demand not only in India but in whole of the world. Due to its easy making process this industry can started by small farmer to big exporter.

b. Grape wine industry

Grape wines are more popular than the fruit wines,but customers are shifting towards fruit wines as they have a wide variety of products along with having the ability to please people with different tastes. The customers with habits of trying new varieties of wines are motivating the producers to constantly produce new flavors of fruit wines. The health benefits of fruit wines, style and brand appeal, royal fragrance, ability to fit any cuisine, and refreshing taste attract customers to consume various types of fruit wines. And the popularity is increasing rapidly in India.

Grape wine is actually a fermented grape juice. Broadly, there are three different types of wines. These are fortified, sparkling and table. Generally, fortified wines have the higher alcohol content (around 14 to 30%). However, these are less perishable and you can get it stable without pasteurization.

India is a large market for grape wine. In addition, the market is growing very fast. Nowadays, consumers can buy good quality wines from the supermarkets and shopping malls. According to Wine Insider 207 report the consumption in recent years then it has increased tremendously since the year 2017 especially since the sales of wine have grown faster than spirits and beer in the country. The hospitality sector has quickly picked up the wine trends in India and it is booming since; we hold a bright future in both producing and consuming wines. In addition, online selling allows customers to get the products at their doorsteps. Earlier the choice was limited. Now there are over 200 wine labels available in Mumbai alone. Also, there is a growing demand for Indian wines outside the country.

Availability of good quality Indian wine at half the price has resulted in a continuous increase in demand. Gradual awareness about the basic difference between wines and hard drinks is also helping the wine industry. Thus, India provides a large virgin market for wine.

c. Grape oil industry

Grape seed oil is one of the main by-products of the winery industry. Depending on the cultivar, the dry seeds contain between 7.0 and 14% total fat content.

The fatty acid profile of this oil showed that it is mainly composed by linoleic and oleic acid, but the total amount and proportion of this depend on the grape variety, the weather, and the extraction method. The levels of linolenic acid are very low while the oleic acid content ranges from 16 to 20%. As grape seed oil has an interesting greenish yellow colour and a neutral flavour it can be used in a wide range of food applications. Grapeseed oil has a high smoke point so it can be used deep frying applications. However, grape seed oil has a limited application from a nutritional point of view, since most. Grapeseed oil are that it has a light, neutral flavour and a high smoke point (around 420°F) so it can be used for cooking with high heat. Grape seeds are one of the waste products produced during winemaking. grapeseed oil has the highest omega96 polyunsaturated fatty acids content among common cooking oils (1 Tbs contains 9470 mg)

Researchers at the Fred Hutchinson Cancer Research Centre inSeattle, WA, found that the use of grapeseed supplements (containingextract, not oil) reduced the risk of prostate cancer in the Vitaminsand Lifestyle (VITAL) cohort.Men who used grapeseed supplements had a statistically significantly lower prostate cancer risk compared with non9users. Previously the same research group reported non9 significant risk reduction of colorectal cancer and no association with lung cancer risk. The authors conclude that their recent findings need to be supported with more research before public health recommendations can be made. In sum, the extract may have health benefits but there is no evidence for health benefits of grapeseed oil.Evelyn (2007)

Rice (1976), reported an oil seed content in 11 red and white native American and hybrid varieties ranging from 13.0% for Concord to 18.4% for Baco noir. Rice (1976) also comments that in 1970 the same varieties had a range of 11.6 to 19.5 % oil. Cruess and Weast (1939) report a range of 11 to 15 % oil in unspecified varieties. Kinsella (1974) reports a range of 9 to 12 % extractable fat in unspecified cultivators. Samples of Müller-Thurgau, Chardonnay, Cabernet Sauvignon and Pinot noir grape seeds were sampled from the Lincoln University Winery in 2000 and 2001.

c. Grape oil industry

Health benefits of grape juice and an increasing focus on organic and non-GM products is anticipated to boost the growth of the grape juice market.

Dark red or purple grapes and green grapes in fresh, mixed, or preserved juice forms are extensively consumed as they are a rich source of antioxidants such as flavonoids and resveratrol. The consumption of grape juice helps the body in fighting free radicals and prevents cell damage caused by oxidative stress. They reduce the risk of blood clots and help in maintaining healthy blood pressure. Thus, the health benefits of grape juice are expected to drive market growth continuously.

For juice variety NRC grapes, Pune develop zero wasteconcept technology ManjariMedika grape juice variety: Suitable for Zero Waste Concept of Processing. (fig.1)

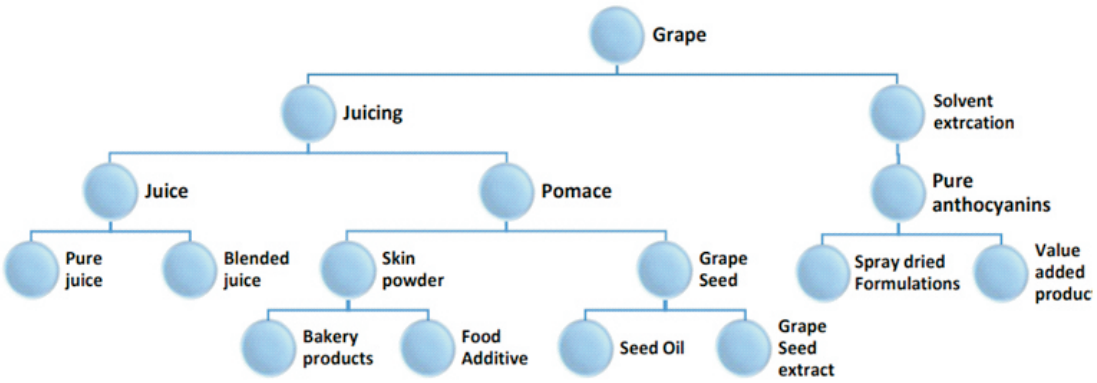
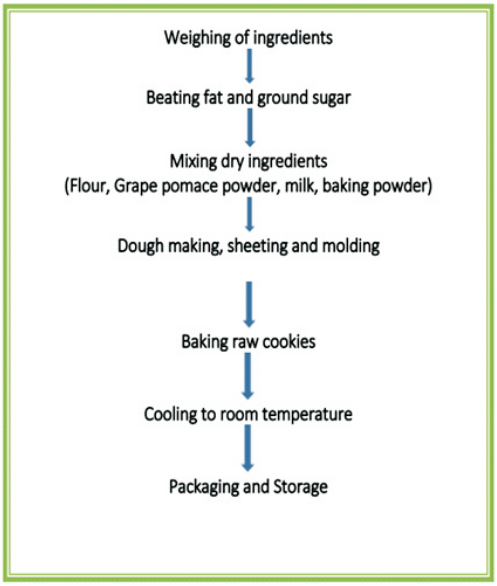


Fig. 1: Utilization of Manjari Medika grapes under zero waste concept

Source- Technical bulletin- 1 NRC grapes (Sharma et al.2019)

By this technology the by-product of the pomes is enriched cookies and bread has been prepared by NRC Grapes.

Enriched cookies:



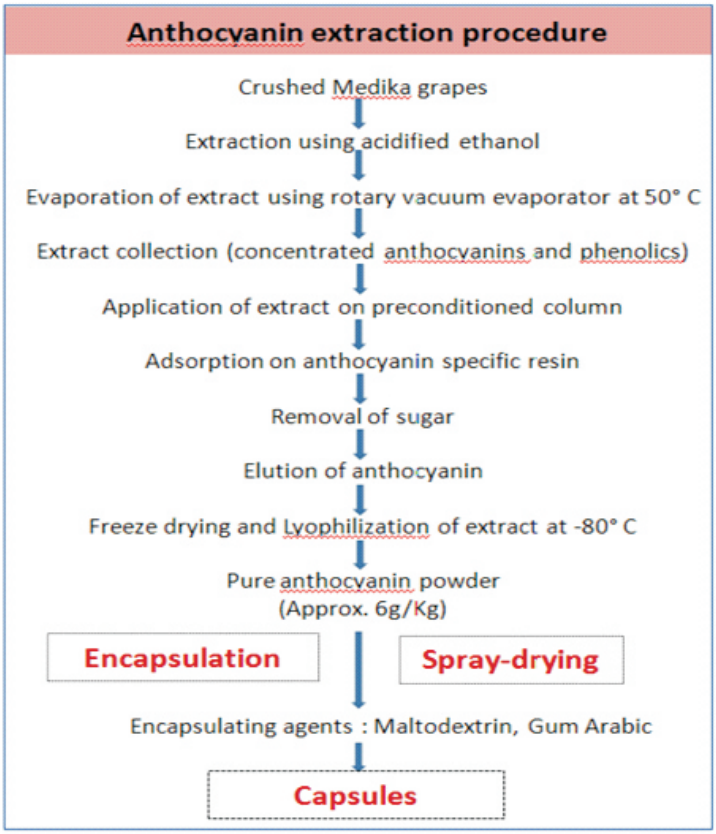
Source- Technical bulletin- 1 NRC grapes (Sharma et al.2019)

Breads:

Anthocyanin extraction technology

Phenolic compounds are group of phytochemicals that play a crucial role in the nutritional and sensory properties of grape and wine. Phenolic compounds can be classified into two major groups: non-flavonoid viz. hydroxybenzoic acids, hydroxycinnamic acids and stilbenes and flavonoid compound viz. anthocyanins, flavan-3-ols and flavonols. The reported literature suggests the involvement of phenolic compounds in many positive health benefits such as protective effects against certain diseases like cancer and cardiovascular diseases, diabetes mellitus, atherosclerosis and dermal disorders or inflammation etc.

The Manjari Medika grapes found to be rich in phenolic compounds, especially anthocyanins. ICAR-NRCG developed a technology for the extraction, isolation and purification of anthocyanins from Manjari Medika. Our in-house study estimation revealed a comparatively higher anthocyanins yield of 5-6 g (dry, purified) anthocyanins/Kg of grapes. These anthocyanins composition was characterized by High Resolution–LC/MS. Further, extracted anthocyanins was formulated to microen capsulated capsules (20%) through spray drying technology. Our collaborative study with CSIR-Indian Institute of Chemical Biology, Kolkata established the invitro and in-vivo anticancer activities of these anthocyanins against colon cancer. Combination of IC30 dosage of IR radiation and anthocyanin treatment resulted more than 50% cell death in human colorectal carcinoma cell suggesting radio sensitizing effect of anthocyanin indicating relevant for the treatment of cancer radio therapy. (Sharma et al.-2019)



Source- Technical bulletin- 1 NRC grapes (Sharma et al. 2019)

Conclusion :

Establishing strong collaboration with national and international institutes in multidisciplinary approach or network or consortia mode would help in developing technologies and resolve the issues in a holistic manner. Imparting education on all the aspects of Viticulture and Enology through full time graduate degree, PG Diploma, Certificate courses may help in developing specialists at all the levels so that grape cultivation and processing will be done in systematic manner with trained man power.

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Chapter - 10

Commercialization Of Horticulture--opportunities And Challenges

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Horticulture embraces wide array of crops viz, fruits, vegetables, flowers, spices and plantation crops, medicinal and aromatic plants. India has immense potential for growing wide array of horticultural crops because of diversities in altitudes and climatic conditions Climatic conditions of India are suitable to grow all the tropical, sub-tropical and temperate horticultural crops in diverse climates.India produces 98579 thousand tonnes of fruits from an area of 6648 thousand hectares recording productivity of 15 tonnes per hectare. In vegetables, 185883 thousand tonnes are produced from an area of 10100 thousand hectares recording productivity of 2 tonnes per hectare. In flowers, 2059 thousand tonnes loose flowers and 807 thousand tonnes cut flowers are produced from an area of 313 thousand hectares recording productivity of 7 tonnes per hectare of loose flowers and 3 tonnes per hectare of cut flowers. India produces 16368 thousand tonnes of plantation crops from an area of 3880 thousand hectares recording productivity of 4 tonnes per hectare. Spice production in the country is 9216 thousand tonnes from an area of 3895 thousand hectares recording productivity of 2 tonnes per hectare.

Leading tropical and sub-tropical crop growing states in the country are: Andhra Pradesh., Uttar Pradesh, Maharashtra, Tamil Nadu, Karnataka, Gujrat, Rajasthan, Madhya Pradesh, Kerala, Assam, Bihar and West Bengal. On the other hand Himachal Pradesh, Jammu and Kashmir and Arunachal Pradesh are the leading temperate crop growing states in the country.

The major pandemic blow impact during the last 20 months are: global economy at a stand still, unemployment has soared up and GDP projections are plummeted . However, Agriculture sector, more particularly the Horticulture sector has emerged relatively unscathed as horticulture sector is protected by its diverse out put.

During post-pandemic period invariablyquestions would arise like …

- How has the virus lockdown affected Horticultural industry?
- How have been the horti- business and horti-farmers impacted?
- How big an issue was supply chain disruptions for horti- farmers?
- What does the road ahead look like for the horti-industry and horti- farmers once the lockdown is lifted?

General assessment of the pandemic blow impact reveals that horti-farmers made up to 80% losses during lockdown. Prime reasons for this are attributed to supply chain disruption, harvesting anomalies, and farmers have lost their crops too, and in addition farmers had to sell their produce in distress at very low price.

If we consider post-pandemic strategy for agriculture sector then certainly growing horticulture crops can be a saviour in the pandemic-hit economy. Importance of Horticulture in meeting Sustainable Development Goal of "Zero Hunger" by 2030 (United Nations) has assumed greater significance after covid- 19 pandemic mainly because horticultural crops are a source for many nutraceuticals and largely build our immune system. Hence post-pandemic strategy for augmenting economic growth would primarily centre around :

- Priority to support horticultural farming at large

- Restore all the operations to catch up opportunities & spurtindemand forhorticultural crops. Some of the major operations in horticulture farming would include Pre-harvest/Post-Harvestoperations, value chainmanagement for produce , to control entire supply chain from farm to pack-houses/distribution centres to domestic retails - finally international retails across the globe.

Commercial Horticulture would definitely be a sustainable Hort-entrepreneurship for livelihood security.

In order to have a profitable commercial horticulture venture certain growingprinciples as the following to be kept in mind:

- Profitability of crop production primarily depends on location, demands on the crops, environment of growing & ease ofgrowing
- plantation site selection/ effective crop management.
- Tropical & Sub-tropical crops are frostsensitive and hence select frost free environment.
- Temperate crops on the other hand need to fulfil Chillingrequirement
- Increase in crop production &productivity at large
- High netprofits to gather from growing crops
- Efficient utilization of all theresources
- Non disruption of supply chainprocess
- Export tradepotential for horticultural crops
- Continuous cashflow from Horti- industry

Execution and application of Good Agricultural Practices(GAP) are of utmost importance to have sustainable commercial horticultural crop production. Good Agricultural Practices are thepractices that address environmental, economic andsocial sustainability for on-farm processes, and result in safe and quality food andnon-food agricultural products.In other words Good Agricultural Practices are the elixirs of commercial crop production. GAP stand on four 'pillars':

- economic viability
- environmental sustainability
- social acceptability and
- food safety and quality.

The concept of Good Agricultural Practices may serve as a reference tool for deciding, at each step in the production process, on practices and/or outcomes that are environmentally sustainable and socially acceptable. The implementation of GAP should therefore contribute to Sustainable Agriculture and Rural Development (SARD).

Basics of Good Agricultural Practices

GAPs principles can be summarized as follows: clean soil, clean water, clean hands, and clean surfaces. Examples of applicable procedures are listed below. These principles must be applied to each phase of production (field selection, pre-plant field preparations, production, harvest, and post-harvest) to be effective. Clean soil involves taking steps to reduce the possibility of introducing microbial contaminants into the soil, particularly via manure and other animal excrements. GAPs address the need to properly compost, apply and store manure. Additionally, the exclusion of domesticated animals from production fields is essential in helping to reduce the possibility of faecal contamination. Taking steps to minimize the presence of wild animals in fields is also important.

Clean water entails making sure all water used in washing, cooling and processing is of drinkable quality. Packing ice should also be made from drinkable water. Ground and surface water sources need to be protected from runoff and animal contamination. Water used for irrigation and foliar applications also needs to be free of human pathogens. Regular water quality testing may be necessary, particularly for surface water sources. Clean hands applies to workers and the use of good personal hygiene in the field and packing house. Providing washing facilities for customers at U-Pick operations is also an important consideration. Clean surfaces means ensuring that all packing bins, work surfaces, storage areas, and transportation vehicles are properly washed and sanitized on a regular, often daily, basis. Farm equipment should also be routinely cleaned and sanitized. An essential aspect of GAPs procedures is accurate record keeping. While keeping records is an important part of any farm operation, it can become critical in cases of food safety issues. When food-borne illnesses do occur, attempts are made to trace the contamination back to the point of original. Growers who document their GAPs procedures will be able to provide evidence that their farm is an unlikely source of the outbreak.

GAP for growers

A farmer who practices Good Agricultural Practices implements proactive food safety control measures to prevent crop contamination. GAP guidelines can be grouped into four categories; health and hygiene, water quality, soil supplements, and environmental hazards.

Crop Specific GAP inHorticultural Crops:

In addition to the general good agricultural practices, crop specific GAP are indeed essential to exploit production potentials of the individual crop. However, GAP vary according to crops. Hence, specific GAP to be prepared for each crop and executed and implemented to exploit commercial production potential of the crop.

Prime concept in commercialization of Horti- Industry should centre around :

- High potential crops selection and commercialization.
- Large sale generation of quality planting materials in crops.
- Measures to keep intact the inherent nutritive/ antioxidant/ nutraceutical properties of the high value horticultural crops.
- Go for organic farming in selective high potential horticultural crops in order to acquire premium price in the produceof such crops.

Chapter - 11

Opportunities in Agriculture Based Entrepreneurship

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ABSTRACT

As we know that our Indian economy is agriculture based and there are huge opportunities in agriculture based entrepreneurship and businesses. Agriculture based rural entrepreneurship shares many characteristics of "generic" entrepreneurship, but also has its distinct features due to the specific context of the agricultural sector. With better industrial and entrepreneurial education discipline, entrepreneurs will naturally take advantage of the vast human resource availability. It is clear that there is a great scope and opportunities for agriculture based rural entrepreneurship in India and this potentiality can be tapped only by effective management of agricultural elements an individual with risk bearing capacity and a quest for latest knowledge in agriculture sector can prove to be a right agripreneurs. The agriculture sector has a large potential to contribute to the national income while at the same time providing direct employment and income to the numerically larger and vulnerable section of the society. Agripreneurship is not only an opportunity but also a necessity for improving the production and profitability in agriculture sector.

Keywords: Agriculture, Agripreneur, Entrepreneurship, Rural, Employment, Youth

Introduction

Agriculture sector provides food for 1.3 million people in India and supports over 60 percent of the population for their livelihood and plays a crucial role in sustainable growth of the country's economy. Traditionally, agriculture has been seen as a low-tech industry with limited dynamics, largely controlled by a huge number of small families, which over the years paid attention to improving crop yield rather than looking at it as money making module. Many farmers are forced to migrate to cities for their livelihood in the wake of lower remuneration or unbearable crop losses on accounts of volatile market dynamics or unpredictable weather conditions. Creating more industries in the urban areas for migrating farmers cannot be a solution to the economic problems being faced by the rural poor. There is need to bring about transformational changes in the agriculture sector by making farmers to change their outlook toward farming. They need to consider their farms as their businesses. Entrepreneurship should be encouraged in agriculture as innovation would not just help farmers improve crop productivity and thus more profit but create new avenues of employment generation for rural youth as well.

Agriculture based tech entrepreneurship involves entrepreneurial skills, models and innovative ideas to solve problems in the farm sector and increase the profitability of the farming business with sustainable, community-oriented, directly marketed farm practices. It is not an opportunity but an imperative to achieve the target of doubling farm income by 2022 through the integration of latest technologies and innovations. Entrepreneurial intervention in the agriculture based rural cottage industries can protect farmers hugely from price volatility of commodity markets and help earn additional money through exports. Agriculture entrepreneurship has potential to revolutionize the entire food chain, benefitting small land holding poor farmers and marginalized communities in a long term.

Entrepreneurs are the key drivers of tomorrow innovations and integral to creating a thriving economy. In agricultural businesses, planning may be even more fundamental because of the inherent ambiguity associated with agricultural production. Some significant sources of uncertainty include production risk, price risk, financial (interest rate) risk, and changes in government programs. In India, 52% of total land is cultivable as against 11% in the world.

Large population of India is dependent on agriculture for their source of revenue. But Indian agricultures low in productivity with large number of disguised unemployment. 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. Entrepreneurs in agriculture are solving the problems like:

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

What is Agricultural Entrepreneurship?

Agricultural entrepreneurship is generally defined as a sustainable, community-oriented, direct marketing agriculture Sustainable Agriculture represents a holistic, system-oriented approach to farming, which focuses on the interrelationship of social, economic and environmental processes.

Why Agricultural Entrepreneurship?

Traditionally, agriculture seen as a low-tech industry with limited dynamics dominated by numerous small family firms, which are mostly paying attention on doing things better rather than doing novel things. Over the last decade, this situation has changed dramatically due to economic liberalization, a reduced shelter of agricultural markets, and a fast changing, more decisive, society. Agricultural companies progressively more have to adapt to the vagaries of the market, varying consumer lifestyle, enhanced ecological regulations, new necessities for product quality, chain management, food security, sustainability, and so on. These alterations have cleared the way for new participator, innovation, and portfolio entrepreneurship.

Concept of Entrepreneurship

Entrepreneurship is the act of being an entrepreneur, who starts any economic activity for being self employed. The entrepreneurial activity is governed by varying combination of socio-economic, psychological, cultural and other factors: Caste/religion, Family background, Level of education, perception, Occupational background, Migratory character, Entry into entrepreneurship, Nature of enterprise, Investment capacity and Ambition (Kumar and Kumar, 2019).

Concept of Agripreneur and Agripreneurship

Agripreneur defined as “entrepreneur whose main business is agriculture or agriculture-related” Agriculture + Entrepreneur= Agripreneur

Agripreneurship defined as “generally, sustainable, community-oriented, directly-marketed agriculture. Sustainable agriculture denotes a holistic, systems oriented approach to farming that focuses on the interrelationships of social, economic, and environmental processes”.

Agriculture based entrepreneur boon for rural area

In context of Indian scenario where majority of people are living in rural area, it becomes necessary to develop the economic environment for rural people to make the rising India. Although there are so many promotional schemes are governing by the government but due to various factors like illiteracy, non-availability of facilities, life-style challenges, lack of knowledge about the new farming system, lack of resources etc. people from rural area still not moving to advance farming.

Considering the growing unemployment in rural areas and slow growth of the agricultural sector, it is necessary to tap the opportunities for promoting entrepreneurship in agriculture, which in turn can address the present problems related to agricultural production and profitability. An "agricultural entrepreneur" is an individual or group with the right to use or exploit the land or other related elements required to carry out agricultural, forestry or mixed activities (Kumar and Kumar, 2019).

Need of Entrepreneurship in Agriculture and its Allied Sectors

The importance of agriculture cannot be overlooked in the economic development of a country. As Mahatma Gandhi ji had said, "The real India is in the villages," and the economy of the village is the backbone of the Indian economy. The objectives of economic planning cannot be achieved without the development of rural economy. Traditionally, agriculture is seen as a low-tech industry with limited dynamics dominated by numerous small family firms, which are mostly focused on doing things better rather than doing new things. In the last decade, this situation has changed dramatically due to economic liberalization, reduced security of agricultural markets and rapid change. Agricultural companies are changing consumer habits, increase in environmental regulations, use technology, new requirements for product quality, food chain management, food security, sustainability. These changes have cleared the way for new entrants, innovation and entrepreneurship. Agriculture entrepreneurs are particularly important for developing countries like India. An agricultural entrepreneur specially helps in providing education and employment opportunities to people located in the struggling areas. Agriculture based rural entrepreneurship development program is beneficial for rural youth because it offers them the opportunity to find out how to sustainably use agriculture in their lives. Agriculture entrepreneurs in India strive to develop prosperity while focusing on sustainable development.

The main problems in a developing country like India are, increasing population, poverty, malnutrition and illiteracy. Out of these problems, poverty and malnutrition can be controlled by adopting innovation and creativity in agriculture, it means entrepreneurship in agriculture. Agricultural entrepreneurship opens several doors of employment in agriculture and its allied sectors such as organic farm green house, dairy farming, poultry farming, fisheries, bee-keeping, horticulture, mushroom farming, fruits and vegetables export, livestock feed production, shrimp farming, fish hatchery, piggery, goat farming, Grocery E-Shopping Portal, medicinal herbs farming, aloe vera farming, certified seed production etc.

Hurdles of Agriculture based rural entrepreneurship

Entrepreneurship in agriculture is not only an opportunity but also a necessity for improving the production and productivity. Though, the rate of achievement is extremely low in India due to the reasons given hereunder:

1. Agriculture is largely a means of livelihood for most of the farmers. In the lack of adequate information, capital, technology and connectivity with the market, it is difficult for the uneducated small owner to turn their farming into an enterprise.
2. Before promoting diverse services by self-employed people, there is a need to create consciousness among the farmers, who are the customers, about the benefits of these services.
3. For promotion of services, the present performance of providing free service by the Government organizations should be discontinued. In fact, lots of farmers, mainly the politically associated leaders are of

the feeling that the government is accountable for providing extension and technical advisory services to the farmers. Though, over the years, the trustworthiness has eroded and the services of these organizations are not on hand to small farmers, particularly those living in distant areas. However, the concept of free service makes the farmers unwilling to avail of compensated services, offered by the local self-employed technicians.

4. The self-employed technicians need regular back up services in the form of technical and business information, contact with the marketing agencies, suppliers of critical inputs and equipment and research stations who are involved in the development of modern technologies.

5. There are several legal restrictions and obstacles, which come in the progress of agri-business, promoted by the SHGs and Cooperatives. Private traders engaged in such business tend to ignore these rules and disturb the fair trade environment.

6. SHGs often hesitate in taking the risk of making heavy investments and adoption of modern technologies, which in turn affect the profitability. With low profitability and outdated technologies, farmer members lose interest in their own enterprises as well as in that of their leaders.

Government initiatives

The National Institute of Agricultural Extension Management (MANAGE), Hyderabad is implementing the Scheme of Agri-clinics and Agri-Business centers initiated by the Ministry of Agriculture, GoI. The Scheme aims at supplementing existing extension network to accelerate process of ToT in agriculture and strengthening input supply and services. Agri-graduates, Post graduates, Diploma holders in agriculture and allied fields can set up their Agri-Clinics and Agri-Business Centers and offer professional/consultancy extension services to farmers. The scheme enumerates availability of better methods of farming to farmers and better opportunities for self-employment to the Agricultural Graduates. As an integral part of the scheme, specialized training is provided free of cost to the eligible agricultural graduates. The course comprises of 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.

Agricultural Entrepreneurship in Dairy Sector

Dairy development in the country got inspiration after independence when industrialization and public awareness fulfilled the need for organized collection, processing and distribution of milk to meet the needs of urban areas. Today, India is the 'Oyster' of the global dairy industry in the world. It provides opportunity to entrepreneurs around the world, who wish to capitalize on one of the world's largest and fastest growing markets for milk and milk products. Indian dairy industry is growing rapidly; galloping around the world is trying to keep pace with progress. It has been possible through the innovation and modern technology in the dairy field. Dairy Entrepreneurship is concerned with the development of dairy through the application of modern science and technology is contributing a great job to improve socio-economic conditions of rural people by making dairy farming more productive and remunerative.

Agricultural Entrepreneurship in Poultry Sector

The word "poultry" is used in India as a synonym to chicken or fowl, although it includes chicken (fowl), ducks, geese, turkeys and guinea fowl. Poultry farming is now recognized as one of the most suitable agro-industries in the world. It is an industry with lots of potential for animal husbandry activities. Poultry in the present scenario of India is a powerful tool to fight poverty by creating job opportunities for rural farmers/ land less farmers or small to marginal landholders or weaker section of people in rural areas. It is one of the sources of getting cheap and easily accessible nutritious protein.

Benefits of Poultry Farming

There are many benefits of poultry farming in India. The main benefits are listed below.

- Commercial poultry farming in India has created profitable business opportunity for the Entrepreneurs.
- Poultry farming business is providing a great employment source for the job seeking people.
- This is India's such business which can never dry up.
- All types of poultry product have a great demand in the market inside India. There is no religious taboo about consuming the poultry meat and eggs.
- Highly productive local and foreign breeds are available for commercial poultry production.
- The required initial investment is not very high. You can start with small scale production and can expand it gradually.
- Bank loans are available all over the country
- There are many poultry farms available and you can easily learn about poultry farming from those established poultry farms.

Possible areas of agriculture based rural entrepreneurship

Nowadays, Easy access to technology, emergence of micro financing, liberalized government rules, awareness and training programmes on agriculture and allied sectors and finally changing mindset of the highly qualified people to go for self-employment in the field of agriculture have contributed significantly in enhancing the potentiality for entrepreneurship in India (Bairwa et al., 2014). Agriculture have several areas of entrepreneurship which include the activities like, Dairying, Sericulture, Goat rearing, Rabbit rearing, Floriculture, Fisheries, Shrimp Farming, Sheep rearing, vegetable cultivation, nursery farming, etc. Pandey (2009). The possible areas of entrepreneurship in agriculture are:

1. Agro produce processing units – Thee units do not manufacture any new product. They merely process the agriculture produce e.g. Rice mills, Dal mills, decorticating mills etc.
2. Agro Produce manufacturing units – These units produce entirely new products based on the agricultural produce as the main raw material. E.g.-Sugar factories, Bakery, Straw board units etc.
3. Agro in-puts manufacturing units – These units produce goods either for mechanization of agriculture on for increasing manufacturing plants, e.g.-Fertilizer production units food processing units, agricultural implements etc.
4. Agro service centres – These include the workshops and service centre for repairing and serving the agricultural implement used in agriculture.
5. Miscellaneous areas – besides the above mentioned areas, the following areas may prove to be encouraging to establish agri enterprises such as setting up of Apiaries, feed processing units, seed processing units, mushroom production units, commercial vermincompose units, goat rearing farmers club, organic vegetable and fruits retail outlet, bamboo plantation, etc.

Agricultural business means growing and rearing of crops and livestock, their production, and marketing. For the people of rural and sub-rural areas of the country, agriculture is one of the major sources of livelihood. This sector used to depend much on the climate for its flourishment but with the introduction of technology and science, this field too has witnessed huge development. Agriculture is a vast field that encompasses forestry, animal husbandry, and fishery too. The businesses related to agriculture are quite profitable if run with passion and dedication.

Before you think about how to start agriculture business, you should first short list the business idea which you are willing to start. Here are the list of more than various business based on agriculture. One can select any suitable

business idea based on their interest/passion and how much they are willing to invest in such business. You should create an agricultural business plan only after the selection of the business idea.

1. Agriculture farm: If you have an empty land suitable for farming, you can start with an agricultural farm. Items that are demanded locally can be produced on it. Maintaining good quality can fetch you high profits.
2. Tree farm: A tree farm grows trees and earns money by selling them. The waiting period of earning money in this business is quite high as the growing of trees requires considerable time. This is one of the best small farm business ideas to start. This might need some maintenance cost.
3. Organic fertilizer production: Vermicompost or organic fertilizer production has become a household business. It does not require much investment and very easy to initiate with a little know-how of the production process.
4. Fertilizer distribution: This business is suitable for people who live in small towns or rural areas. In this business, you are required to buy fertilizers from big cities and make them available in rural areas. This could be one of the best small agricultural business ideas to start in small towns.
5. Dry flower business: The business of dry flowers has flourished over the last 10 years. If you have vacant land, you can grow flowers, make them dry and sell to craft stores or hobbyists.
6. Mushroom farming: The business of growing mushrooms can fetch you big profits in a short period of time. It can be started with low investment and it requires less space also. Mushrooms are in great demand at hotels, restaurants, and households.
7. Poultry farming: The business of poultry farming has transformed into a techno-commercial industry. In the last few decades, it is one of the fastest-growing industries. If you are looking for small farm income ideas, this could be best fit for you.
8. Hydroponic retail store: Hydroponics is a new plantation technology that does not use soil for growing plants. A hydroponic retail store deals in hydroponic equipment and also develops plants to be sold for both commercial and home use.
9. Organic greenhouse: An organic greenhouse business has good potential to grow because the demand for organically grown products has been increasing consistently. Beforehand, this business was done on small family-run farms, but with increasing demand as people are now buying land for making organic greenhouse.
10. Beekeeping: With the increasing awareness for health, the demand for honey is growing day by day. This way, beekeeping has become a great business opportunity. This business demands day-to-day monitoring of the bees with close supervision.
11. Fish farming: Commercial fish farming is a very lucrative business that can fetch a huge amount of money. With the implementation of modern techniques, production and quality can be enhanced to a great deal. This is one of the most lucrative agricultural business ideas that require moderate to high investment.
12. Snail farming: Snail farming is the process of raising land snails for human consumption. Snails contain a high rate of protein, iron, low fat, and almost all the amino acids needed for the human body. Keeping their nutrient value in mind, they are in high demand. This business opportunity demands discipline and specific knowledge of modern technology.
13. Fruit and Vegetable export: You can initiate the business of exporting fruit and vegetables in which you have to collect fresh fruits and vegetables from local farmers and sell them internationally. For this business, you need to know the import and export policies as well as local markets. This is one of the best agriculture export business ideas to start.

14. Broom production: For centuries, the broom has been used for sweeping up the floor and removing the dirt and dust in and around workplaces and homes. The process of broom production is quite simple and the project can be initiated with low capital investment. Maintaining a good quality and competitive prices can give you good profits in a short span of time.

15. Fruits & vegetables processed products: The production processed of fruits & vegetables products is quite simple and can be initiated with low investment. This business has a huge market opportunity. Hygiene, taste, and quality of fruit have to be kept in mind while starting this business.

16. Quail farming: Quail farming is about raising quails for profitable eggs and meat. At the global levels, quail farming is gaining importance as it fulfills daily family nutrition demand.

17. Tea plantation: With the increasing demand for tea leaves, this business has huge potential. Tea plants typically required acidic soil and heavy rainfall, although they can be grown anywhere from sea level to high altitudes. So, if your demographic situation is suitable for growing tea, you should go in this business. This is one of the good agriculture business ideas that require high capital.

18. Cultivation of MAPs: Growing of medicinal and aromatic plants at the commercial level is one of the most profitable agriculture business ideas. If you possess good knowledge about the herbs and have sufficient land, you can initiate the farming of medicinal herbs. You may need to take certain licenses from local government in the case of medicinal herb business.

19. Cactus and other ornamental plants: Cactus has been extensively used as a decor item, either indoor or outdoor. Many cactus plants can coexist happily in the same container. So, with a touch of creativity, you can make beautiful cactus arrangements. It is a very profitable and self-rewarding business.

20. Potato products: Potato is extensively used in the snack food industry for production of chips, french fries, powder, etc. It can be used in any recipe where mashed potatoes are required. Powder is used as a thickener in ready to eat vegetable gravies and soups. It is a small-scale industry based on making potato chips and french-fries. The demand for potato chips and french-fries as an FMCG is increasing steadily in the global market. This is one of the most profitable small agricultural businesses to start with low to medium capital.

21. Goat Farming: Goat is one of the main meat-producing animals used globally. For this reason, goat rearing has been flourishing as an economic industry with good prospects.

22. Soil Testing: Soil testing is a technique used for monitoring the nutrients present in the soil is well as for making precise fertilizer recommendations for different crops. Establishing a soil testing laboratory with Government certification is one of the best small agricultural business ideas.

23. Fodder farming: The term fodder is used for the food given to domestic animals for feeding and not the food they graze by themselves. There are plants grown particularly for this purpose like barley, oats, alfalfa, etc. Fodder is used to feed animals like cows, goats, pigs, horses, etc. and always in great demand.

24. Rose farming: Rose is a flower with high commercial value. It is used in flower arrangements and bouquets on a large scale. If you are interested in gardening, you can turn it into a profitable business. It can be initiated on a small piece of land.

25. Rabbit farming: Rearing of rabbits has been started on a commercial level. Angora rabbits are mainly raised for their wool and well known for quality. Rabbits are the best producers of wool on per kg body weight basis.

26. Dairy farming: Demand for milk and milk products can never go down. Commercial dairy farming is one of the most profitable agriculture-based business ideas. Apart from milk, it produces manure in huge quantities. Hygiene and quality should be always kept in mind while doing this business.

27. Spice processing: Organic spices are in high demand locally as well as internationally. The processing and

packaging methods are not very complex and can be initiated with moderate capital.

28. Horticulture crop farming: Horticulturists produce fruits, plants, and vegetables, flowers in greenhouses, and nurseries with highly specialized knowledge. The selection of the crops and method is very important in this business.

29. Certified Seed Grower: Quality seeds are always in huge demand. One can start his/her business as certified seed grower at their own farm. Now a days, it a booming business in agriculture sector.

30. Certified seed dealer: Seed certification is a process of quality check whereby the seeds are inspected and checked with proper process. In simple words, the system certifies that a box or packet of seed is in accordance with the requirements of a certification scheme. You can start a business that sells only certified seed. There are a few formalities to establish this business. You do not need any land for it. It can be initiated by contract farming.

31. Greenhouse flower export: Many people establish a greenhouse for producing only export-oriented flowers. It is one of the most profitable business ideas it requires substantial capital investment and good knowledge about the process.

32. Agriculture consultancy: If you are an expert in a specific field of farming, you can adopt the business of agriculture consultancy. This business is flourishing day by day as farmers need expert advice at many stages.

33. Agro blogging: If you possess good knowledge about agriculture with a niche in writing, you can always try for agro-blogging. It contains blogs related to agriculture and farming. With the advent of the internet in rural areas, farmers have started using technology to improve their farming skills. They need fair advice on their agricultural problems. This is one of the best agricultural related business ideas to start with zero to low investment.

Advice: Before initiating any agro-based business, you should conduct proper market research on the demand of the product, it's technical know-how and its marketing. You should sketch a proper agricultural business plan before going for it.

Conclusion

Agripreneurship plays various roles in the growth and development of national economy through entrepreneurship development which increases the income level and employment opportunities in rural as well as urban areas. Agripreneurship also play following role in the economic system, it helps in inducing productivity gains by smallholder farmers and integrating them into local, national and international markets. It helps in reducing food costs, supply uncertainties and improving the diets of the rural and urban poor in the country. It is also generating growth, increasing and diversifying income, and providing entrepreneurial opportunities in both rural and urban areas.

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Chapter - 12

Biological control of plant diseases: an innovative tool in sustainable production

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Plant diseases caused by fungi, bacteria, virus, nematodes and phytoplsmaneed to be controlled to maintain the quality and abundance of food, feed, and fiber produced by growers around the world. Different approaches may be used to prevent, mitigate or control plant diseases. Beyond good agronomic and horticultural practices, growers often rely heavily on chemical fertilizers and pesticides. However, the environmental pollution caused by excessive use and misuse of agrochemicals has led to considerable changes in people's attitudes towards the use of pesticides in agriculture. The best alternative used in recent years for management of plant diseases is the biological control

The terms “biological control” and its abbreviated synonym “biocontrol” have been used in different fields of biology, most notably entomology and plant pathology. In plant Pathology, the term applies to the use of microbial antagonists to suppress diseases as well as the use of host-specific pathogens to control weed populations. The organism that suppresses the pest or pathogen is referred to as the biological control agent (BCA). More broadly, the term biological control also has been applied to the use of the natural products extracted or fermented from various sources. These formulations may be very simple mixtures of natural ingredients with specific activities or complex mixtures with multiple effects on the host as well as the target pest or pathogen. Endophytes are alsoan example for biocontrol agents

Plant pathogens and arbuscular mycorrhizae are the best fungi associated with plants. In addition to those, numerous species of fungi known as endophytes inhabit the tissues of all plant species. These microbes are an intriguing group of organism associated with various tissues and organs of terrestrial and some aquatic plants, whose known infections are inconspicuous and the infected host tissue are at least transiently symptomless.

Anton de Bary first introduced the term "epiphytes" for fungi that live on the surface of their host and "endophytes" for those living inside the plant tissue. Later, this term was expanded as fungi and bacteria, including actinomycetes, which spend the whole or part of their life cycle colonizing inter- or intra- cellularly, inside the healthy living tissues of the host, typically causing no apparent symptom of disease. The word endophyte came from two Greek words, "endon" means within and "phyton" means plant. Wilson (1995) defined endophytes as the fungi that live internally and remain asymptomatic for at least part of their life-cycle. He also described the symptomless nature of endophyte occupation in plant tissue, symbiotic and mutualistic relationship between the endophytes and their host. But they can also be aggressive saprophytes or opportunistic pathogens. There have been several studies on the plant endophyte relationship, especially for grasses such as tall fescue, where it has been shown that endophytes produce toxins that discourage insects and other grazing animals. Persian darnel, an annual grass, considered as a troublesome weed by wheat farmers, is probably the plant that has been studied most extensively as far as endophytes are concerned. It has been discovered that grasses with high endophyte content are often resistant to attack by certain insects.

Taxol, a highly functionalized diterpenoid, is found in each yew (Taxus) species. This compound is the world's first billion dollar anticancer drug, and is used for treatment of ovarian and breast cancers. In the early 1990s, a novel taxol-producing endophytic fungus, Taxomyces andreanae, was isolated from Taxus brevifolia (Strobel et al. 1993). An examination of the endophytes of Taxus wallichiana yielded the endophytic fungus Pestalotiopsis microspora, and a preliminary screening indicated that it produced taxol.

Selection of Plant Material

Following criteria must be considered in plant selection strategy

1. Plants from a unique ecological environmental niche, and growing in special habitats, especially those with an unusual biology and possessing novel strategies for survival should seriously be considered for study.

2. Plants that have an ethnobotanical history, and are used for traditional medicines should be selected for study, as inhabiting endophytes may be the source of the medicinal properties of this plant. For example, the endophytic fungus Fusarium proliferatum possessing antimicrobial activity, was isolated from traditional Chinese medicinal plant Celastrus angulatus.

3. Plants that are endemic, having an unusual longevity, or have occupied a certain ancient land mass, are appropriate for study. An endophytic fungus Chaetomium globosum, isolated from leaf of endemic plant Maytenus hookeri, which is only distributed in areas of Yunnan, China, was found to produce Chaetoglobosin B which showed anti-tuberculosis activity.

4. Plants growing in areas of great biodiversity also have the potential for housing endophytes with great diversity.

5. Plants surrounded by pathogen infected plants, and showing no symptoms are more likely to lodge endophytes possessing antimicrobial activity than other plants.

6. Young plant tissue is more suitable for isolation of endophytic fungi than older tissues which often contain many additional fungi that make isolation of slow growing fungi difficult to isolate.

The collected plant samples are stored at 4°C until the isolation procedure is carried out, and isolation should be as soon as possible after collection to avoid contamination by air microspora.

Isolation and Cultivation of Endophytic Fungi from Plants

Isolation of endophytes is a critical step, because it requires sensitivity to recover a maximum number of colonized endophytes and should be accurate enough to eliminate the epiphytic microbes which are present on the plant surface. Endophytes can be isolated from various plant parts such as seeds, leaves and stems. The most important step for the isolation of endophytic fungi that reside in plant tissues is surface sterilization and the plant parts under investigation should be cut into small pieces to facilitate sterilization and isolation processes. To achieve complete surface sterilization, there are various methods to eliminate most of the epiphytic fungi from the exterior tissues and encourage the growth of the internal mycota, according to the type of tissue as well as its location (Strobel 2003)

Mechanism of action of endophytes

Endophytes offer several advantages to the host plants. They are 1) greater access to nutrients, 2) Protection from desiccation, 3) Protection from surface feeding insects, parasitic fungi, etc. In addition, several secondary metabolites are synthesized by endophytes like antibiotics, antioxidants, enzymes and plant growth promoters etc. Endophytes are known to manage the plant diseases by induction of systemic resistance, antibiosis, hyperparasitism, predation, production of metabolites with nematicidal and insecticidal properties and occupation of ecological niche.

Direct Inhibition of Plant Pathogens

Many studies recently found that endophytic fungi have the ability to protect host from diseases and limit the damage caused by pathogens. The mechanisms is direct effect (interaction between endophytes and pathogens), indirect effect (enhanced plant defense) and ecological effects (occupation of ecological niche). In the case of direct effect,endophytes directly suppress pathogens by producing antibiotic, secreting lytic enzymes. However, the direct interactions between fungal endophytes and pathogens are complex and sensitive to species-specific antagonism .

- Secondary metabolites synthesized by endophytes

a)Antibiotics

Many fungal endophytes produce secondary metabolitesand some of these compounds are antifungal andantibacterial which strongly inhibit the growth of othermicroorganisms including plant pathogens. A group of biocontrol strains can produce single ormultiple kinds of antibiotics including terpenoids, alkaloids,aromatic compounds and polypeptides. Fivecadinane sesquiterpenes derivatives were isolated fromPhomopis cassiae, which is an endophytic fungus isolatedfrom Cassia spectabilis and 3,11,12-trihydroxycadaleneas one of those five derivatives was revealedas the most antifungal active compound againstCladosporium sphaerospermum.

Muscodor albus, anendophytic fungus of tropical tree species, can producemany volatile organic compounds including tetrohydofuran,2-methyl furan, 2-butanone and aciphyllene whichhave antibiotic activities.

b)Antioxidants: Two compounds, "pestacin" and "isopestacin" were isolated from the culture broth of Pestalotiopsis microspora, an endophyte isolated from Terminalia spp. in New Guinea. Both the compounds had antimicrobial as well as antioxidant properties.

c)Enzymes

When endophyte colonizes on the plant surface, they produce enzymes such as β-1,3- glucanases, chitinases and cellulases to hydrolyze the plant cell wall. In addition, these enzymes also have a function to suppress the plant pathogen activities directly and have the capability of degrading the cell wall of fungi and Oomycetes. Senthilmurugan et al. (2013) isolated Botrytis sp. as endophyte from the aerial roots of Ficus benghalensis in India. The culture of this fungus produced amylase and laccase enzyme. The crude fungal extract inhibited E. coli and Klebsiella by producing bioactive compounds such as alkaloids, flavonoids, saponins, steroids and terpenoids.

d. Lytic enzymessecreted from endophytes: Many microorganisms produce and release lytic enzymes that can hydrolyze a wide variety of polymericcompounds, including chitin, proteins, cellulose,hemicellulose and DNA. When endophytes colonize on the plant surface, they produce enzymes to hydrolyze plant cell walls. As a result, these enzymes also have the function to suppress plant pathogen activities directly and have the capability of degrading the cell walls of fungi and Oomycetes. There are many kinds of these enzymes which include β-1,3-glucanases, chitinases and cellulases. Mutagenesis of β-1,3-glucanase genes in Lysobacter enzymogenes strain C3 resulted in reduced biological control activity towards bipolaris leaf spot of tall fescue and pythium damping-off of sugar beet.

- **Indirect effects to enhance plant resistance**

Plants emerge a series of mechanisms against unfavorableenvironment such as drought, cold, salt stress orpathogens. During the long term evolution, two types ofinnate resistance: non-specific (general) resistance andspecific resistance are formed to resist pathogensinfestation. The former form iseffective against several pathogenic species, while thelatter can resist infection of one or a few pathogenicstrains. Since fungal endophytes may evolve from plantpathogenic fungi, plant defense could be triggered byfungal endophytes like pathogens. Actually, the defenseof plant associated with endophytes is increased throughresistance enhancement and secondary metabolitesproduction.

- **Induction of plant resistance**

Systemic acquired resistance(SAR) and induced systemic resistance (ISR) are twoforms of induced resistances. Fungal endophytes induced ISR may also associate with the expression of pathogenesis-related genes. F. solani, isolated from the root tissues of tomato elicited induced systemic resistance against the tomato foliar pathogen, Septoria lycopersici and triggered PR genes, PR5 and PR7 expression in the roots.

- **Antibacterial activity of endophytes:**

The antimicrobial activity of endophytic fungi has been observed in a range of bacteria. The endophytic fungus Curvularia lunata isolated from Niphates olemda, was found to produce cytoskyrins, which show antibacterial

activity, and is considered as a potential anticancer agent.The broths of 16 endophytic fungi isolatedfrom the medicinal herb, Cynodon dactylon(Poaceae), were identified as having potentanti-Helicobacter pylori activity. Out of 377 isolates of endophytic fungifrom Garcinia plants, 18.6% isolates displayedantimicrobial activity against at least onepathogenic microorganism, such as S. aureus,a clinical isolate of methicillin-resistantS. aureus, C. albicans and C. neoformans.T. hartigii exhibited a significantantibacterial effect on Enterococcus faecalis. Fusarium was the mostfrequently isolated endophyte from the Chinesetraditional medicinal plant, Dioscoreazingiberensis, and F. redolens showed themost potent antibacterial activities againstB. subtilis, S. haemolyticus, E. coli and X.vesicatoria.

- **Antiviral activity of endophytes**

Viruses are an important causal agent of variousdiseases in plants and animals. Endophytescan induce plant resistance againstviral diseases, but there is a contradictionand Guy (1992) found no correlation betweenvirus infection and the incidence of endophytein perennial ryegrass (L. perenne),whereas other correlative studies haverevealed that some endophyte-infected tallfescue (Festuca arundinaceum) seem to bemore resistant to barley yellow dwarf virus(BYDV) than the others.

- **Nematicidal activity of endophytes**

Endophytic fungi are known to producesome compounds which are toxic to nematodes.The first report on antagonistic activityof endophytic fungi against plantparasitic nematodes was observed in tallfescue (F. arundinacea) infected by Pratylenchusscribneri. The nematode populationwas found to be comparatively less inthe soil surrounding endophyte-infectedplants. Endophyte-free perennial ryegrass plants areshown to have a larger number of M. incognitapopulation in roots than endophytecontainingplants.Another endophyticmicrobe, Burkholderia ambifaria, isolatedfrom corn root, produced some toxic metaboliteswhich inhibited egg hatching andmobility of second-stage juveniles of M.incognita.Severalendophytic fungi isolated from above-groundplant organs produced 3-hydroxypropionicacid (HPA) by bioactivity-guided fractionationof extracts and showed selective nematicidalactivity against the plant-parasiticnematode, M. incognita. Radopholussimilis is an important parasiticnematode on banana and other plants. It issuggested that the dual inoculations ofendophytic fungal isolates reduce a largenumber of the R. similis population

- **Insecticidal activity of endophytes**

Fungi are known to produce a large numberof insecticidal metabolites such as destruxins,ibotenic acid, pantherine, tricholomicacid, etc. The endophyticfungus, P. oblonga, was responsible forreducing the spread of Dutch elm diseasecausal agent, Ceratocystis ulmi, by controllingits vector beetle (P. brevilineum). Several highly infected ryegrass specieswith endophytic fungi consequently haveshown less attack frequency of Argentinestem weevils (Listronotus bonariensis). In L. perenne anda few members of genus Cyperus, insectpestSpodoptera frugiperda was affectedadversely by endophytic fungus like Balansiacyperi.Endophytic Acremoniumsp. deterred the grasshopper,Acheta domesticus. Beauveria bassiana is a highly effectiveentomopathogen of a wide range ofinsects. Grass varieties infected by Neotyphodiumendophyte has affected the feedingperformance and preference of newlyhatched nymphs of the hairy chinch bug,Blissus leucopterus hirtus, a common turfgrasspest in north-eastern USA.The endophytic fungi,B. bassiana and Clonostachys rosea, isolatedfrom coffee plant, showed strong antagonisticactivity against coffee berry borers. A strain of endophytic Penicilliumsp., isolated from the fresh roots ofDerris elliptica, produces some insecticidalcompound analogues to rotenone againstthe adult turnip aphid, Lipaphis erysimi.

- **Production of Phyto-Hormones**

Endophytes may enhance growth by producing phytohormones without any apparent facilitation of host nutrient uptake or stimulation of host nutrient metabolism. The endophytic fungi may enhance biomass by producing growth hormones or inducing the host hormone production. The use of fungal culture extracts of endophytes to enhance plant growth, indicate that soluble agents in culture extracts may stimulate host growth similarly to the

actively growing fungi, and this prove that endophytic fungi produce phytohormones in vitro as well as in vivo.

For example, the mycelial extract of P. fortinii induced a similar increase in Larix decidua shoot and root biomass as did the fungus itself, the growth promotion was attributable to IAA as the fungus synthesized the hormone in vitro. A similar effect has also been observed with P. indica. When a fungal filtrate (1% w/v) was added to maize seedlings three times a week for 4 weeks, shoot biomass increase was similar to that observed in inoculation experiments with living cultures of the fungus.

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Chapter - 13

Fresh water fish farming - A way for sustainable development in Aquaculture

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Introduction

Aquaculture is presently one of the fastest growing food production systems in the World. As defined by the united food nations Food and Agriculture Organization (FAO), aquaculture is the "farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Most of the global aquaculture output is made in developing countries and significantly in low-income food-deficit countries. Due to not growing fish catches from many capture fisheries and increasing demand for fish and fishery products, opportunities for aquaculture to increase its shares to the world's production of aquatic food are very high, and there is also expectation that aquaculture will persist to strengthen its role in contributing to food security and poverty relief in many developing countries. Nevertheless, it is also acknowledged that aquaculture encompasses a very wide range of different aquatic farming practices with regard to species, environments and systems utilized, with very distinct resource use patterns involved, offering a wide range of options for diversification of avenues for enhanced food production and income generation in many rural and peri-urban areas.Farming involves some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc., Farming also implies individual or corporate - proprietorship of stock being cultivated.Two essential factors together distinguish aquaculture from capture fisheries.

- Intervention to increase production
- Ownership/Proprietorship of the stock

Activities involving in Aquaculture:

The following activities are considered as aquaculture:

- Rearing of fry, spat, post larvae etc., in hatcheries.
- Stocking of ponds, cages, pens, tanks, raceways and temporary savages with wild caught or hatchery reared juveniles to produce marketable fish/shellfish/aquatic plants/other aquatic animals.
- Culture in tidal ponds
- Rearing molluscs to market size from hatchery produced spat, transferred natural spat fall or transferred part
- Stocked fish culture in paddy fields.
- Harvesting planted or suspended seaweed
- Valliculture (Culture in coastal lagoons)

Origin of Agriculture and Aquaculture

- Agriculture first developed 10,000 years ago in the Middle East when human population changedfrom hunting-gathering to cultivating wheat and barley.Subsequently there were independent origins of farming cereal crops on other major land masses
- Middle East wheat and barely

- Rice cultivation began in Asia 7000 years ago
- Sorghum and millet developed in Africa and maize in America
- Compared to agriculture the origins of Aquaculture much later
- Common carp culture developed some hundreds of years BC in China
- The first aquaculture text book was written some 500 BC by Fan Lei a Chinese politician
- Africa, America, Australia introduced aquaculture in recent centuries.

The late origin of aquaculture is because humans who are terrestrial cannot readily known parameter of aquatic environment. Several aquatic parameters affect aquatic organism such as very low solubility of O2, high solubility of CO2, (pH) Hydrogen ion concentration, Salinity, buffering capacity, dissolved nutrients, toxic nitrogenous wastes, turbidity/transparency, heavy metals and other toxic substances, phyto and zooplankton concentration, and current velocity.

It is difficult for terrestrial human being to known influence of these environmental factors causing longer period for aquaculture development than other forms of food production. Establishing of physical facilities building up productivity of the system and attainment of skills take considerable period of time, therefore, aquaculture started much later than agriculture.Also, the major consequence of late origin of aquaculture is that, relatively little genetic selection has taken place in fish being farmed compared to plants and animals used in agriculture and animal husbandry. Modern agriculture based on organisms vastly different from wild ancestors in heavy cases wild ancestors. Don't exist because, selection and domestication took place over thousands of years. In contrast majority of aquaculture is based on wild plants and animals.

Only a few species have been domesticated. Following are the example of fish species that have been domesticated such as Common carp, Atlantic salmon, Rainbows trout, Tilapia species, Channel catfish. Many other aquaculture species are based on wild brood stock or larvae collected from the wild.In some cases production cycle has not be closed i.e., the species have not been matured under captivityand spawned under captive conditions. Therefore there is minimal potential for selective breeding becauseunless the production cycles are closed selective breeding cannot take place.

Top five aquaculture producer countries (2017). China was the top producer of fish through aquaculture. The

Sl.No	Name of the Country	Million metric tonnes
1	China	15.37
2	Indonesia	6.69
3	India	5.43
4	United States	5.04
5	Russia	4.87

Aquaculture production by environment

Freshwater environment dominated the aquaculture production. The following table give the production statistics by environment.

Name of the resource	By Quantity	By Value
Freshwater	60.61 %	56.0%
Seawater	31.75%	30.7%
Brackish water	7.60%	13.3%

Species

Carps, barbels and other cyprinids are accounting for a quarter of global aquacultureproduction quantity (112 million tonnes) and value (USD 250 billion) in 2017 (FAO). Other major groups cultured include shellfish, tilapias, shrimps and prawns; and salmons. The following table shows percentage contribution by species groups to total world aquaculture production.

Species groups	% contribution
Carps, barbels and other cyprinids	25.32
Red seaweeds	15.42
Brown seaweeds	12.30
Tilapias and other cichlids	5.25
Oysters	5.10
Clams, cockles, arkshells	5.05
Catfishes	4.93
Marine shrimps and prawns	4.92
Salmons, trouts, smelts	3.11
Freshwater fishes (Miscellaneous freshwater fishes)	2.19
Other species	16.40

Freshwaters are one of the essential resources for the survival of mankind. Among other uses, freshwaters are also use for farming of fish. Freshwaters can be divided into surface waters, ground water, ice and glaciers, and soil moisture. Further, surface water can be sub-divided into rivers/streams, SS Lakes, ponds/tanks and wetlands.

Following are the top 10 countries with freshwater resources

Sl. No	Country	%
1	Brazil	14.9
2	Russia	8.1
3	Canada	6.0
4	United States	5.6
5	Indonesia	5.1
6	China	5.1
7	Columbia	3.9
8	Peru	3.5
9	India	3.5
10	Congo	2.3

Out of these total resources ponds and tanks are most suitable for culture, while, pen and cage culture can be undertaken in Lakes and Reservoirs.

Freshwater Resources of India

India is blessed with different types of freshwater resources, some of which can be utilized for fish culture. Following are the types of water bodies found India and their extent.

Type of water body	Area
Rivers and Canals	1,97,204 Kms
Ponds and tanks	2.25 Million Ha
Lakes and Reservoirs	2.09 Million Ha
Bheels and wetlands	1.30 Million Ha
Paddy fields	2.30 Million Ha
Irrigation canals	0.12 Million Ha

Only 45% of the ponds and tanks in India are currently utilized for fish culture. Therefore great potential for horizontal expansion exists.

Biological Resources (Species)

India is also blessed with great biodiversity of fish. Only a few of the fish found in India have been used for fish culture or are suitable for fish culture. The following species of fish are either used for fish culture or can be used for fish culture.

a) Carps

- India is basically a carp country
- Freshwater farming is mainly focused on carps
- Three Indian major carps viz., Catla, Rohu and Mrigal are the main species cultivated.
- The three Chinese carps – silver carp, grass carp and common carp are also used in the compositefish culture.
- A wide range of technology for seed production and culture of the carps is available
- Carp culture expanded rapidly after 1980s in the states of Andhra Pradesh and West Bengal.

b) Air breathing fishes

- Giant murrel, striped murrel, spotted murrel, Magur, Singhi and Climbing perch are the airbreathing fish available for culture.
- Air breathing fish are the second most popular group of fish cultured in freshwaters.
- They can withstand poor water quality
- Therefore can be grown in areas unsuitable for carp culture such as marshes and derelict waterbodies.
- Pangasius catfish has recently been performed in India to augment fish production.

c) Crustaceans

- Giant freshwater prawn and the Indian River prawn are the two species of crustaceans suitable forculture.
- Highly priced, fast growing species suitable for export
- It can be polycultured with the carps
- In monoculture yields of 800 to 1000 kg/ha/year can be obtained.

d) Molluscs

- The freshwater mussels Lamellidenssp and Hyriopssp. are used for production of freshwater pearls.

e) Coldwater fish

- The Mahseers and the exotic trouts are species available for cold water fish culture
- Species Mahseers suitable for culture are Tor putitora; T. tor, T. khudree, T. mosal and T.malabaricus
- The snow trout Schizothoraxsp and minor carps such as Labeodero and L. dyocheilus are alsosuitable coldwater species.
- The exotic cold water fish introduced to India are Salmogairdneri, S. truttafario andSalvelinusfontnualis
- The tenchTincatincais also suitable so also the common carp, Cyprinuscarpio

f) Tilapia fish

Status of freshwater Aquaculture in India

Freshwater aquaculture has expanded rapidly in India, particularly in the States of Andhra Pradesh andWest Bengal. As stated earlier carps are the dominant group of fish cultured in India as is the case in someother parts of Asia, particularly China. The following statistics illustrate the point.

Freshwater aquaculture, accounts for 70% of the total Inland production

- Aquaculture is growing at a rate of 5.6% per annum.
- Carps contribute to 90% of the freshwater aquaculture production
- Due to constant Research and Development, and extension aquaculture productivity in India has been enhanced from a more 500 kg/ha/yr to 2000 kg/ha/yr. However, the potential is yet to be reached.

The potential for increasing fish production by adopting scientific farming methods are given in the following table.

Sl.No	Method of culture	Potential (tonnes/ha/year)
1	Composite fish culture	4-6
2	Intensive culture	10-15
3	Catfish culture (Magur catfish)	3-5
4	Sewage fed fish culture	3-5
5	Integrated fish culture	3-5
6	Pen culture	1-2
7	Running Water culture	20-50 kg/m^3
8	Cages	10-15 kg/m^3

By bringing more area into culture and by increasing productivity of the systems, India can substantiallyincrease its fish production through freshwater aquaculture.

Sustainable Aquaculture

Sustainable developmentis the management and conservation of the natural resource base and the orientation of technological and institutional modification in such a manner as to safeguard the attainment and continued satisfaction of human needs for present and future generations. Though living resources are self-renewable, they have to be utilized wisely on a sustainable basis inco-ordination with the environment. Such sustainableimprovement (in the divisions like agriculture, forestry and fisheries) conserves land, water, plant and animal geneticresources and it is environmentally non-degrading, technically suitable/applicable, economically viable and sociallyacceptable.

Requirement - Sustainable development

Aquaculture currently shows for roughly one third of the World's total supply of food fish and undoubtedly thecontribution of aquaculture to sea food supplies will increase in the future. It has potential to develop asustainable practice that can add-on capture fisheries and significantly contribute to feeding the World'sgrowing population. In common with all other food production practices, aquaculture is facing challenges for sustainabledevelopment. FAO-highlightedaugmentation of inland fishproduction through integrated aquaculture cum agriculture farming systems and integrated utilization of small andmedium size water bodies.

Unsustainable aquaculture will only make short and medium term profits for multinational corporationsat the expense of long-term ecological balance and social stability. Sustainable development includesthe management and conservation ofnatural resource base, and the orientation of technological and institutional change in such a manner to ensure theachievement and continued satisfaction for present and future generations. Such expansions conserve land, water,plant and genetic resources as well they are environmentally non-degrading, technologically appropriate,economically viable and socially acceptable.Elevation of sustainable aquaculture development needs that enabling environments, in particularthose aimed at ensuring continuing human resource development and capacity building, are created andmaintained. There are a number of choices for sustainable development of aquaculture - include ecologicalbased aquaculture, organic based aquaculture, composite fish culture, integrated aquaculture and closed recirculating aquaculture systems.

1. Ecological based aquaculture

It has been defined asan alternative model of aquaculture research and developmentthat carries the technical aspects of ecological principles and ecosystem thinking to aquaculture and concerns forthe wider social, economic and environmental context of aquaculture.It emphases on the development of farming systems that safeguard the environments in whichthey are situated and enhances the quality of these environments, also maintaining aproductive culture system.

2. Organic based aquaculture

Sustainability is one of the chief goals of organic food production. Some of the elementary principles of organicaquaculture as per the International Federation of Organic Agriculture Movements are as follows; to encourage natural biological cycles in the production of aquatic organisms. Using various methods of disease control and non-use of synthetic fertilizer or other chemicals in production. Utilize of polyculture technologies whenever/wherever possible.

3. Polyculture- Integrated fish culture

Polyculture and integrated fish culture are methods of raising variousvarieties within the same farming systems,where each species utilizes a distinct niche and distinct resources within the farming system. This may includethe rearing of various aquatic organisms together or in conjunction with terrestrial plants or animals.This culture technique can provide reciprocal benefits to the organisms reared by allowing for a balanced use ofthe available aquatic resources while integrated systems can increase the economic efficiency through improvedconversion rates of input materials. The waste from one animal is used as input to another resulting in

theoptimal use of resources and less pollution overall.

4. Closed recirculating aquaculture systems

Issues for water conservation and reduced waste discharges have understood the use of closed recirculatingaquaculture systems. It save water and allow control of environmental factors, predators and introduction and transfer of diseases. It has less impact on environment becauseof their close nature - wastes and uneaten feed are not simply released in the ambient environment. Wastes are filtered out of the culture system and disposed of in a responsible mode in this system.

To improve into an environmentally and socially responsible food productionendeavour in aquaculture, following points should be suggested. Implement more ecologically sustainable methods. Change to use of closed systems and low discharge systems, especially those that provide totalcontainment of fish and recovery or reuse of wastes. Considerably decrease or eliminate the dependence on wild fisheries. Improve sustainableaquaculture practices that provide long term social and economic benefits to communities.

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Chapter -14

Scope for Entrepreneurs in Postharvest Technology of Horticultural Produce

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Introduction

India is a leading producer of many major horticultural crops due to varied agro climatic conditions and cultivation of a large number of crops. On production basis, India occupies 2nd position after China with a production of 311.71 Million MT (NHB, 2017-18).However, on the basis of processing and preservation, the country remains an insignificant player in global market due to lack of proper postharvest management, preservation and value addition of horticultural produce. Processing and Value addition in India is merely 2-8% which is highly insignificant as compared to USA-80%, Malaysia-80%, France-75%. The overall result of this high production and in absence of proper postharvest management, processing and preservation leads to higher spoilage and wastage of horticultural produce. This wastage is mainly due to lack of proper postharvest management, micro and macro processing units and inadequate storage and marketing infrastructure. It was estimated that at least 20-30% of the production of fruits and vegetables is lost every year in the absence of processing units, storage and post-harvest management. The cost of loss(wastage) is estimated at 40811/-Crore annually(Jhaet al., 2015).Now the scope is open for all and entrepreneurs can take this challenge. This major scope of processing and value addition could be fulfilled by entrepreneurship development in horticulture with the help of postharvest technology.

Postharvest Technology is basically a science based techniques or methods applied to agricultural and or horticultural produce after harvesting the crop for its protection (from spoilage) and quality maintenance during subsequent handling and distribution. In fact it starts at preharvest stage and continued till retail distribution and ends at the hand of consumers. Hence consumer is at the last position of any handling and distribution channel. The entire operations after harvesting till it reaches at consumers' hand is altogether called postharvest handling. So the major postharvest handling operations include sorting, grading, pre cooling, packaging, storage, preservation and value addition. Thus postharvest handling maintains quality of fresh produce and protects from spoilage and wastage. High respiration rate, high water content, short shelf life and high spoilage are some of the characteristics features of fruits and vegetables that make it highly perishable and at the same time a challenging job for entrepreneurs. This also gives an opportunity for those who want to take this challenge as a career and invest in processing and value addition and in creating infrastructure like pack house, precooling unit, cold storage, refrigerated vans etc. All these investments are aimed to improve postharvest managements in horticultural produce by creating entrepreneurship development. Overall a strong and successful entrepreneurship development is possible in postharvest technology of horticultural produce. The scope for entrepreneurs is mentioned as below (fig 1)

Processing of fruits and vegetables into different value added products would be a wonderful effort to reduce postharvest losses, increase farmer's income and to generate employment. The types of products that are suitable for small-scale productions are mainly fruits and vegetables. In general, fruits and vegetable have a low price when they are in raw form but can be processed into a range of food products into high value commodities such as juice, pulp, jams, jelly, marmalade, pickles, dried and dehydrated products etc.

There are Five major business scope:

a) Processing and preservation plant
b) Fresh produce trading
c) Quality testing and certification (Laboratory)
d) Cold Storage cum Packaging units
e) Packaging materials manufacturing

Figure 1: Entrepreneurship development in Postharvest Technology

Processing of fruits and vegetables into different value added products would be a wonderful effort to reduce postharvest losses, increase farmer's income and to generate employment. The types of products that are suitable for small-scale productions are mainly fruits and vegetables. In general, fruits and vegetable have a low price when they are in raw form but can be processed into a range of food products into high value commodities such as juice, pulp, jams, jelly, marmalade, pickles, dried and dehydrated products etc.

Why Postharvest Technology (pht)? (importance And Scope Of Postharvest Technology)

India is 2nd largest producer of fruits and vegetables in the world. Unfortunately, unlike other horticulture rich countries, average Indians do not get the basic daily requirement of fruits and vegetables and our Human Development Index (HDI) is very low. This is because a considerable amount of this valuable produce is lost due to improper post harvest management. High moisture content, living nature, microbial and enzymatic actions, physical and physiological deterioration make fruits and vegetables highly perishable commodities.Many institutions and surveys claimed poor post harvest management, shortage of cold storage and lack of processing facilities, around 10-20% of the produce gets lost annually (Jhaet al., 2015). According to another study, at least 25 to 30 percent of the production of fruits and vegetables in the country is lost due to wastage and value destruction. The wastage cost was estimated to be Rs. 67,500 crores each year. Even if 1% of this could be saved by converting them into value added products, there will be a saving of Rs. 67.5 crores annually. Further, the cost of reducing spoilage is much lesser than the production of the same quantity and quality produce. Post harvest management of horticultural produce is therefore the need of the hour in order to feed ever-growing population of the world in general and India in particular. The most important advantage of post harvest management of horticultural produce is the reduction of post harvest losses of fruits and vegetables.The importance of Postharvest technology in Indian perspective can be grouped as follows

1. Increase in food availability
2. Provide nutritional security
3. Employment generation
4. Value addition
5. Export earning
6. Rural industrialisation

1. Increase in food availability

It is well known fact that fruits and vegetables are perishable in nature due to its high moisture content, high rate of physiological activity viz. respiration, transpiration and ripening, microbial attack, rapid bio-chemical changes such as enzyme activity, softening of the texture and many other biotic and abiotic factors. Harvesting season of almost all fruits and vegetables is very narrow lasting only for 2-3 months. During this short period, availability of that particular fruits and vegetables is abundant and create a glut condition in the market. This glut condition fetches low price for the producer and it is a direct loss to the farmers, but at the end of harvesting season, products availability decreases rapidly and may be completely out of market within 1-2 months. Here, comes the role of Post harvest management of horticultural commodities like proper handling, packaging and storage at safe low temperature, maintenance of cool chain during transportation and marketing, pre and post harvest treatments in order to increase self - life and reduce the overall spoilage and extend the marketing period etc. These practices make fruits and vegetable available for longer period and sometimes whole year. Many modern technologies such as refrigerated storage and transportation, controlled and modified atmospheric storage, irradiation, processing into value added products are some of the ways to extend the availability of fruits and vegetables beyond the end of the harvesting season. In this way, the food already produced can be saved for consumption by applying the techniques of post harvest management and indirectly increase food availability throughout the year without producing more.

2. Provide nutritional security

Fruits and vegetables constitute an important part of human's food. Even though they are generally not considered as a staple food yet they help in intake of cereal foods by making them more palatable in nature. Fruit and Vegetables are rich source of vitamins and minerals and protects against many dreaded diseases hence rightly called as protective foods. In general, fruits and vegetables are not rich source of carbohydrate, protein and fat. However, exceptions are also available like some of the roots and tubers are rich source of carbohydrate, particularly starch, in amounts comparable to the cereal crops, and the leguminous vegetables supply as much as 14 per cent protein. The lipid content in most vegetables is less than 0.1 per cent except avocado. Most fruit, vegetables and root crops are rich in minerals, carotene (Pro-vitamin A) and vitamin C. Besides, there are some trace elements required by the body like copper, manganese and zinc, which acts as coenzymes, is also available in fruits and vegetables. The amount of nutrient can vary with fruit and vegetables, cultural practices, stage of maturity, post-harvest handling and storage conditions. Once they are harvested, their composition goes on changing as a result of physiological and biochemical activities, which are natural processes.

Fruits and vegetables are the rich source of vitamins, minerals, and trace elements, deficiency of which leads many diseases such as scurvy, beriberi, night blindness etc. In addition, most of the fruits and vegetables are also loaded with antioxidants and fibers. Antioxidant neutralizes free radicals produced in the body that is found a possible cause of cancer and also prevents faster aging. At the same time fiber controls many cardiovascular diseases and movement of foods in the digestive system. Several vitamins and minerals that are scarce in cereals and animal products are present in abundance in fruits and vegetables. Beside this, fruits and vegetables also supply carbohydrates and protein and fulfill the essential nutrients in human diet. Therefore, human health is protected if fruits and vegetables or their processed products are consumed regularly. Fruits and vegetables are therefore considered as protective foods. Further, several vitamins, minerals and phyto-hormones found in fruits and vegetables have now assumed the status of functional food. These substances are capable of providing additional physiological benefit, such as prevention or delaying onset of chronic diseases, as well as meeting nutritional requirements. Keeping in view the nutritional quality of fruits and vegetables, post harvest management of these perishable commodities is the only solution for nutritional security to ever growing population of the country.

3. Employment generation

Employment generation of Indian youth is becoming more and more difficult with increasing in population and decreasing new job creation. It has been observed that job opportunities in government sectors are shrinking day by day and private companies closing fresh recruitment. In both the sectors, new investments are negligible, as a result

number of unemployed youths is increasing day by day. For rural youth, it becomes more and more difficult to get a good or moderate employment in rural areas as a result unemployed rural youth are rushing towards towns and cities to do any sort of work. This migration is creating a big problem in metro cities also. Therefore it is the need of the hour that these youth start their own small business that should not only be remunerative and attractive in nature but also easy to operate. Post harvest handling and processing of fruits and vegetables is one such area that can provide great possibility for employment generation. During harvesting season, people can get employment in harvesting, assembling, pre-treatments if any, packaging and transportation of fresh produce to towns and cities. The surplus production and cull fruits and vegetables can be converted into pulps and value added products during the season and later it can be used to prepare various processed products. All these operations require human resources in large quantity.

A fruit and vegetable processing factory having a capacity of 10qt/month can engage 4-6 people for the whole year. In addition in order to handle freshly produced fruits and vegetables properly grading and packing stations and quality control laboratory is required to be developed to assure quality of the produce. Further, many ancillary industries or manufacturing units like food processing machinery, packaging materials both for fresh and processed fruit and vegetable products will also develop side by side and generate employment. Other relevant industries and establishments, such as, retail outlets, transportation facilities etc, will also provide additional employment. In our country 90% of fruit and vegetable produced are marketed by the farmers and their organizations compared to only 20% of cereals/food grains production of India. Employment potential of food processing industries including fruits and vegetable industries is much higher compared to many other relevant industries. For example per 1,000 crores of investment employment potential in food is 54,000 compared to textiles - 48000 and paper - 2500. It has been reported that there is a 4 fold indirect employment on investment in food and it provides 60% employment in small towns and rural areas.

4. Value addition

Value addition is a term used to transform a less valuable commodity into a high value commodity. For example a misshaped and less color apple is a less valuable commodity because it will fetch low price in the market. But the same apple if converted into jam would fetch high price if more than a good looking apple. Another example is a physically damaged fruit and vegetables would fetch very low price could be converted into durable and value added processed products like pickle, jam, jelly, dehydrated products etc. Utilization of physically damaged fruits and vegetables into value added processed product could considerably reduce the price of main product as a result more processed food products will come within the reach of common people. Fruits and vegetables are perishable in nature, it cannot be stored for longer period. It has been observed that about 25-30% of total production are not fit for fresh marketing and called culled produce. These produce are undersized, oversized and malformed/deformed and physically damaged fruits and vegetables but not spoiled at the time of harvest. The produce of this category either sold at throw away prices or left to spoil as such. Thus a huge quantity of horticultural produce in the form of cull fruits and vegetables occurs every year which otherwise could be utilized, if processed into various value added products and by products.

Fruits and vegetable processing units also generate large amount of valuable waste such as peel, stones and other inedible plant parts that are generally not utilised properly and rejected as such in our countryand finally end up as garbage. However, if they are gainfully utilised at the proper time they can become value added products. Some of these waste are rich source of vital constituents like carbohydrates, protein, fat, minerals, edible fibres, etc. and also constituents of commercial use such as pectin, starch, colours/ pigments, essential oils, sugars, vinegar, alcohol, and many compounds useful in food and beverage industries. In addition the waste may be used as cattle feed that is in short supply in our country. These waste processing not only gives value added products but also reduce the price of the primary processed products that are sold at a premium price in our country beyond the means of the common people. In general, it improves the overall economy of the country.

Premature fruit drop due vagaries of climate such as storm or hailstorm is also a big problem in India. As a result a substantial quantity of fruits and vegetables are lost before they attend proper maturity stage. These produce

can be utilized usefully if processed into value added products such as pulp, pickle, chutney, dried powder etc. During peak harvesting season a good amount of quality fruits and vegetables are available in abundant quantity resulting in market glut and all of these quality produce cannot be marketed in the fresh form. As a result, there is huge spoilage and wastage of fresh fruits and vegetables. This wastage can be reduced if they are timely processed into different value added products or preserved by different methods during harvesting season. Now it can be used throughout the year and can be transported to distant market. Value added products not only palatable but also nutritious and gives economic gain. Nutritional value of these products can be increased many folds through fortification particularly of protein, vitamins and minerals.

Processing and value addition serves as an outlet for surplus production and therefore acts as price stabilizer. Fruits are generally consumed as fresh but mostly vegetables are cooked before consumption expecting a few ones like cucumbers, tomatoes etc. Value addition also includes peeling, slicing, cutting into pieces, processing and packaging. All such activities increase value of the products. India has a wide range of indigenous fruits that are underutilized and placed in a separate group called minor fruits. Most of these fruits are tropical/subtropical in nature and grow even under adverse agro-climatic conditions. A large number of these fruits are known for their therapeutic/medicinal and nutritive value and have excellent flavour and very attractive colour. Some of these fruits are not easy to eat out of hand e.g. baelfruit that has a hard shell, mucilaginous texture and numerous seeds; as a result it is not popular as a dessert fruit. Kokum is not acceptable as a fresh fruit because of its high acidity, only its thick outer rind is used in beverage industry or for culinary purpose in the dried form. Similarly aonla as a fresh fruit is not liked because of its strong astringent taste.

All these minor fruits have a great potentiality to processing into a value added fruit products of commercial importance. So that the growers get a remunerative price and consumers get the opportunity to enjoy the indigenous fruit products. A shrink-wrapped fruit and vegetable fetches more prices compared to non shrink-wrapped ones because of value addition. It has already been mentioned that less than 2% of production of fruits and vegetables in India goes for processing.

5. Export earning

It is known that about 84 different fruits and 63 items of vegetables are traded in world market. Postharvest management directly affects national economy not onlyby reducing postharvest losses but also by improving horticulture trade atnational and international level. As per APEDA database (2015-16), thetotal worth of exported fruits and vegetables was 8,391.41 crore INR. Inwhich, the part of fresh fruits was 3,524.50 crores INR and that of vegetables was4,866.91 crore INR.In a similar way, PHT also plays an important role in value addition and processing. As processed food products are exported every year in India, for instance, it was up to the worth of 26,067.64 Crores INR in 2015-16. Postharvest processing enables to export important commodities such as mango pulp (Rs. 796.17 Crores INR), Dried and Preserved Vegetable (914.21 Crores INR) and other Processed Fruit and Vegetable (2,900.33 Crores INR). The above facts clearly indicate the immense importance of postharvest technology in increasing export of horticultural fresh as well as their processed products.

India by virtue of its varied agro-climatic conditions has the advantage of producing most these fruits and vegetables and processing them into products that can be traded in the world market. In order to achieve export potential, following fruits have been identified as having good market potential viz. Mango, Grapes, Banana, litchi or lychee, exotic fruits chikoo, ber, pomegranate, Amongst vegetables the items identified as having good export potential are - Onion, Potato, Green vegetables. Hardly there is any fruit that is not cultivated in this country. At present only few established fruits and vegetables are exported. Government has already recognized it as one of the major thrust for augmenting the country's export. Lack of proper post harvest management and infrastructure facilities are the major hurdles for export of horticultural produce. Countries like Indonesia, Malaysia, Thailand etc. are far behind in production of fruits and vegetables compared to India but their exports are many folds higher than our country. It is mainly because of good post harvest management practices, quality maintenance throughout the marketing channel and basic infrastructure for export.

6. Rural industrialisation

Post harvest management and processing of fruits and vegetables is the backbone of the horticulture industry as it takes care of gluts and all possible wastage that occur during handling, storage, distribution and marketing. Most growers are rural people. During peak harvesting season, always there is glut. There is no preservation unit, grading and packinghouse in rural areas. They cannot hold their produce, even for few days due to lack of storage facility and they are unable to preserve their produce. This situation forced them to sale their good quality produce at very low price to middleman. Cull fruits and vegetables are generally goes waste or sold at a very low price. After harvesting season is over, again rural people become jobless. They generally migrate to cities in search of any sort of job. Setting up of small and cottage level preservation factory at village level not only reduces losses due to glut but also provides jobs for rural people. It can always fetch an additional income to the grower and help in stabilizing the prices and providing economic return. Hence, fruit and vegetable processing industry should be encouraged and developed in rural areas, a way of rural industrialisation.

Survey Before Investment In Pht

A survey is must before any initiative in postharvest technology. The survey must be based on SWOT (Strength, weakness, opportunity and thread) analysis as shown below (fig 2). This is a general analysis. Weakness and thread may not be equally important in all places and conditions. This may vary from business to business and place to place. Similarly strength and opportunity may also vary. For example cheap raw material and cheap labours may not be available in some places. At the same time one can find more opportunities like marketing options, more demands etc. So, overall impact of SWOT analysis is necessary for setting up a business in postharvest technology.

Strength

- **Bulk raw material avaibility**
  - **Seasonal - Litchi, mango, guava, grapes, apple etc.**
  - **Year round – Banana, potato**
- **Quality produce at cheap rate**
- **Govt. sponsoring agencies supported by many technological advancement.**

Weakness

- **Infrastructure, Trained human resource, Testing and Training facilities, Licensing and laws**

Opportunity

- **Market gluts, Very low processing level**
- **Rural unemployed youths**
- **Fresh produce business (Storage, transportation, DC etc.)**
- **Agricultural based economy, healthy consciousness.**

Threat

- **Seasonal availability of raw materials, power shortage**
- **Natural Calamities- Flood and dry spell**
- **Marketing problem**

Figure 2: SWOT analysis

Business Models In Pht

Two business models are prevalent in postharvest technology (fig 3)

A. Raw material preservation (Semi processed)

B. Fully processed (Finished products)

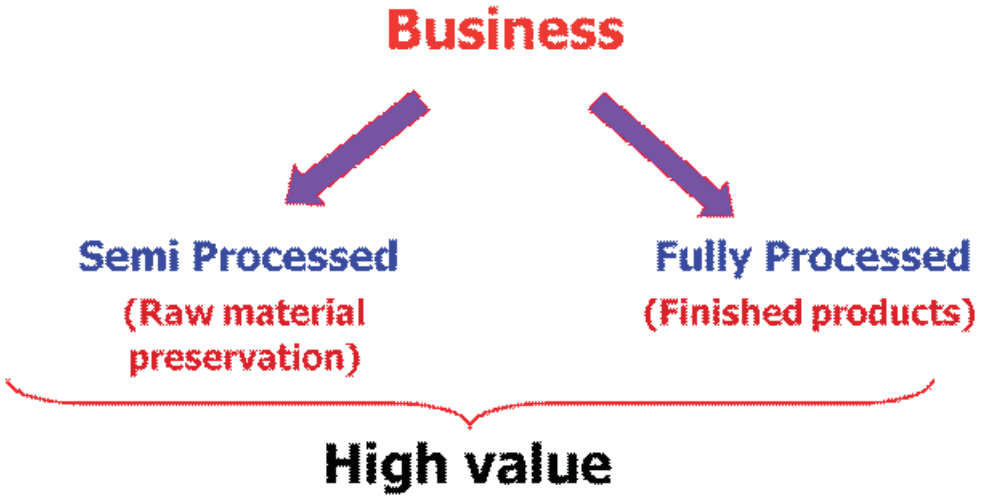


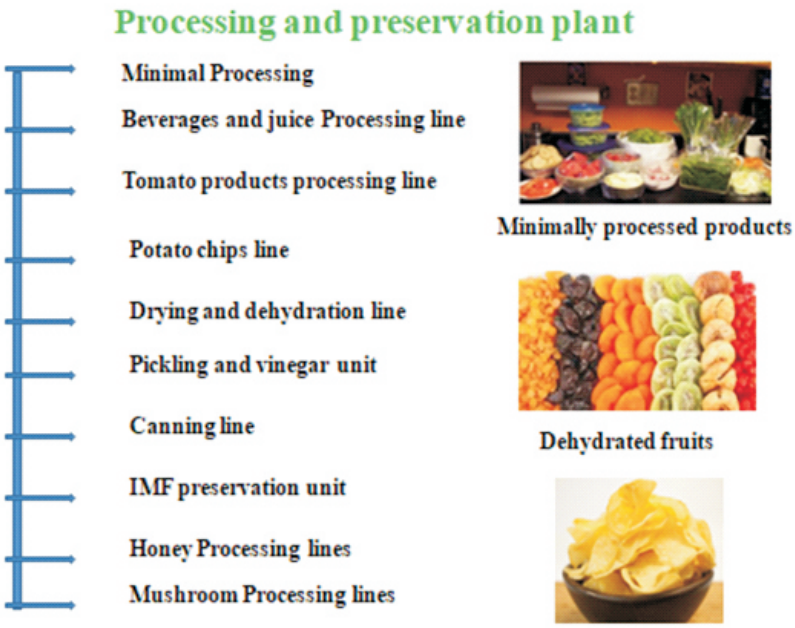
Figure 3 Pictorial representation of business model

SCOPE FOR ENTREPRENEURS IN PHT

Although there are many options for entrepreneurs to start a business in postharvest technology but five main and core businesses are advised. These are

1) Fruits and vegetable processing and value addition unit
2) Quality testing and certification laboratory
3) Cold storage cum pack house facility
4) Transportation facilities
5) Manufacturing units of packaging materials

1) Fruits and vegetable processing and value addition unit: There are many sub units of this major field as illustrated below.



1) Quality testing and certification laboratory:

BASIC REQUIREMENTS FOR SETTING UP A PROCESSING UNIT

The beauty of postharvest technology oriented business is that entrepreneurs can start at any stage based on his or her investment capacity i.e. cottage, small, medium or large scale. But to start even at cottage or small scale some basic equipment needs to be purchased as shown below (Figure 4**)**

Fig 4 Showing basic and starting equipments for starting a processing unit

As the production and diversification of products will increase, one can add more equipments. A more comprehensive list for cottage and/or small scale is given below

1. Pulper- 1 no.
2. Crown corcking machine- 1 no. (heavy duty)
3. Juice mixing tank (20 L) made up of Stainless steel (SS)- 1 no.
4. Refractometer- (0-320B) - 1 no.
5. Refractometer- (28-70 or 750B)- 1 no.
6. Thermometer upto 110 degree C
7. Plastic crates (10 & 20 Kg)- 10 nos.
8. Mug (SS or aluminium) – 3 nos.
9. Working table (SS)- 2 nos.
10. PP cap sealing machine- 1 no.
11. Lug cap sealing machine
12. Aluminium patila (5/10/20)- 1 no. each
13. Weighing balance
14. Plastic barrels (Food grade)
15. Gas chulha (Heavy duty)
16. Gas cylinder (Industrial use)
17. Cutting, Coring/Peeling knieves.

SCOPE BASED ON LOCATION

According to a business thumb rule, a profitable business should be either located near the production of raw materials or it should be located near to the market. If location is near to the raw material production, it becomes easy to small and medium entrepreneurs to start a business of semi processed (raw material preservation) and sale to the city based established firms. A collection and primary processing centre could also be developed. If location is near to the market, finished products are required and accordingly investment will be little more. A list of equipments with approximate price is also listed in table 1

S. No.	Name of equipments	Approximate cost (Rs.)	Remarks if any
1.	Pulper	50,000.00	Contact parts SS
2.	Crown corcking machine	8,000.00	Hand operated adjustable
3.	Mixing cum storage cum preparation tank	30,000.00	Whole body SS with stirrer
4.	Working table	10,000.00	Whole SS or upper surface only
5.	Weighing balance	10,000.00	One big size for raw materials and one small for chemicals
6.	Plastic barrels (Food grade)	10,000.00	For raw material preservation
7.	Refractometer (0-32^{0}B)	3,000.00	For sugar reading

8.	Refractometer (28-70 or 75^0B)	3,000.00	For sugar reading
9.	Thermometer up to 110 degree C	500.00	
10.	PP cap sealing machine	50,000.00	For tightening PP caps in PET bottles
11.	Lug cap sealing machine	20,000.00	For tightening lug caps on jam and jelly bottles
12.	Powder making machine	60.000.00	For making powder
13.	Cabinet dehydrator (perforated SS trays)	70,000.00	For drying and dehydration purpose

Table 1 List of equipments and its approximate price

Note: The above mentioned price is only indicative. Always consult more than one firm and compare prices offered by them before final purchase. Always some concession is offered by the manufacturers. If possible try to visit any running processing unit before any investment. The visit will give you an idea about functioning of unit.

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Chapter - 15

Agroforestry for Enhancing Farming Profits

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Introduction

The issues of hunger, food security, scarcity of water, soil-related issues like degradation, depletion of soil fertility, and loss of biodiversity have been the burning issues linking up with the changing climate. This led to the need for the diversification of existing farming systems warrants development of suitable agroforestry models for popularization and further adoption by the farmer. In this context, the concept of agroforestry, where deliberate integration of trees with agricultural crops/animals under same unit of land has become very attractive, relevant and viable one to solve the dilemma of this challenges. In other words agroforestry is a land use system to compliment food production while also enabling carbon sequestration, and is majorly a low-input system. Realizing the full potential, the "National Agroforestry Policy 2014" has been put in place in India to help promote this land use option for harnessing multifunctional that it has proven to provide especially in terms of livelihood improvement and climate change adaptation. Thus, the introduction of agroforestry, which is a form of multiple land/use system, is considered more resilient than monocropping system in challenging the climate change phenomena with a view to improve the food and livelihood security. Changing priorities in context to present climate justice and green energy avenues like bio-fuels, employment generation, carbon sequestration and value addition are now being discussed and debated for agroforestry. Nonetheless, it has been realized that agroforestry is the only alternative to meet the target of increasing forest cover to 33 per cent. Meanwhile, it is also necessary to development mechanism to reward the rural poor for the ecosystem services of agroforestry such as biodiversity conservation, watershed protection and carbon sequestration. Over all, it requires appropriate research interventions, investment, suitable extension strategies, incentives and marketing linkages to enable diversification agroforestry practice and system to harness both tangible and intangible benefits.

Importance and Role

Diversification of existing farming systems by developing suitable agroforestry models seems to be the need of the day to cope-up with ever increasing demand for diversified products such as food, fiber, fodder, fruit, timber, etc. Agroforestry, add to the sustainability of agriculture and help in its diversification to attain higher benefits per unit area, when carefully selected and managed fast growing, multipurpose trees are raised with little effect on agricultural crops (Johlet al. 1986). The rising population pressure and urbanization, coupled with land degradation and global warming are the major causes for unsustainability in food production in developing world. Among different approaches to combat this problem, agroforestry, or woody perennial based intercropping systems, has proved itself as a key component of sustainable agriculture and is popular in addressing the issues related to supply of wood, fuel and fodder and to preserve fragile agro-ecosystem. It not only arrests land degradation but also improve site productivity through interactions among trees, soil, crops and/or livestock, and thus restore part, if not all, of the degraded lands (Kumar 2006; Jhariyaet al. 2015).Agroforestry is considered as a panacea for maladies of intensive agriculture. It is a way out to practice agriculture without deteriorating agro-ecosystem. Its role in the light of combating hunger, diseases and environmental degradation is highly appreciable (Garrity 2004).

Agroforestry has been heralded and actively promoted as a practical and beneficial landuse system for smallholders in developing countries more than two decades now. With the integration of trees into agriculture increased farmers' production by improving soil fertility and through the additional products that can be derived from trees such as fruits, fuel and timber. Trees also improve the soil's ability to absorb water, prevent erosion and enhance

biodiversity (Jhariyaet al. 2015).More importantly, trees absorb carbon making it a major key in the mitigation of climate change or global warming. Agroforestry systems reduce the risk of farmer's capital being lost to crop failure. It reduces the cost of production by improving the fertility of the soil as well as its biological and physical properties. Tree products such as timber, fruits, fuel, fodder and medicine further increase farmers' income and improve their living standards. Trees on farm improve microclimate and enable more species of plants and animals to develop and survive in the system, thus enhancing biodiversity and providing improved environmental services.

Science in Agroforestry

According to Sanchez (1995) the process of agroforestry development centered around four points namely a) Sustainability; b) Profitability;c) Competition and d) Complexity.

A) Sustainability: In agroforestry system, the inclusion of woody perennial or animal component could enhance the conservation of soil resources most preferably by the action of trees. Besides this, agroforestry tends to build more ecosystem diversity than monocropping, greater potential to store carbon (carbon sequestration) in the soil and woody component and efficient utilization of plant nutrients via litter decomposition and nutrient pumping process of trees in any agroforestry system.

B) Profitability: Inclusion of more than one component in the system not only increased the productivity of the system but also enhance the incomes of the farmers. Nevertheless, three major strategies viz., domestication, marketing and policy innovation should be adopted for maximizing the profitability of the system.

C) Competition: When plants grow in proximity to each they interact either in positive ways (complementary) or in negative ways (competition). The biophysical bottom line of agroforestry is how to manage the interaction for light, water and nutrients between the tree component and crop and/or livestock. Competition for solar radiation is the most prominent above ground competition between trees and companion crops. Low light intensity is one of the important limiting factors for higher yield of intercrop. Tree roots can also be competing with the intercrop for available water and nutrients in the top soil. Therefore it is necessary to have information on the nature of root development of tree crop as well as intercrop.

D) Complexity: Due to integration of more than one component in the particular land use, the issue of complexity has been appeared. Some of the major complexities in agroforestry system are as follows i) socio-economic complexity; ii) ecological complexity; iii) methodological complexity.

Major approaches for classification of agroforestry system (Nair, 1985)

CATEGORIZATION OF SYSTEMS Based on their structure and function			GROUPING OF SYSTEMS According to their spread and management	
STRUCTURE Nature and arrangement of components especially woody ones		FUNCTION Role and/or output of components, especially woody ones	AGRO-ECOLOGICAL/ ENVIRONMENTAL	SOCIO-ECONOMIC AMD MANAGEMENT LEVEL
Nature of components	Arrangement of components			
Agrisilviculture (crops and trees incl. shrubs/trees and trees) Silvipastoral (pasture/animals and trees) Agrosilvopastoral (crops, pasture/ animals, and trees) Others (multipurpose tree lots, apiculture with trees, aquaculture with trees, etc).	In Space (Spatial) Mixed dense (e.g.: Home garden) Mixed sparce (e.g.: Most systems of trees in pastures) Strip (width of strip to be more than one tree) Boundary (trees on edges of plots/fields) In time (Temporal) Coincident Concomitant Overlapping Sequential (separate) Interpolated	Productive Function Food Fodder Fuelwood Other woods Other products Protective Function Windbreak Shelterbelt Soil conservation Moisture conservation Soil improvement Shade (for crop, animal, and man)	Systems in/for Lowland humid tropics Highland humid tropics (above 1,200 m a.s.l; e.g.: Andes, India, Malaysia) Lowland subhumid tropics (e.g.: savanna zone of Africa, Cerrado of South America) Highland subhumid tropics (Tropical highlands) (e.g.: in Kenya, Ethiopia)	Based on level of technology input Low input (Marginal) Medium input High input Based on cost/benefit relations Commercial Intermediate Subsistence

Need and potentials of Agroforestry

Agroforestry has now been widely practiced all over the world especially in the developing countries. Records of experiences from agroforestry initiatives worldwide indicate that agroforestry has the following potentials:

- Being more complex than monoculture, agroforestry provides wide ranges of products available to farmers such as wood fuel, timber, poles, stakes, medicines, fodder, green manure or mulch, fruits or nuts, spices and resins.
- Provide beneficial ecological services include wind speed reduction, soil temperature moderation, shade provision for certain crops and livestock.
- Helps in carbon sequestration mainly by woody components and thus reduces the environmental global warming.
- Watershed stabilization, soil erosion control and soil fertility improvement or maintenance.
- Minimizing soil and nutrient losses due to the deep rooting nature of the woody components, which enhances soil stability on sloping land, and uptake of nutrients from deeper soil layers.
- Helps in the microclimatic changes thus favoring the crop growth of crops.
- Better resistance in disease, insect, etc. due to variety in crops in the systems.
- Beautifying the agricultural landscapes.
- Improving biodiversity conservation domesticating wild trees and shrubs of high value and growing them on farm.
- Integration of all resources available to farmers can generate more employment opportunities and income.

Agroforestry in India

The works of agroforestry and its related activities has been paid attention by different stakeholders in this region with the advent of All India Coordinated Research Project on Agroforestry (AICRP-AF) in 1983. Since, then, the practices of agroforestry are being employed in different scales across the region with an expectation of increasing agroforestry area in the coming years.Indian Council of Forestry Research and Education (ICFRE), its regional centres, private institutions, NGOs and co-operatives e.g. WIMCO, ITC, BAIF, IFFDC, West Coast Paper Mills Ltd., Hindustan Paper Mills Ltd., Tree Growers Cooperatives are also engaged in promotion of AF in the country. At present in India under the AICRP-AF, there are total of 37 centres spreading across the different agro-climatic zones of India. Specifically, these centres are spreading as follows a) Himalayan: 08; b) Indo-gangetic: 05; c) Humid & sub-humid: 06; e) Arid & semi-arid: 10 and e) Tropical: 08. Since then, agroforestry has been engaged in meeting the requirement for the demands of various multifarious needs of the country. For instance, almost half of the demand of fuel wood, 2/3rd of the small timber, 70-80 % wood for plywood, 60 % raw material for paper pulp, 9-11% of green fodder requirement of livestock.Dhyaniet al. (2013)estimatedthe current area under agroforestry in India at 25.32 M ha i.e., 8.2% of the total geographical area of the country. DARE (2014) highlighted the major share of the land to be brought under agroforestry in India will come from fallows, cultivable fallows, pastures, groves and this rehabilitation of problem soils. Thus, a total of 53 m ha, representing about 17.5% of the total reported geographical area of the country could potentially be brought under agroforestry in the near future, which will make agroforestry a major land-use activity, afteragriculture and forestry.

Suitable Major Agroforestry systems of Different Regions

According to (Nair, 1993), different system of agroforestry which can be successfully implemented in different regions of world is presented in table 1.

Table 1: Suitable Major Agroforestry systems of Different Regions

Agroforestry practices	Suitable climatic condition
Multistorey including home garden	Mainly in Humid and moist sub-humid climates
Plantation crop combinations	Humid to moist sub-humid climates
Boundary Plantation	All regions
Hedgerow intercropping, barrier hedge	Humid, sub-humid, possibly in semi-arid climates
Trees and erosion control structure	All climatic conditions
Windbreaks and shelterbelts	Semi arid zone
Silvipastoral practices	Semi arid, humid and sub-humid
Hortipasture	Hilly areas
Home Gardens	Tropical regions
Reclamation forestry	All climatic conditions
Shifting cultivation	Tropical areas
Scattered trees on farms	All regions, especially semiarid and arid
Aqua Forestry	Low lands
Combinations of the above in integrated watershed management	All climatic conditions

Improved Agroforestry system in India

After the inception ofAll India Coordinated Research Project on Agroforestry (AICRP-AF) in 1983, formerly National Centre for Agroforestry (NRCAF), now renamed as Centre for Agroforestry Research in India (CAFRI), Jhansi tirelessly worked on the design and diagnosis of different traditional agroforestry system in India. An improved agroforestry system for various agro-climatic zones of India (NRCAF, 2007) is presented in Table 2.

Table 2: Improved agroforestrysystems for various agro-climatic zones of India (NRCAF 2007)

***Note: Irri-Irrigated; RF-Rainfed; TBO-Tree Borne Oilseeds**

Agro-climatic Zone	Agroforestry System	Tree component	Crop/Grasses
1.Western Himalayan Region	Silvipasture (RF)	*Grewiarobusta* *Morus alba*	*Setaria* spp. *Setaria* spp.
	Agrihorticulture	*Maluspumila*	Millets, Wheat
	Agrihorticulture	*Prunuspersica*	Millets, Soybean
2.Eastern Himalayan Region	Agrisilviculture	*Anthocephaluscadamba*	Paddy
	Agrihorticulture	*Alnusnepalensis*	Large cardamom/ Coffee
	Silviculture	*Bamboos, Parkiaroxburghii, Morusalba*	-

	Silvipasture	*Bauhinia variegata, Ficus spp., Morus alba*	Napier
3. Lower Gangetic Plains	Agrisilviculture (Irri.)	*Eucalyptus, Albizialebbeck*	Paddy
	Agrihorticulture (Irri.)	*Mango/Banana/Litchi*	Wheat, Paddy, Maize
	Silvipasture	*Morusalba,Albizialebbeck*	*Dichanthium, Pennisetum*
4. Middle Gangetic Plains	Agrisilviculture (Irri.)	*Populusdeltoides*	Sugarcane-Wheat
	Agrisilviculture (Irri.)	*Eucalyptus spp.*	Rice-Wheat
	Agrisilviculture	*Dalbergiasissoo*	Sesamum
	Agrihorticulture (Irri.)	*Mango/Citrus spp.*	Rice-Wheat
	Silvipasture	*Albizialebbeck*	*Chrysopogon, Dichanthium*
5. Trans Gangetic Plains	Agrihorticulture (Irri.)	*Emblicaofficinalis*	Black gram/Green gram
	Agrisilviculture	*Azadirachtaindica*	Black gram-Wheat/Mustard
	Silvipasture	*Bauhinia variegate, Albizialebbeck*	*Cenchrus, Pennisetum*
6. Upper Gangetic Plains	Agrisilviculture (Irri.)	*Populusdeltoides*	Wheat, Bajra fodder
	Agrisilviculture (Irri.)	*Eucalyptus spp.*	Rice-Wheat
	Silvipasture	*Bauhinia variegate, Albizialebbeck*	*Chrysopogon*, Poa
7. Eastern Plateau & Hills	Agrisilviculture	*Gmelinaarborea*	Paddy, Linseed
	Agrisilviculture	*Acacia nilotica*	Paddy
	Silviculture	*Acacia mangium, A. nilotica, Bamboos*	-
	Silvipasture	*Leucaenaleucocephala*	*Chrysopogon, Pennisetum Dichanthium*

8.Central Plateau & Hills	Agrihorticulture (Irri.)	*Psidiumgujava*	Bengal garm/Ground nut
	Agrihorticulture (RF)	*Emblicaofficinalis*	Black gram/Green gram
	Agrisilviculture	*Acacia nilotica/ Leucaenaleucocephala/ Azadirachtaindica/Albizialebbeck*	Soybean, Black gram-Mustard/Wheat
	Silvipasture (RF and degraded lands)	*Albiziaamara, Leucaenaleucocephala, Dichrostachyscinerea*	-
	TBOs (RF)	*Jatrophacurcus*	
9. Western Plateau & Hills	Agrihortisilviculture (Irri.)	*Tectonagrandis, Achrussapota,*	Paddy, Maize
	Agrihorticulture	*Areca catechu*	Black pepper, cardamom
	Silviculture	*Prosopisjuliflora, Ailanthus spp.*	-
	Silvipasture	*Acacia mangium, Albiziaamara*	*Cenchrus*
10. Southern Plateau &Hills	Agrisilviculture (RF)	*Eucalyptus spp*	Cotton
	Agrisilviculture (Irri.)	*Eucalyptus spp*	Chilli
	Silviculture (RF)	*Leucaenaleucocephala Eucalyptus spp*	-
	Agrihorticulture	*Tamarindusindica*	Chilli
	TBOs	*Pongamiapinnata*	-
11. East Coast Plains & Hills	Agrisilviculture (RF)	*Ailanthus excelsa, Acacia leucocephala*	Cowpea
	Silviculture	*Casuarinaequisetifolia Leucaenaleucocephala*	-
	TBOs	*Pongamiapinnata*	-
	Silvipasture	*Artocarpus spp.*	*Chrysopogon,* Napier, *Cenchrus*

12.West Coast Plains & Hills	Agrisilviculture (RF)	*Acacia auriculiformis*	Black pepper
	Agrihorticulture (RF)	*Artocarpusheterophyllus*	Black pepper
	Agrisilviculture (RF)	*Acacia auriculiformis*	Paddy
	Agrihorticulture	*Cocusnucifera/Areca catechu*	Paddy
	Agrisilviculture	*Casuarinaequisetifolia*	Paddy
	Silvipasture	*Hardwickiabinata, Albizialebbeck*	*Cenchrus*
13. Gujarat Coast Plains & Hills	Agrisilviculture	*Azadirachtaindica*	Cowpea
	Silviculture	*Prosopisjuliflora, Acacia nilotica*	-
	Agrisilviculture	*Ailanthus excelsa*	Green gram
	Silvipasture	*Leucaenaleucocephala*	*Cenchrus, Setaria*
14. West Dry Region	Agrisilviculture	*Prosopis cineraria, Azadirachtaindica*	Pearl millet
	TBOs (RF)	*Jatrophacurcus*	
	Silvipasture	*Albizialebbeck*	*Cenchrus*
15. Island Region	Agrohorticulture	*Cocusnucifera*	Paddy
	Silvipasture	*Bauhinia, Erythrina, Leucaena*	*Cenchrus Pennisetum*

Some of successful agroforestry models in India (Handa, 2019)

Agroforestry model	Suitable area	Yield	Other benefits
Mulberry based agroforestry system	Degraded sloppy lands of Western Himalaya, Jammu and Kashmir, Himachal Pradesh and Uttarakhand	Tree productivity:8t/ha/yr as green fodder and 24t/ha/yr as green grass forage (*Setariaanceps* grass)	Reclamation of the degraded land
Alder based agroforestry system	Eastern Himalayan region	Tree productivity: 85t/ha as bole biomass at 30 year rotation; 2.5 -3.5	Alder trees can fix 50-150 kg/ha amount of nitrogen. Cardamom - alder system stores

		t/ha/yr as fuel wood ; 150-200 kg/ha/ yr as fodder. Intercrop cardamom gave the yield of about 250-350 kg/ha/yr up to 30 years rotation.	about 150 -160 t/ha carbon stocks over 20 years.
Poplar based agroforestry system	Indo-Gangetic region	Tree productivity: 150t/ha.	Net income of Rs. 975384/ha/yr as against Rs. 34,268 from sole cropping of rice-wheat system.
Eucalyptus based agroforestry system	Lower, Middle, Upper and Trans Gangetic Plains; Eastern and Central Plateau and Hills regions	Tree productivity: 260t/ha.	Net income of Rs. 95000 to 126072/ha/yr under irrigated condition
Shisham based agroforestry system	Middle and Upper Gangetic Plains region and Central and Hill region	Tree productivity: 210t/ha	Net income of Rs. 41000/ha/yr from shisham + paddy and Rs 35000 from shisham + wheat under irrigated condition
Bamboo based agroforestry system	Plains of pan-India except for the water logged areas of N-E parts of India	Bamboo yield: 20-22t/ha/yr	Net income of Rs 95000 to 200000/ha/yr after four years under irrigated condition.

Gamhar based agroforestry system	Eastern and Central Plateau and hills region	Timber yield: 1000 cft/ha; firewood: 100t/ha	Net income of Rs 30000/ha/yr with crops
Acacia mangium based agroforestry system	East Coast Plains and Hills region and Central Plateau and Hill region	Timber yield: 1000 cft/ha; firewood: 100t/ha	Net income of Rs 33000/ha-fourth year; Rs 140000-150000/ha-ninth year
Teak based agroforestry system	Middle Gangetic Plains region and Plateau and Hills region	Tree yield: 77 cum/ha	Teak-first 50 % thinning at 7th year (Rs. 6000/ha); second (25%) thinning at 12th year (Rs. 22890/ha) and final harvesting Rs. 2600000/ha at 20-22 years
Meliadubia based agroforestry system	Southern and Central Plateau and Hill Region, Gujarat Plains and Hill region	Tree yield: 148t/ha	Carbon sequestration by *Meliadubia* gets converted into stored carbon in the form of plywood

Nutrient cycling in Agroforestry system

It is believed that agroforestry systems can promoteefficient nutrient cycling than any other agricultural systems by regulating the uptake, recycling and synchronization (Nair, 1993). Interestingly, agroforestry trees species are more capable of taking up the nutrients (nutrient pumping) and water from the deep layers that are usually not utilized by the herbaceous crops. The accumulation of litter and their decomposition processes which played a major role for soil fertility improvement in any agroforestry systems. However, the amount of nutrient released from the litter depends on the various factors like climate, abundance of soil microbes, species characteristics, land use pattern and their management activities, etc. Thus the understanding of soil nutrients dynamics in agroforestry is very crucial as it influences the amount of biomass production and availability of soil nutrients in soil and overall controlling the nutrient cycling in situ (Rawat and Singh, 1988).

Role of agroforestry systems in influencing overall soil quality

- Controlling soil erosion

- Maintain soil organic matter and soil physical properties
- Augment nitrogen fixation and soil nutrient inputs
- Promote efficient nutrient cycling
- Reduce soil toxicities
- Promote desirable soil faunal activity
- Augment soil water availability to crops

Major constraints in adopting agroforestry systems in India

- Mostly farmers of this region are small and marginal land holder
- Lack of supply for quality tree planting materials to farmers
- Long gestation period of trees
- Lack of agroforestry demonstration and training programmes
- Lack or improper implementation of agroforestry policy
- Non availability of market for agroforestry produce
- Astringent and restrict rules for tree felling and transportation

Conclusion

Agroforestry have the potential to meet the ever increasing demand for diversified products such as food, fiber, fodder, fruit, fuel and timber. Challenges in diversification of existing farming systems warrants development of suitable agroforestry models for popularization and further adoption by the farmer. Integration of trees on farm enhances overall farm productivity, improve microclimate and enable more species of plants and animals to develop and survive in the system. It also has the potential to enhance ecosystem services through carbon sequestration process, prevention of deforestation, watershed conservation, biodiversity conservation, and soil and water conservation. Agroforestry is the only alternative to meet the country's target of increasing forest cover from present less than 25 to 33%. By adopting agroforestry practices, it aims not only to improve thefarmers' income and their socio-economic status but also conserve the natural resources also.

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Chapter - 16

Application of MS Excelfor Agricultural Data Exploration

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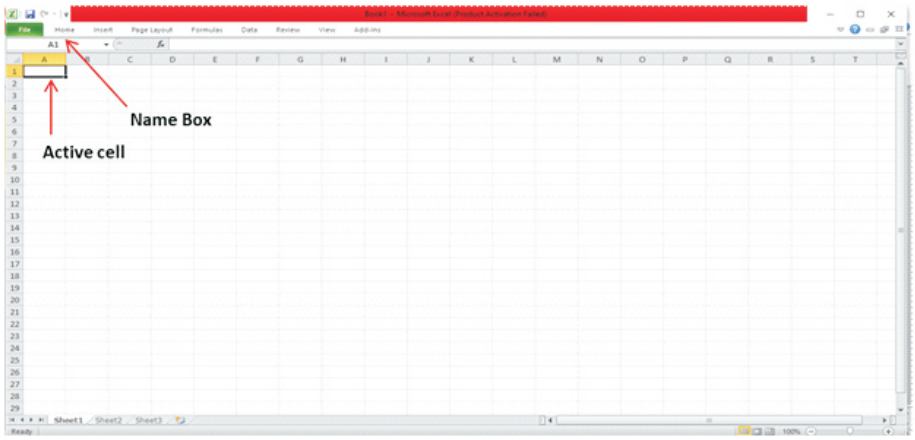
Introduction

Microsoft Excel is application software, available in Microsoft Office Suite,that'sdesigned to record and analyze numbers and data. The files we create in Excel are called workbooks. It is also popularly known as Spreadsheet. The extension of files created in MS-Excel 2013 is .xlsx. The primary data that we use in Excel to store and with data is called a worksheet. Columns in the Excel are labeled with letters(A, B, C, D, etc.)whereas the rows are labelledwith numbers(1, 2, 3, 4, etc.). A Cell is the intersection of a row and a column. The data value in each cell can be recorded in the form of dates,text, times, and numbers (including currency and percentages). MS-Excel makes it easy for us to juggle numbers, formulas, and text. Formulae are relationship between cells. Excelalsohas some advanced tools to enable us to present our work in a polished, professional-looking format. Nowadays, it is one of the most widely used powerful research tool requiring minimum teaching. Furthermore, Excel can be used to solve a variety of mathematical and statistical and financial problems. This lecture is concerned with the application of the Excel spreadsheet to solve focused problems pertaining to agriculture and sectorswith emphasis on Analysis Toolpak. The prime reason of using Excel for statistical analysis is because it provides easy user interface and widely available.In today's world, Spreadsheet takes place of all types of applications using paper worksheets.

Loading Excel

We can load Excel, in several ways. (i) The easiest way is to Go to the Search charm of Windows taskbar and type Excel 2010 and then press enter. We can also use Windows Start menu to open Excel. ClickStart on left bottom corner of Windows or pressing Windows key on the keyboard will display the Start menu >Scroll down to letter "M" to find Microsoft Office>Click drop down arrow of MS Office>Click Microsoft Excel 2010 to open. We can also load Excel by simply clicking the Excel button on the taskbar, if it is pinned to taskbar. Excel opens and the parts of a typical Excel opening screen is given below:



The user can enter data and formulae in the cell. The power of Excel is hidden in formulae. We can create a formula based on some values in the worksheet. We can then change any or all of these values. Excel automatically updates the results. We do not need to create new formula for new values. All formulae in Excel must begin with an

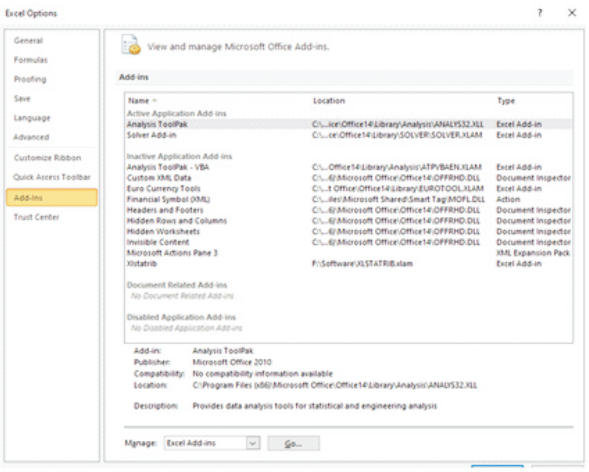
equal sign (=). The equal sign entered in the cell conveys the Excel that the entry is a formula is entered in the cell followed by = sign. MS Excel allows us to perform the following:

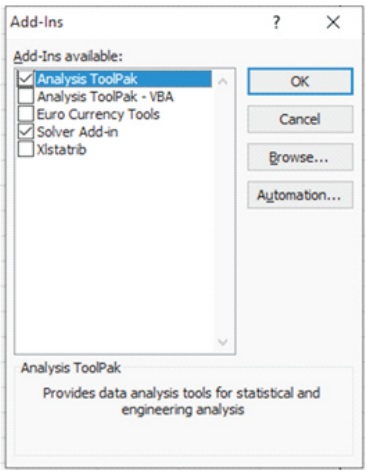
- All types of simple as well as complex arithmetic calculations
- Creating a wide variety of exciting charts/ graphs
- Allows importing data from a wide variety of sources
- Allows to use as a database program to collect and record data
- Creating macros in Excelto perform a tedious task
- Allows performing simple to advancedstatisticaldata analysis

The Analysis ToolPakand Solver is an add-on that can be installed for free usingMS Office installation disk.Using Analysis ToolPak in Excel, wecan perform statistical analysis such as Analysis of Variance- ANOVA (single factor; double factor with/ without replications), Correlations, Descriptive Statistics, Histograms, Percentiles, Regression, t-tests, F-testand Z-test. In Excel, SolverAdd-in uses techniques of the operation research to find optimal solutions for various decision problems.The article delineates how to perform statistical analysis using Analysis Toolpak and Solver Add-in using Excel.

Getting started with the Analysis ToolPak

Go to File Tab and select Options. Excel options window will open up.Click Go for Excel Add-ins. Add-ins dialogue box will open up. Click Analysis ToolPak and Solver Add-in checkboxes. Finally, Click OK to install Add-Ins. The screen shots for installing the same are given below. Once add-ons are installed, we can now use Data Analysis and Solver function under Data

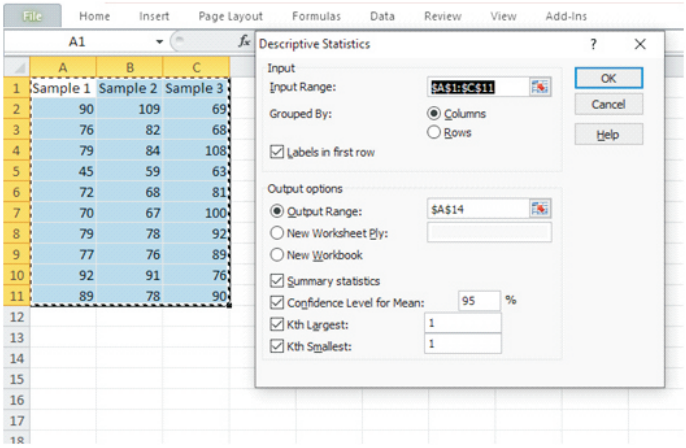




Descriptive Statistics

It is used for generating report of univariate statistics viz., measures of central tendency and dispersionfor data in the input range.Suppose we have data on height of 10 plants of Sorghumobtained during three samplings. The steps to obtain descriptive statistics for the data (3 samples of size 10 each) on height of Sorghum plant is as follows:

Enter the data from A1 to C11 in a worksheet of the workbook. Since this is data for three samplings, the user has to enter in three columns, that is in Column A, B and C. The first row contains headings on sample numbers, that is, Sample1, Sample 2 and Sample 3. Go to Data → Data Analysis →scroll down to select Descriptive Statistics. The Descriptive Dialogue box will open up.



Rowcheckbox.Further,weconvey Excel where the results to be written under Output options. The results may either be written in the same worksheet containing the dataset or in the new worksheet. For results to be written in the same worksheet containing datasets, the Output Range is given by entering/ selecting the reference cell address, say, A14. Thus, Output Range is from A14. Click the New Worksheet Ply checkbox for resultsto be written in a new sheet.This option of displaying result in new worksheet prevent us from accidentally overwrite some of our precious data.Finally, click the summary statistics checkbox. Click OK.Theoutputgiven below will appear on the screen.

	Sample 1	Sample 2	Sample 3
	76.9	79.2	83.5
Stdandard Error	4.275	4.414	4.641
Median	78	78	85
Mode	79	78	89
StandardDeviation	13.519	13.9586	14.676
Sample Variance	182.767	194.8444	215.388
Kurtosis	3.117	1.48488	-0.9369
Skewness	-1.429	0.854	0.1898
Range	47	50	45
Minimum	45	59	63
Maximum	92	109	108
Sum	769	792	835
Count	10	10	10

Test of Significance

Excel provides a number of statistical tests of significance viz.,Two-sample t-test (for means assuming equal variances/unequal variances/ paired sample), Two-sample F-test (for equality of variances), Two sample Z-test (for means), ANOVA (single factor and two factor with/ without replication) and Regression. We use t-test and F-test when sample size is small ($n \leq 30$) and Z-test when sample size is large. ANOVA is used for testing significance of more than two means.Theprocedure for carrying these tests of significance in Excelis described below.

Two-Sample t-test: Assuming equal variances

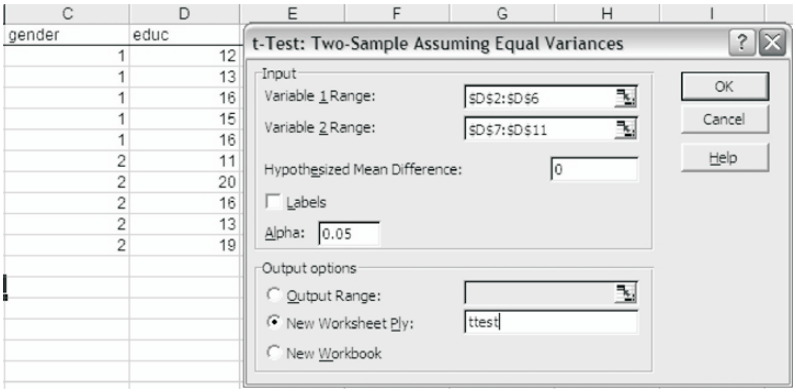
This test is used for testing the equality of means for two independent samples under the assumption of equal variances of population from where the two samples are drawn. To perform a two-sample t-test, first step is to enter the

data in worksheet. Here, we can enter data either by creating two columns for each variable/ sample or by sorting the data for the grouping variable. For example, suppose we want to test for significant differences in education levels for males and females. To this end,we have to either reorganize our dataset so that there is a column for male's education and a column forfemale's education, or we may sort the dataset by gender first (Gender has been labelledwith a value of 1 assigned for males and a value of 2 assigned for females).State the hypotheses, that is,

Null Hypothesis (H0): The mean education levels of males and females are same.

Alternative Hypothesis (H1): Mean education levels of males and females are not same.

Go to Data → Data Analysis →t-test: Two-Sample Assuming Equal variances. Click OK. The dialog box for t-test will appear.



Under Input, the Variable 1 Range is given by selecting the rows in the education column corresponding to all gender rows assigned values of 1 (D2:D6). Similarly, the Variable 2 Range is given by selecting, the rows in the education column againstthe all gender rows with values of 2 (D7:D11).In order to test the null hypothesis that mean education levels of males and females are same, put'0'in theboxforHypothesized Mean Difference.Here, we neednotclick the Labels checkbox since the sorted data on Variable 1 (gender) are being compared and Variable 2 (Education) is not labeled.Select the appropriate level of significance, Alpha(i.e., 0.05 or 5%).Finally, choose where we want to place the results under Output options. In this example, we informed Excel to display results in new worksheet by clicking theNew Worksheet Ply checkbox and named it ttest.ClickOK.The Excel will produce result in the new worksheetnamedttest:

t-Test: Two -Sample Assuming Equal Variances		
	Variable 1	**Variable 2**
Mean	14.4	15.8
Variance	3.3	14.7
Observations	5	5
Pooled Variance	9	
Hypothesized Mean Difference	0	
df	3	
tStat	**-0.73786**	
P(T<=t) one-tail	0.240838	
t Critical one-tail	1.859548	
P(T<=t) two-tail	0.481677	
t Critical two-tail	**2.306006**	

Interpretation:Note that, the calculated value of t,|calt|(0.737) is less than critical two-tail t value (2.306),we may accept our null hypothesis.We conclude that there is no significant difference between education levels of males and females.

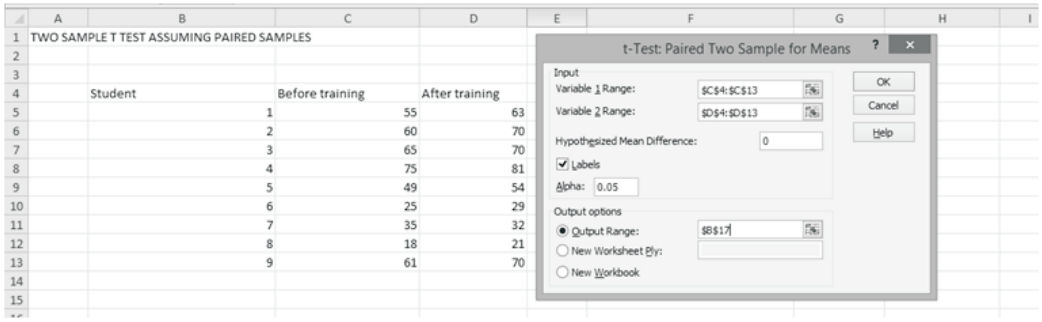
t-test: Paired two samples for means

It performs a paired two-sample t-test for testing whether a sample's means are distinct. This test should be used when there is a natural pairing of observations in the samples. We must obtain each of the paired observations from the same subject. It does not assume that the variances of both populations are equal. Suppose we have scores of participants in a test before and after the training programme and we want to test whether the score indicate that participants have been benefited by the training programme. State the hypotheses, that is,

Null Hypothesis, H0: The mean score of participants before and after trainingisequal.

Alternative Hypothesis, H1: Mean score of participants before and after training is not equal.

Go to Data → Data Analysis →t-test: Paired Two samples for Means. Click OK. The dialog box forpairedt-test will appear.



Under Input, the Variable 1 Range is entered by selecting the cellsfrom C4:D13. One must note that the range must consist of either a single column or a single row. Similarly,weenter the Variable 2 Range by selecting the cells fromD4:D13. Under null hypothesis, enter '0'inthe box for Hypothesized Mean Difference.Thisindicates that the sample mean scores of participants before and after training are hypothesized to be equal. Click the Labelscheckbox,itconveys Excel to consider the labels of columns as the variable names. Enter appropriate level of significance, Alpha(say, 0.05 or 5%).Finally, we convey the excel where to place theresult/ output under Output options. Enter the reference cell as B17 in the Output Rangeto keep the results on the same worksheet containing datasets. Thus, Output Range is from A14. Click OK.The displayed output is shown below.

t-Test: Paired Two Sample for Means		
	Before training	***After training***
Mean	49.22222222	54.44444444
Variance	370.6944444	471.7777778
Observations	9	9
Pearson Correlation	0.989408885	
Hypothesized Mean Difference	0	
df	8	
t Stat	**-4.052627767**	
P(T<=t) one-tail	0.001835398	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	0.003670796	
t Critical two-tail	**2.306004135**	

Interpretation:Note that, the calculated value of t, |calt|)4.0526) is greater than critical two-tail t value (2.306),the null hypothesis may be rejected. We conclude that training programme has benefited the participants of the training programme.

Similarly, we can carry out other tests of significance (t-test: two-sample assuming unequal variances and F-test for two population variances) using Data Analysis under Data Menu in Excel

Analysis of Variance (ANOVA)

ANOVA performs the testing of more than two group means. The assumptions of ANOVA are (i) The observations are independent and (ii) Parent population from which sample is drawn is normally distributed. One must check that assumptions are fulfilled before performing ANOVA. The data can be transformed by using appropriate transformations so as to follow normal distribution.

ANOVA: Single Factor

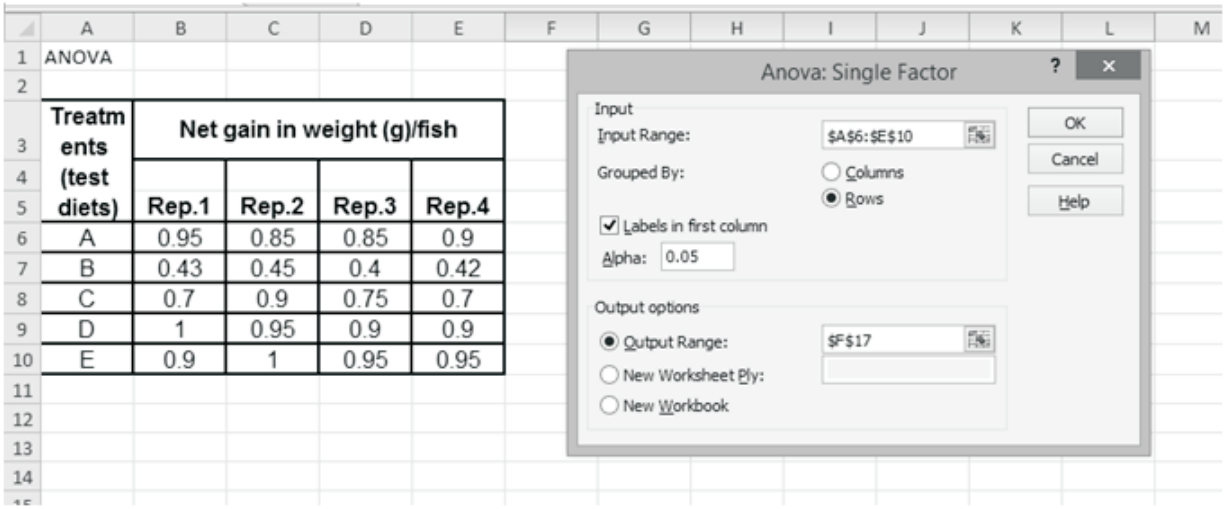
It consists of a single factor with more than two levels. ANOVA: Single Factor is used for analysis of one-way classification of data or data generated from a completely randomized design (CRD).The complete homogeneity of the experimental material is an important feature of CRD.Laboratory studies, pot culture experiments, animal feeding experiments, green house experiments, etc. are examples of CRD. The data for ANOVA: Single Factor (CRD) is entered in the Excel either in rows or columns in such a way that observations in a row (or column)corresponds to one treatment only. For example, suppose we want to test the five diets for ascertaining the growth performance of a particular fish in plastic pools for a period of one month. The fishes were fed 50% of the total weight of 40 fry kept in each plastic pool. CRD was used for this study and each treatment was replicated 4 times. (Source: Biradar, 2002)

First step is state the hypotheses, that is,

Null Hypothesis, H0: Thereis no significant difference among treatment means.

Alternative Hypothesis, H1: Atleast one of the treatment means differ significantly from others.

Click on Data → Data Analysis →ANOVA: Single Factor. Click OK. The dialog box for ANOVA: Single Factor will open up.



Under Input, the Input Range box is entered by selecting the cells from A6:E10. Click on the Grouped by Rows checkbox since each row represents a treatment (test diet). Since the columnA includes the test diet names, click on the Labels in first columncheckbox. Enter appropriate level of significance, Alpha(say, 0.05 or 5%).Finally, we convey the excel where to place theresult/ output under Output options. Enter the reference cell as F17 in the Output

Rangeto keep the results on the same worksheet containing datasets. Thus, Output Range is from F17. Click OK.The displayed output is shown below.

ANOVA

Source of Variation	Sum of squares	df	Mean sum of squares	F	P-value	F-crit
Between Groups (Treatments)	0.76325	4	0.190813	60.99494	4.24E-09	3.055568
Within Groups (Error)	0.046925	15	0.003128			
Total	0.810175	19				

Interpretation:The hypotheses that "there is no difference in net weight gain of fish betweendifferent test diets" can be tested by comparing calculated F-Value with tabulated (critical) F-Value. Since Fcal(60.99)>Ftab(3.06), the null hypothesis may be rejected.We conclude that the mean gain in weight for the test diets differed significantly.

ANOVA: Two factor without replication

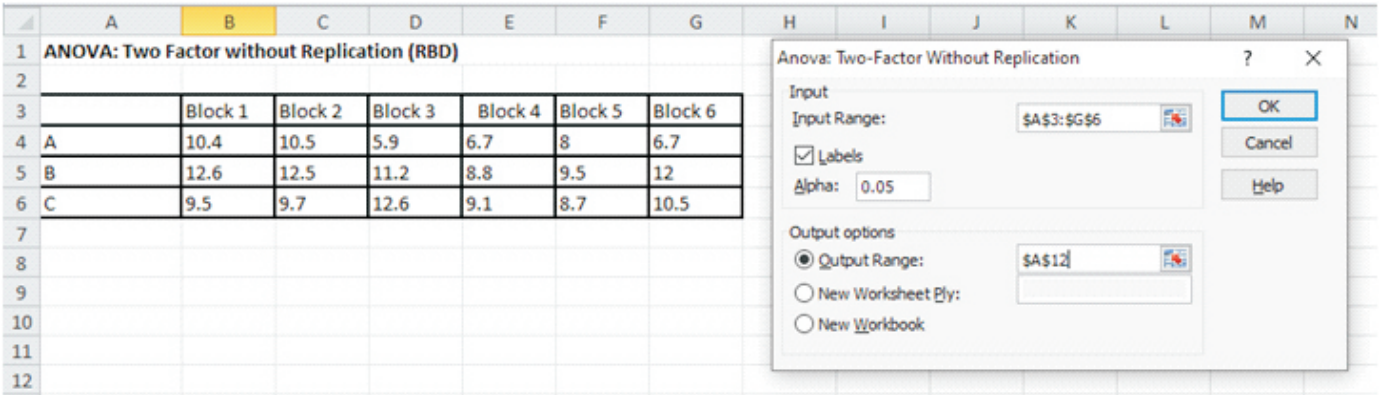
It is used for the analysis of two-way classification data with single observation per cell or the data generated from a complete randomized block design (RBD). Suppose there are 'v' treatments and each treatment is replicated 'r' times. Each treatment occurs once in each block. We need to prepare a v x r datasheet in Excel. For example, an experiment was conducted to test the effect of 3 types of protein supplement on average milk yield of cows. The cows are arranged in 6 blocks, 3 per each block according to similar productivity(milk yield) during pre-experimental period. The treatments are applied such that no treatment repeats in each block.

First step is state the hypotheses, that is,

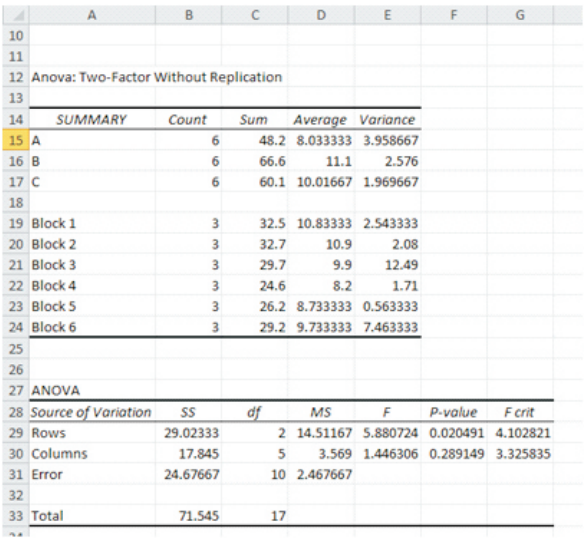
Null Hypothesis, H0: Thereis no significant difference among treatment means.

Alternative Hypothesis, H1: Atleast one of the treatment means differ significantly from others.

Click on Data → Data Analysis →ANOVA: Two Factor Without Replication. Click OK to open up the dialog box for ANOVA: Two factor without replication.



Under Input, the Input Range box is entered by selecting the cells from A3:G6. Click on the Labels checkbox since each row represents a treatment (protein supplement) and each column represent a block. Enter appropriate level of significance, Alpha(say, 0.05 or 5%). Finally, under Output options enter the reference Cell as A12 in Output Range box to keep the results on the same worksheet containing datasets. Thus, Output Range is from A12. Click OK. The displayed output is shown beside.



Anova: Two-Factor Without Replication

SUMMARY	Count	Sum	Average	Variance
A	6	48.2	8.033333	3.958667
B	6	66.6	11.1	2.576
C	6	60.1	10.01667	1.969667
Block 1	3	32.5	10.83333	2.543333
Block 2	3	32.7	10.9	2.08
Block 3	3	29.7	9.9	12.49
Block 4	3	24.6	8.2	1.71
Block 5	3	26.2	8.733333	0.563333
Block 6	3	29.2	9.733333	7.463333

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	29.02333	2	14.51167	5.880724	0.020491	4.102821
Columns	17.845	5	3.569	1.446306	0.289149	3.325835
Error	24.67667	10	2.467667			
Total	71.545	17				

Interpretation:The hypotheses that "there is no difference of milk yield between protein supplements" can be tested by comparing calculated F-Value with tabulated (critical) F-Value. Since Fcal(5.8807)>Ftab(4.1028), the null hypothesis may be rejected. We conclude that the milk yield of cowsfor the protein supplements differed significantly.

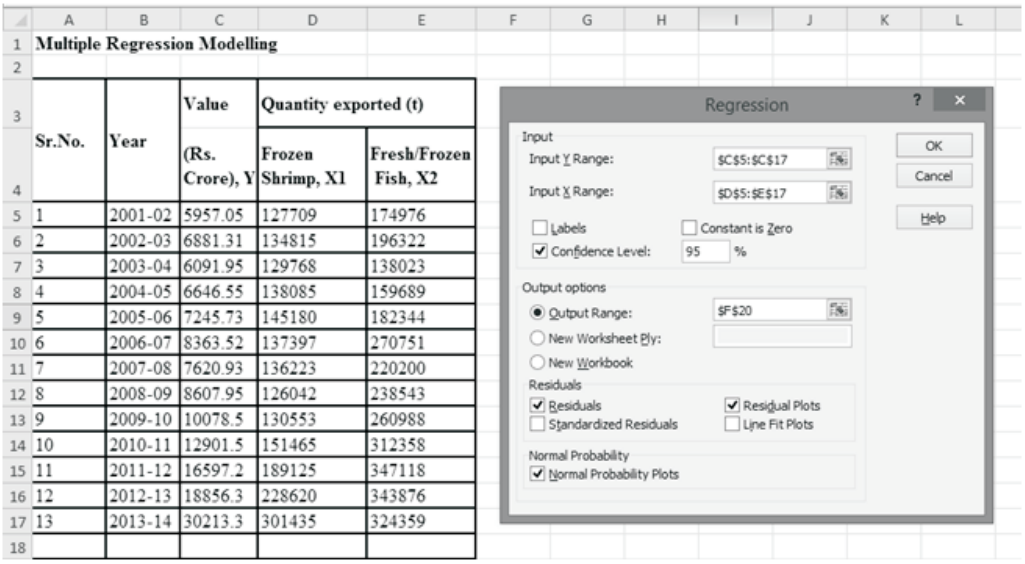
Regression Analysis

Linear regression analysis consists of fitting aline through a set of observations using the principle of 'least squares'. It helps to analyze how a single dependent variable is affected by the values of one (or more) independent variables. For example, Data on value of marine products exported (Y), quantity of shrimp (X1) and finfish (X2) exported during 1985-86 to 1998-99 are given below. Fit the multiple regression equation of Y on X1 and X2 and interpret your result.

Year	Value (Rs. Crore), Y	Quantity exported (t)	
		Frozen Shrimp, X1	Fresh/Frozen Fish, X2
2001-02	5957.05	127709	174976
2002-03	6881.31	134815	196322
2003-04	6091.95	129768	138023
2004-05	6646.55	138085	159689
2005-06	7245.73	145180	182344
2006-07	8363.52	137397	270751
2007-08	7620.93	136223	220200
2008-09	8607.95	126042	238543
2009-10	10078.5	130553	260988
2010-11	12901.5	151465	312358
2011-12	16597.2	189125	347118
2012-13	18856.3	228620	343876
2013-14	30213.3	301435	324359

Source: Handbook on Fisheries Statistics, 2014, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India (Website: http://www.dahd.nic.in)

Click on Data → Data Analysis →Regression. Click OK to open up the dialog box for Regression.



Multiple Regression Modelling

Sr.No.	Year	Value (Rs. Crore), Y	Quantity exported (t) Frozen Shrimp, X1	Fresh/Frozen Fish, X2
1	2001-02	5957.05	127709	174976
2	2002-03	6881.31	134815	196322
3	2003-04	6091.95	129768	138023
4	2004-05	6646.55	138085	159689
5	2005-06	7245.73	145180	182344
6	2006-07	8363.52	137397	270751
7	2007-08	7620.93	136223	220200
8	2008-09	8607.95	126042	238543
9	2009-10	10078.5	130553	260988
10	2010-11	12901.5	151465	312358
11	2011-12	16597.2	189125	347118
12	2012-13	18856.3	228620	343876
13	2013-14	30213.3	301435	324359

In this example, the variable Y, Vaue (Rs. Crore) of export is the dependent variable.Under Input, we select all of the values (C5:C17) of the dependent variable (Y) in the Input Y Rangebox.Next step is to enter the data (D5:E17) of independent variables in the Input X Rangebox. Here,Frozen Shrimp and Fresh/ Frozen Fish are the independent variables.Here, we need not need to click Labels checkbox since first row is not given in the input Y and X range. One must not forget to click the Labels checkboxif the first row of data (variable label) is given in input Y and X range.Clicktheconfidencelevelcheckbox(by default, 95%). Finally, under Output options enter the reference Cell as F20 in Output Range box to keep the results on the same worksheet containing datasets. Thus, Output Range is from F20. Click OK. The displayed output is shown below.

Regression Statistics	
Multiple R	0.986613
R Square	0.973405
Adjusted R Square	0.968086
Standard Error	1252.173
Observations	13

ANOVA

	df	SS	MS	F	Significance F
Regression	2	5.74E+08	2.87E+08	183.0065	1.33E-08
Residual	10	15679372	1567937		
Total	12	5.9E+08			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-11986.5	1334.388	-8.98273	4.21E-06	-14959.7	-9013.25
X Variable 1	0.110651	0.009351	11.83261	3.33E-07	0.089815	0.131487
X Variable 2	0.022757	0.006692	3.400352	0.006767	0.007845	0.037668

(i) Based on the summary output, the multiple regression equation fitted can be written as

Y= -11986.5 + 0.058879X1+ 0.022757X2

The adjusted coefficient of determination is 0.9681, indicating that this regressionequation explains 96.81% of the variation in the value of marine productsexported (Y).

(ii) Based on ANOVA, it can be concluded that multiple regression highly significant since p-value is highly significant and the null hypothesis that both the regression coefficients are zero is rejected indicating that atleast one regression coefficient is not equal to zero. From last table of regression output obtained above, it is observed that p-value of both the regression coefficientsis highly significant since it is very less than 0.01, that is, Ho : 1 = 2 = 0 is rejected in favour of 1= 2 0). Hence, it can be concluded that both the variables, the quantity of frozen shrimp exported (X1) and quantity of fresh/ frozen fish (X2) has highly significant effect on value of marine products exported (Y).

Linear optimization using Excel Solver

In linear programming problems (LPP), we are given something that we want to optimize (either maximize or minimize) that are subject to some constraints. It consists of an objective function (to be maximized or minimized) and constraints in the form of linear equations or inequalities.LPPhas been used for planning in the field of agriculture and allied sectors for a long time but still there is scope for its expansion.Forsolving the LPP, we will be using the Solver, an Add-in and a part of MS-Excel. The following LPP example will be considered for solving using Excel.

A farm manager plans to plant two crops, Wheat and Mustard. The cost of cultivating Wheat and Mustard is $40/acre and $60/acre, respectively. The farm manager has maximum of $7400 available for land cultivation. Each acre of Wheat and Mustard crop requires 20 labor-hours and 25 labor-hours, respectively. The farm manager has a maximum of 3300 labor-hours available. If the farm manager expects to make a profit of $150/acre and $200/acre on crop Wheat and Mustard, respectively, how many acres of each crop should farm manager plant in order to maximize his profit?

In order to formulate the given LPP, let X and Y (in acres) be the total area for growing wheat and mustard. X and y ae our decision variables. The given problem is equivalent to

Objective function (Z) is given by, Maximize $Z = 150X + 200Y$

subject to the constraints

$40X + 60Y \leq 7400$ ……. Constraint for cost (price/acre)

$20X + 25Y \leq 3300$ ……. Constraint for available labour-hours

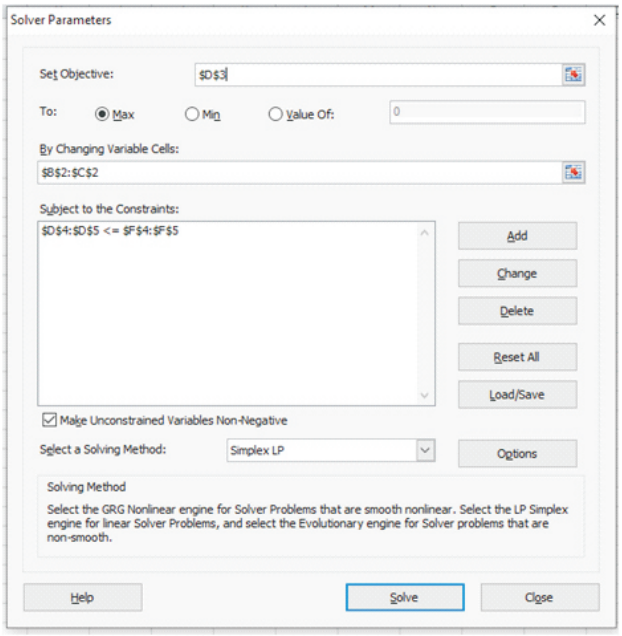
$X, Y \geq 0$ …… non-negativity restriction

Enter the LPP in the Excel as given below. It is clear that the given LPP contains 2 decision variables (X and Y) and two constraints (Cost and labour-hours). The first row contains the labels of the variables. The second row is the "Changing variable cells" wherein the Solver will display the final values of each decision variable. The third row is objective function and contains the coefficient of variables in Objective function.Cellsfrom B4:C5refersto coefficients in the constraints matrix.The next important part in the LPP is the Left hand side spanning from D3:D5.

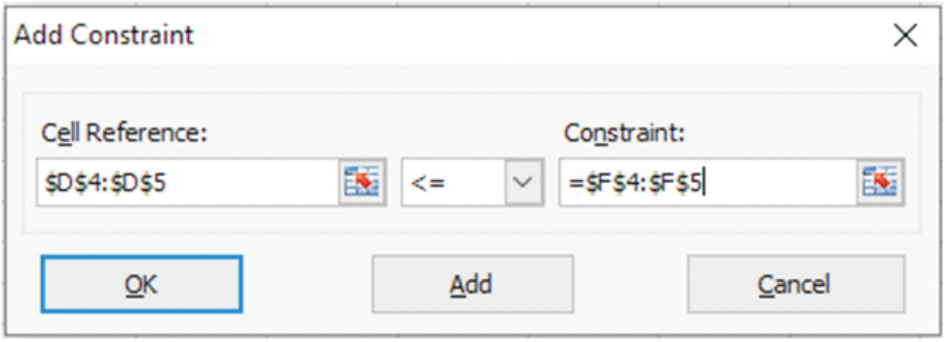
Place the pointer in D3 and type formula '=SUMPRODUCT($B$2:$C$2,B3:C3)' and copy the formula in cell D4 to D5. Column E gives the inequality since the given LPP demands cost (price/acre) and available labor-hours to be maximum $7400 and 3300labor-hours.

	A	B	C	D	E	F	G	H
1	Constraints/ coefficients	Wheat, X	Mustard, Y	left hand side	relation	right hand side		
2	Changing variable cell	0	0					
3	Objective function	150	200	0				
4	Cost of cultivation per acre ($)	40	60	0	≤	7400		
5	Available labor-hrs	20	25	0	≤	3300		
6								

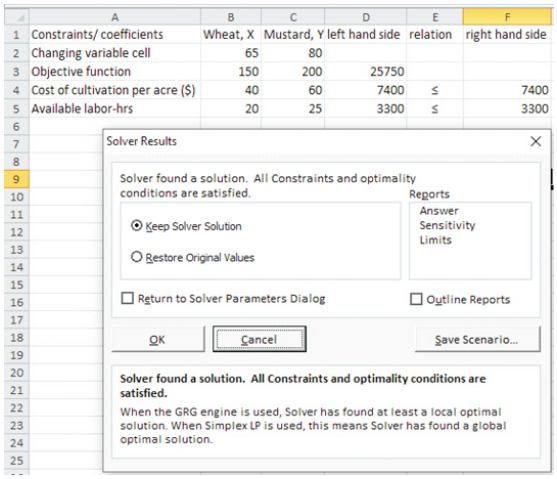
Click on Data → Solver.The Solver Parameters daialogue box shown below will open up. Here, weneed to enter all the necessary parameters for solving the given LPP.



In the Objective cell, enter the cell reference D3, wherein the Solver will display the final value of the objective function.Click on To Max checkbox. It will convey the Excelto maximize the given Objective. Enter cells in span B2:C2 in the By Changing Variable Cells box and they are assigned 0 value in the starting set of the task. Click on add button for adding the constraints. The following window will be displayed. Type D4:D5 in the Cell Reference box and F4:F5 in Constraint box. Click on OK will return you to the Solver Parameters dialog box with the filled information as shown above.



Select a Solving Method: Simplex LP from drop-down arrow. Finally, click on the Solve to start solver to keep the optimum values in the relevant positions and will be displayed on the screen. Click the Keep Solver Solution option to retain the optimum values in the table. Click OK. The following output will be displayed.



It is clear from output that to maximize the profit the farm manager should produce wheat and mustard in 65 acres and 80 acres, respectively. The maximum profit the farm manager will gain is Max Z = 150 * (65) + 200 * (80) = $ 25,750.

Conclusion

In conclusion, MS-Excel is usefulsoftwareto answer basic research questions at no cost. The beauty of using Excel lies in the fact that it is menu driven and provides user friendly interface. The only thing it requires that one should have some statistical background to process the data and interpret the results obtained after analysis. However, there are some disadvantages also in using Excel for statistical data analysis.

- It handles missing values inconsistently and incorrectly sometimes.
- Organization of data differs as per the analysis in Excel. This forces the users to rearrangethedata in several ways if different statistical analyses are to be performed.
- Many statistical analyses of datain Excel can only be performed on one column at a time.ThismakesExcel inconvenient in doingsame analysis on several columns.
- There no log or record of analyses performed in the Excel.

- Further, it lacks variousessentialfeatures for advanced statistical analyses. That is, we cannot perform regression diagnostics, collinearity diagnostics, post-hoc analysis, significance of correlation, weighting cases, etc. However, these can be performed by entering required formulae for the corresponding analyses in the Excel, if one has sound statistics background.

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Chapter - 17

Mushroom Cultivation: An Entrepreneurial Enterprise for Income and Employment Generation

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Introduction

Mushroom cultivation might be considered as an optional source of income generation to uplift the human index of rural family and to avail good quality protein in their daily diets.Its cultivation is being an indoor cultivation, low costing, labour intensive, high profit venture and suitable for rural areas as it can provide employment to small farmers, landless labourers, women, unemployed youth and even retired or in-service personnel in rural areas to a an extent (Das, 2014). Mushroom cultivation helps to improve the socio-economic condition of farmer and generate employment to both literate and illiterate, especially to women. It can also be evidence as a most successful tool for rural development (Biswas, 2015). Commercial cultivation of mushroom might proved as a step to meet nutritional and medicinal needs, to reduce malnutrition and to upgrade livelihood status of rural poor. Per capita consumption of mushrooms in India is less than 50 g as compared to 1 kg in various other countries. Mushroom is a novel food item and it is choice for its flavour, texture and nutritive medicinal value. But many of Indians are not aware of 'what is mushroom and if aware, they are still confused whether it is vegetable or non-vegetable?' Therefore, there is need to popularize the value of mushroom by advertize, literatures, posters and demonstration may be highly helpful to aware the people and mushroom the consumers.

Now a day, mushroom farming is being practiced in more than 100 countries and its production is increasing at an annual rate of 6-7%. In few developed countries of Europe and America, mushroom farming has attained the status of a high-tech industry with very high levels of mechanization and automation.China is the global leader in production, consumer and exporter of mushrooms followed by USA and Netherlands. At present, the total mushroom production in India is approximately 0.13 million tons. But, this contribution amounts to less than 1 per cent of global mushroom production (Wakchaure, 2011). From 2010-2017, the mushroom industry in India has registered an average growth rate of 4.3% per annum.

Mushroom cultivation

There are many Government and Non-Government agencies engaged in production of fresh mushroom and mushroom spawn. Mushroom cultivation is done in India mainly on hills, as it requires low temperature for its growth; however using modern cultivation technology it is being cultivated under uncontrolled conditions (Thakur, 2014). Himachal Pradesh is head of state state for commercial mushroom production and known as land of mushroom. Other states such as Punjab, Uttarakhand, Haryana, Uttar Pradesh, Odisha, West Bengal and Tamil Nadu, are also turning into major contributors of mushroom production in the country (Prakasam, 2012).The Indian subcontinent is known worldwide for its varied agro climatic zones with a variety of habitats that favour rich mushroom biodiversity (Vermaet al., 2003; Thakur et al., 2011). In the last ten years, large numbers of commercials units have been established by the entrepreneurs/farmers, which are involved in the mushrooms production.

Spawn (Mushroom seed) has become a most important input and key driver in mushroom cultivation. The main problem that hinders the mushroom industry is the unavailability of mushroom spawn. Lack of technicalknowhowis one of the hindrancesto prepare the mushroom spawn since it requires particular laboratory procedures. There should be a mushroom center which could undergo research, training, workshops and technical supports to the growers. ICAR-AICRP on mushroom has made lot of efforts to train the entrepreneurs for establishment of a good Mushroom Spawn Laboratory. Mushroom spawn technology is a low cost enterprise which cans double the farmers income within 5-15 days depends on the variety of mushroom.Majority of the commercial

spawn is being supplied by the private units and the contribution of public sector organizations in spawn supply is only 10%.

Mushroom crop production is the second step to goforward for mushroom farming of any of the mushroom suiting to the agro-climatic conditions. There are different types of edible mushroom out of which generally four types viz., button (Agaricus sp.),oyster (Pleurotus sp.), paddy straw (Volvariellavolvacea) and milky mushroom (Calocybeindica) are commercially grown in most of the states of India. Button mushroom (Agaricus bisporus) is the most popular variety, fetches high price, still dominating the Indian and International market (Tewari and Pandey, 2002). It grown for both domestic and export market. It secured rank first at global level for consumption and export. This mushroom requires hi-tech infra structure for quality production. Oyster mushroom has species suitable for both temperate and sub-tropical regions. In India, it is largely adopted by the women of the self help groups in a small to medium scale and is most appropriate for rural areas and can major role in self employment. It grows on wide range of agricultural wastes. The most popular species of oyster mushroom are P. sajor-caju, P. flordia, P. ostreatus, P. flabellatus, P. eous. The areas suitable for button mushroom are equally suitable for the cultivation of these species. Post harvest processing particularly dehydration/sun drying and value edition is easy of this mushroom. Paddy straw mushroom (Volvariellavolvacea) is another mushroom cultivated in South East and East Asian countries. In India, Odishais the most dominating state for cultivation of this mushroom and available in every nook and corner of the state. This mushroom is known for excellent test and flavour and has very short cropping cycle. Milky mushroom (Calocybeindica)is a purely Indian mushroom and is most suitable for tropical condition. At present this mushroom is being commercially cultivated in South Indian status such asTamil Nadu, A.P. and Karnataka. Recently its production has started in North India. Paddy straw, wheat, soybean, cotton wastes, coffee waste, water hyacinth, tree saw dust, sugar cane bagasse, wild grasses and various categories of refuse and lignocellulosic wastes are required for the cultivation of above mentioned different type of mushroom. These substrates have great potential to exploit and convert it in to a highly nutritious food in less time per unit area (Singh, 2011).

Post harvest handling

Mushroom processing and value addition technologies have massive potential to knock the world market. In view of their high perishable nature, the fresh mushrooms have to be processed to extend their shelf life for off season use. This can be achieved by adopting appropriate post-harvest technology to process surplus mushrooms into novel value added products. Loss of texture, development of off flavour, discoloration, moisture loss, microbial contamination are the major post harvest losses results in poor marketable quality and restricts trade of fresh mushrooms. The course of developing post harvest technology thus requires scientific ability, innovative ideas and commercial entrepreneurship in an integrated manner to meet the food requirements of the growing population from the diminishing land in presently changing vulnerable climate scenario. Presently, the farmers sell their products in the local without processing and fetch low price during gluts in the market but if they go for processing and adding value to their products in the villages, they may be able to generate more employment and income in rural areas. The possible value-added products can be developed either by converting freshly harvested mushrooms into ketch-up, murabba, candy, chips and pickles or by dehydrating freshly harvesting mushrooms into dehydrated form and then making soup powder, biscuit, nuggets and RTE.

Eventually, it can be said that spawn production, crop production, processing and value addition has enough potential to convert rural economy, generate income and offer employment opportunities for migrant laborers and entrepreneurship aspirant. We must follow China, USA, Japan, Netherland etc. to make head way in this direction.

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Chapter - 18

Role of Vegetables as immunomodulator for enhancing immunity in COVID-19 Era

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Abstract

Covid-19 pandemic is a most important challenge worldwide. It is obligatory to achieve and retain balanced nutritional condition to fight against corona virus. Nutritional status of individual is vary withage, health status and life style. Nutritional status of individuals has been used asresilience towards destabilization during this COVID-19 pandemic. Optimal nutrition and dietary nutrientintake impact the immune system, therefore the only sustainable way to survive in current context is tostrengthen the immune system.This chapter focused on chronology of event occurs after COVID-19 infection and role of different vitamins (particular B, C and D) and minerals (Selenium and zinc) to combat the problem.

Introduction

The Corona virus disease 2019 (COVID-19) is caused by SARS-CoV-2 virus, is a respiratory disorder that is consequence of severe acute respiratory syndrome. During this pandemic, the nutritional status and immunity are measure of resilience to survive. Famous theory of Darwin "survival of fittest" is so true in COVID-19 situation. Self-isolation, lockdown, and social distancing have imposed a new set of challenges for the individual to maintain a healthy life. The act of confining to one's home result in reduces physical activity, changes in eating and sleeping patterns has noteworthy impacts on one's health and wellbeing (Aman, F., and Masood, S., 2020). It would promote sedentary behaviours that affect mental and physical health and lead to an increased risk oflifestyle disease like obesity, diabetes, cardio-vascular disease (CVD) and cancer.

Currently, world is looking an approved vaccine or drug treatment against the diseases SARS-CoV-2. Until these become available and obtainable, balanced diets including vegetable will assurance proper body functioning and boosting of the immune system. Micronutrients, like Zinc and selenium has immune regulator and anti-viral properties andvitamin like C and D have potentialimmunomodulatoryfunction due to their anti-in?ammatory and immune-supporting properties (Shakoor et al., 2020a). Deficiency of vitamins D and C lead to suppressive immune system.Evidence has revealed that balanced vitamin D concentrations causes lowermortality rate in COVID-19 patients and vitamin C supplementation increases the oxygenation index in COVID-19 infected patients (Shakoor et al., 2020b). Similarly, balanced vitamin B concentrations can significantlyimprove function of cell and immune system. This chapter focused on chronology of event occurs after COVID-19 infection, role of different vitamins and minerals to combat the problem and their major vegetable sources.

Chronology of events during SARS-CoV-2 infection.

Corona viruses are identified to cause infect humansand animals. They typically infectonly the upper respiratory tract and cause relativelyminor symptoms. However, there are three coronaviruses(severe acute respiratory syndrome coronavirus(SARS- CoV), Middle East respiratory syndromecoronavirus (MERS- CoV) and SARS- CoV-2) that canreplicate in the lower respiratory tract and cause pneumonia,which can be fatal. SARS- CoV-2 belongs to thebetacoronavirus genus and wheninfects cells expressing the surfacereceptors angiotensin- converting enzyme 2 (ACE2) and TMPRSS2. The virus undergoactive replicationand multiplication of the virus cause the host cell to undergo highly inflammation response and program cell death (pyroptosis) and release damageassociatedmolecular including ATP and nucleic acids etc.These are recognized by adjacent endothelial cells epithelial cells and alveolarmacrophages. They triggers the generation of pro- inflammatory cytokines and chemokines(including IL-6, IP-10, macrophage inflammatory protein 1α (MIP1α), MIP1β and MCP1).These proteins attract macrophages, T cells and monocytes to the site of infection. In a defective immune response(Fig. 1),

this may lead to further accumulation of immune cells in the lungs, causingoverproduction of pro- inflammatory cytokines, which eventually damages the lunginfrastructure. The resulting cytokine storm circulates to other organs, leading tomulti- organ damage. In addition, non- neutralizing antibodies produced by B cells mayenhance SARS-CoV-2 infection through antibody- dependent enhancement,further leads to organ damageespeciallythe cardiac, hepatic and renal systems. On the other hand, in case of healthy immune response (Fig. 2), the initial inflammation attracts virus- specific T cells to the site of infection, wherethey can destroy the infected cells before the virus spreads. Neutralizing antibodiesin these individuals can block viral infection, and alveolar macrophages recognizeneutralized viruses and apoptotic cells and clear them by phagocytosis. Altogether,these processes lead to clearance of the virus and minimal lung damage, resulting inrecovery.

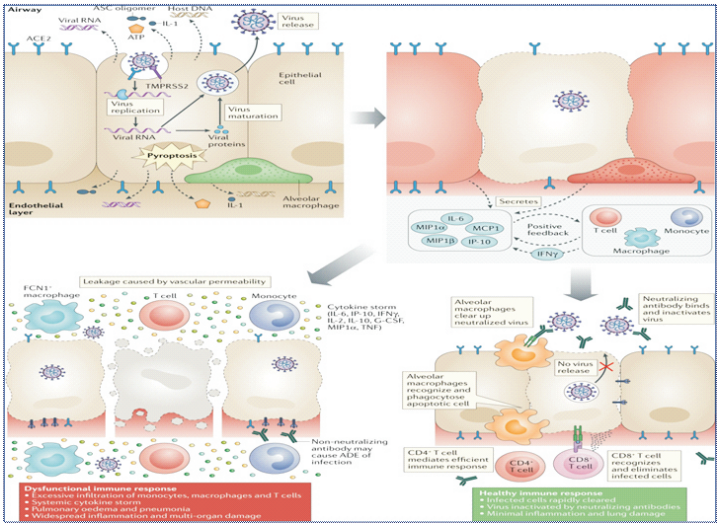

Fig.1.Sequences of events during (Corona Virus) SARS-CoV-2 infection (Source: L. Zhang, Y. Liu 2020)

Role of Vitamin B complex as immunomodulator :

Vitamin B assists in proper activation and regulation of both the innate and adaptive immune responses, reduces pro-inflammatory cytokine levels, improves respiratory function, maintains endothelial integrity, prevents hypercoagulability and decreaseseverity of disease(C.A. Micheleet al., 2020 and L. Zhang, Y. Liu 2020)). Therefore, vitamin B status should be assessed in COVID-19 patients and vitamin B could be used as a supplementto current treatments. The potential role of Vitamin B is tabulated in Table 1.

Table 1. A potential role of vitamin B in COVID-19 and their role

Vitamin	Role in enhancing Immunity
Vitamin B1 (Thiamine)	1. Thiamine is able to improve immune system function as it regulates antibodies, and T cell production 2. Thiamine also functions as a carbonic anhydrase isoenzyme inhibitor
Vitamin B2 (Riboflavin)	1. Riboflavin together with UV light cause irreversible damage to nucleic acids such as DNA and RNA 2. Rendering microbial pathogens unable to replicate 3. Riboflavin-UV decreased the infectious titer of SARS - CoV-2 below the limit of detection in human blood

Vitamin B3 (Nicotinamide, Niacin)	1. Niacin acts as a building block of NAD and NADP, both vital during chronic systemic inflammation 2. NAD+ is released d uring the early stages of inflammation and has immunomodulatory properties, known to decrease the pro-inflammatory cytokines, IL-1β, IL-6 and TNF-α. 3. Nicotinamide reduces viral replication (vaccinia virus, human immunodeficiency virus, enteroviruses, hepat itis B virus)
Vitamin B5 (Pantothenic acid)	1. Decreases inflammation 2. Cholesterol-and-triglyceride-lowering properties, improves wound healing
Vitamin B6 (Pyridoxal 5' -phosphate, Pyridoxine)	1. Essential cofactor in various inflammatory pathways and deficiency leading to immune dysregulation 2. Low PLP levels have been noted in patients with type -2 diabetes, cardiovascular disease and in the elderly
Vitamin B9 (folic acid, folate)	1. Folate is an essential vitamin for DNA and protein synthesis and in the adaptive immune response 2. Folic acid was able to inhibit furin, preventing binding by the SARS -CoV-2 spike protein, preventing cell entry and virus multiplication
Vitamin B12 (cobalamin)	1. Vitamin B12 acts as a modulator of gut microbiota 2. Low levels of B12 increased inflammation, reactive oxygen species and oxidative stress by elevate methylmalonic acid and homocysteine

Vitamin B not only helps to build and maintain a healthy immune system but it could potentially prevent or reduce COVID-19 symptoms or treat SARS-CoV-2 infection. Vitamin B has versatile role (Fig 2) in modulates immune response by downregulating pro-inflammatory cytokines and inflammation, reducing breathing difficulty and gastrointestinal problems, preventing hypercoagulability, potentially improving outcomes and reducing the length of stay in the hospital for COVID-19 patients.

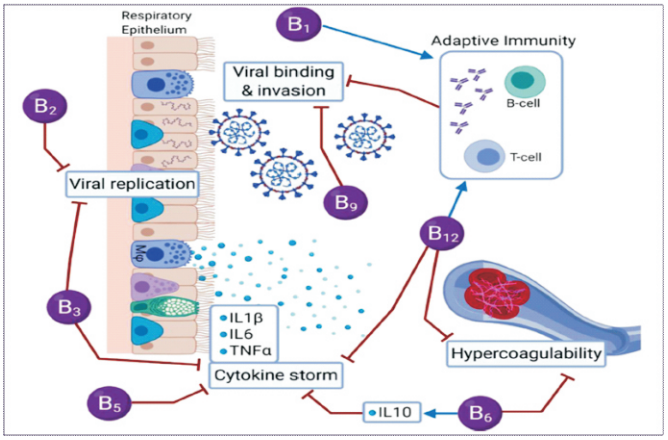

Figure 2: Summary of the different roles Vitamin B can Play during COVID-19 (Source: Shakooret al2020b)

Vitamin C and its immune responses in COVID-19

Vitamin C, or ascorbic acid, is a water-soluble nutrient that cannot be synthesized by humans. It accumulates in leukocytes, in concentrations of 50- 100-fold higher than in the plasma. During infection, vitamin C that is present in leukocytes is rapidly utilized. Disturbance of the balance between antioxidant defenses and oxidant generation can alter multiple signaling pathways involving pro-inflammatory transcription factors, such as nuclear factor κB (NF-κB) cause cytokine storm.For instance, the pro-inflammatory cytokines, IL-1β and TNF-α increase rapidly after infection, and the acute response triggered by this stimulates further secretion of IL-6 and IL-8 promoting an ongoing pro-inflammatory state.There is unpublished data suggesting beneficial effects of high dose vitamin C supplementation in 50 Chinese patients with severe symptoms, though this requires substantiation (R.Z. Cheng, 2020). Therefore, vitamin C supplementation is a sensible option in micronutrient deficient individuals that are at risk of COVID-19 infection to assist with the prevention and support of immune responses.

Immunomodulatory role of vitamin D

Vitamin D is a fat-soluble steroid hormone precursor that arises from ultraviolet B (UVB) radiation exposure of 7-dehydrocholesterol (7-DHC) in the epidermis of the skin, where it is transformed into the circulating precursor cholecalciferol. In the liver, cholecalciferol is hydroxylated to form 25-hydroxyvitamin D, which is transformed into the active hormone 1,25-hydroxyvitamin D (1,25(OH)2D) in the kidneys(Gormanet al., 2017). Vitamin D has roles in a wide range of body systems, including in both innate and adaptive immune responses as shown in Fig. 3. Vitamin D enhances innate cellular immunity through stimulation of expression of anti-microbial peptides, such as cathelicidin and defensins. Defensins maintain tight and gap junctions, adherens and enhance the expression of anti-oxidative genes. Viruses such as influenza are known to significantly damage the integrity of epithelial tight junctions increasing the risk of infection and pulmonary oedema. Vitamin D is known to maintain the integrity of these junctions with low levels of vitamin D receptor expression leading to increased expression of claudin-2 and inflammation. Vitamin D also promotes the differentiation of monocytes to macrophages whilst increasing superoxide production, phagocytosis and bacterial destruction. In addition, vitamin D is able to modulate the adaptive immune response, by suppressing T helper type-1 (Th1) cell function and decreasing the production of pro-inflammatory cytokinesIL-2 and interferon-gamma (INF-γ).

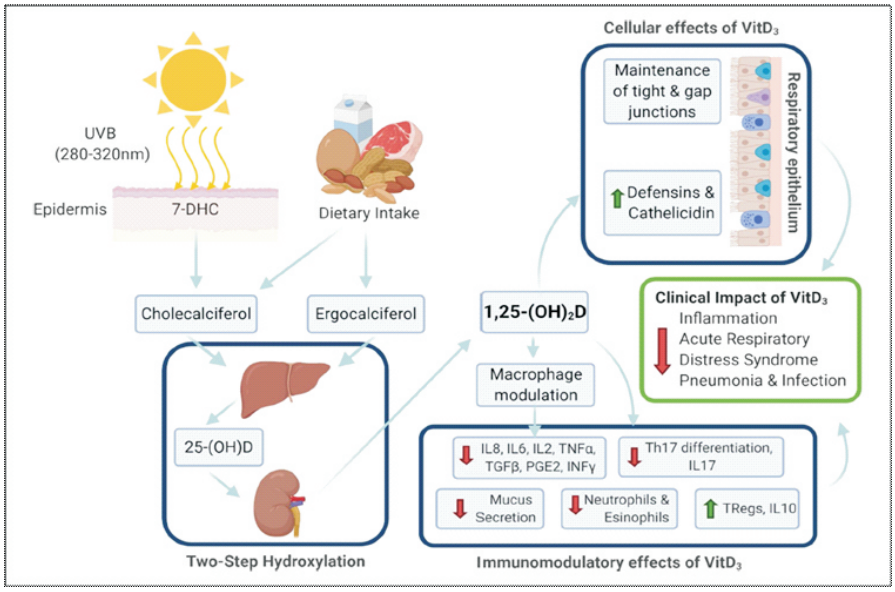

Fig: 3 Immunomodulatory actions of vitamin D.IL: interleukin; TNF: Tumor necrosis factor; IFN: Interferon; Th: T-Helper; 7-DHC: 7-Dehydrocholesterol; PGE2: Prostaglandin E2. (Source: Shakoor et al 2020a)

Immunomodulatory role of zinc:Zinc is a key trace mineral, involved in many biological processes including immunity and it is vital in both the innate and acquired responses to viral infection. Zinc deficiency significantly increases pro-inflammatory cytokines and remodeling of lung tissue is noted, an effect which was partially countered by zinc supplements (V.S. Biaggioet al.,2010)

Immunomodulatory and anti-viral properties of zinc:Zinc plays a significant role in the recruitment of neutrophil granulocytes and chemotactic activity and has positive effects on NK cells, phagocytosis, generation of oxidative burst, and CD4+ and CD8 + T cells. Zinc deficiency reduces lymphocyte counts and impairs their function; in fact, zinc supplementation increases the number of T cells and NK cells and increases IL-2 and soluble IL-2 receptor expression. Zinc has been shown to inhibit the synthesis, replication and transcription complex of coronaviruses (A.J. Te Velthuis et al., 2010). It can also interfere directly with viral replication and protein synthesis, providing beneficial and therapeutic effects against viral infections.(A.V. Skalnyet al., 2020).

Immunomodulatory role of omega-3 fatty acids : Omega-3 fatty acids are polyunsaturated fatty acids and include eicosapentaenoic and docosahexaenoic fatty acids, and are well known to have favorable effects on immunity and inflammation. Of interest, omega-3 fatty acids exert anti-viral effects by inhibiting influenza virus replication. According to the European Society for Parenteral and Enteral Nutrition expert statement, the use of omega-3 fatty acids may improve oxygenation in COVID-19 patients, although firm evidence is still missing (R. Barazzoni et al.,2020).

Immunomodulatory role of Vitamin E and Selenium: The anti-oxidant Vitamin E, and trace element selenium, are major components of anti-oxidant defense. Epidemiological studies demonstrate that deficiencies in either of these nutrients alters immune responses and viral pathogenicity. It has been noted, that there is a correlation between geographic selenium levels and COVID-19 cure rates in different Chinese provinces (Zhang et.al , 2020). Vitamin E and selenium both act through anti-oxidant pathways to increase the number of T cells, enhance mitogenic lymphocyte responses, increase IL-2 cytokine secretion, enhances NK cell activity, and, decreases the risk of infection (Fig. 3). Selenium and vitamin E supplementation has also been shown to increase resistance to respiratory infections (Zhanget.al, 2020, Wu et.al.,2019).. It is worthy to note that mixed tocopherols are more effective than α-tocopherol alone, due to the range of receptors for these nutrients (Liu, et al., 2002). Despite these beneficial roles in immunity, there is limited information on the effects of vitamin E or selenium supplementation in humans with COVID-19 infection, though patients are encouraged to have adequate intakes of these antioxidant nutrients. Figure 4. showing protective actions of vitamin C, Zn, Selenium and Omega-3

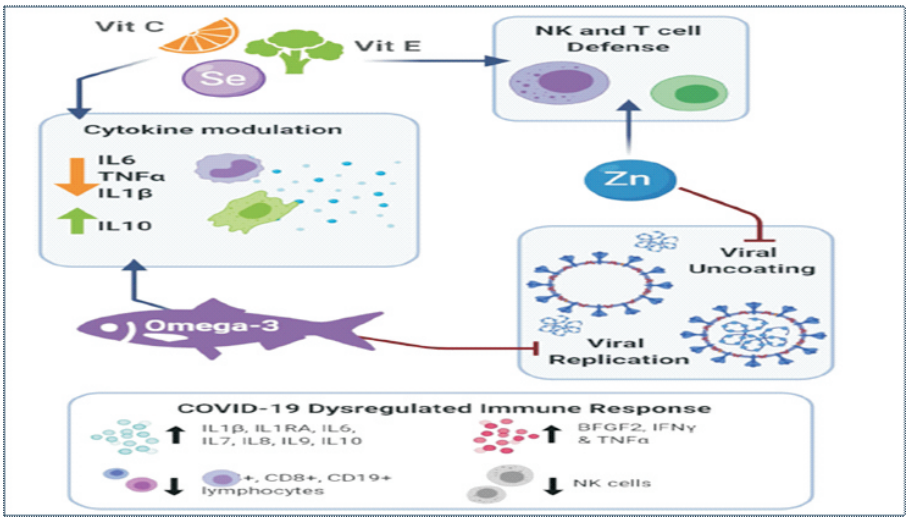

Figure 4. Protective actions of vitamin C, Zn, Selenium and Omega-3

Food synergy to enhance nutrition

New evidence suggests that certain foods that taste great together also interact with one another in nutritionally positive ways. In other words, two particular foods consumed in combination can actually deliver more benefits than either one would on its own (Shubha et al., 2020). Epidemiologist David R. Jacobs refers to this phenomenon as "food synergy." Some example of food combinations are presented in table 2.

Table 2: List of healthy Combination of vegetables

Combination	Advantage
Spinach and Lemon	The vitamin C in lemon will helps to increase the absorption of the iron from the spinach
Cabbage and capsicum	The vitamin C in capsicum helps to increase the absorption of the minerals from the cabbage.
Tomato and Olive Oil	A healthy, monounsaturated fat like olive oil helps to increase the absorption of the lycopene (a fat soluble vitamin).
Radish and carrots	Carrots cleanse the body internally, and radishes have natural anti -fungal properties so the combination is a powerful one.
Leaf green and ginger	Leafy greens like kale and spinach are loaded with fibre and ginger adds great and aids in digestion.
Kidney beans and green peppers	The vitamin C in green pepper helps to increase the absorption of the iron from the Kidney bean.

Conclusions

Supplementation of higher dosage of vitamins D, C and zinc may have a positive effect during COVID-19 infection and act as potential immunomodulators. Smillarly, vitamin B modulates immune response by downregulating pro-inflammatory cytokines and inflammation, reducing breathing difficulty and gastrointestinal problems, preventing hypercoagulability, potentially improving outcomes and reducing the length of stay in the hospital for COVID-19 patients. A proper and healthy diet can ensure a robustimmune system that can resist any

onslaught bythe virus. A certain amount of particular nutrientsaturates into cells and prevents any kind ofnutritional deficiency. Individuals consumingwell-balanced diets appear to be safer with betterimmune systems and lower incidence of chronicdiseases and infections

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Chapter - 19

Project Planning And Management

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Introduction

Given the complex and diversified nature of activities in agriculture, project management approach has been a very effective instrument to plan, implement, coordinate and control the activities, despite all the sectorial risks and uncertainties. The importance of systematic agricultural project planning and implementation are often not fully realized and the time and effort spent on these aspects are very minimal. Projects are often designed on an adhoc and piecemeal basis without fully verifying their viability, resulting in avoidable waste of resources and delays. Identification of viable projects, scientific formulation and expeditious implementation of agricultural projects are essential to achieve the desired development at farm and national level. As the projects in the field of agricultural sector are quite different from their counterparts in other sectors due to various factors like change of farming systems, difference in climatic conditions, change in socio economic conditions of the farmers etc., one has to properly identify the agricultural projects with relevance to local factors to achieve optimum gains.

In general, the knowledge and skills to identify, prepare, analyze and manage projects in the agricultural sector are still inadequate among extension functionaries. Therefore, it is essential to improve the capabilities of extension functionaries engaged in project formulation and administration of agricultural and allied sectors to realize the project objectives.

Project Definition

Project in general refers to a new endeavor with specific objective and varies so widely that it is very difficult to precisely define it. Some of the commonly quoted definitions are as follows:

Project is a temporary endeavor undertaken to create a unique product or service or result(AMERICAN National Standard ANSI/PMI99-001-2004).

Project is a unique process, consist of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective confirming to specific requirements, including the constraints of time, cost and resource.

Examples of project include developing a watershed, creating irrigation facility, developing new variety of a crop, developing new breed of an animal, developing agro-processing center, construction of farm building, etc.It may be noted that each of these projects differ in composition, type, scope, size and time.

Characteristics of Project

Despite above diversities, projects share the following common characteristics.

- Unique in nature.
- Have definite objectives to achieve.
- Requires set of resources.
- Have a specific time frame for completion with a definite start and finish.

- Involves risk and uncertainty.
- Requires cross-functional teams and interdisciplinary approach.

Project Performance Dimensions

Three major dimensions that define the project performance are scope, time, and resource. These parameters are interrelated and interactive. The relationship generally represented as an equilateral triangle. The relationship is shown in figure-1. proteins attract macrophages, T cells and monocytes to the site of infection. In a defective immune response(Fig. 1), this may lead to further accumulation of immune cells in the lungs, causingoverproduction of pro-inflammatory cytokines, which eventually damages the lunginfrastructure. The resulting cytokine storm circulates to other organs,

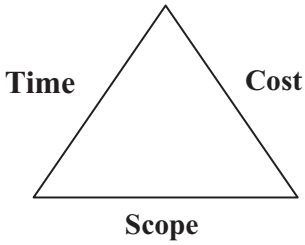

Figure-1. Project performance dimensions

It is evident that any change in any one of dimensions would affect the other.For example, if the scope is enlarged, project would require more time for completion and the cost would also go up.If time is reduced, the scope and cost would also be required to be reduced.Similarly any change in cost would be reflected in scope and time.Successful completion of the project would require accomplishment of specified goals within scheduled time and budget. In recentyears a fourth dimension, stakeholdersatisfaction, is added to the project. However, the other school of management argues that this dimension is an inherent part of the scope of the project that defines the specifications to which the project is required to be implemented.Thus the performance of a project is measured by the degree to which these three parameters (scope, time and cost) are achieved.

Mathematically

Performance = f (Scope, Cost, Time)

In management literature, this equilateral triangle is also referred as the "Quality triangle" of the project.

Project Life Cycle

Every project, from conception to completion, passes through various phases of a life cycle, synonym to life cycle of living beings. There is no universal consensus on the number of phases in a project cycle. An understanding of the life cycle is important to successful completion of the project as it facilitates to understand the logical sequence of events in the continuum of progress from start to finish. Typical project consists of four phases-Conceptualization, Planning, Execution and Termination. Each phase is marked by one or more deliverables such as Concept note, Feasibility report, Implementation Plan, HRD plan, Resource allocation plan, Evaluation report etc.

Conceptualization Phase

Conception phase, starting with the seed of an idea, it covers identification of the product / service, Pre-feasibility, Feasibility studies and Appraisal and Approval. The project idea is conceptualized with initial considerations of all possible alternatives for achieving the project objectives. As the idea becomes established a proposal is developed setting out rationale, method, estimated costs, benefits and other details for appraisal of the stakeholders. After reaching a broad consensus on the proposal the feasibility dimensions are analyzed in detail.

Planning Phase

In this phase the project structure is planned based on project appraisal and approvals. Detailed plans for activity, finance, and resources are developed and integrated to the quality parameters. In the process, major tasks need to be performed in this phase are

- Identification of activities and their sequencing
- Time frame for execution
- Estimation and budgeting
- Staffing

A Detailed Project Report (DPR) specifying various aspects of the project is finalized to facilitate execution in this phase.

Execution Phase

This phase of the project witnesses the concentrated activity where the plans are put into operation. Each activity is monitored, controlled and coordinated to achieve project objectives. Important activities in this phase are

- Communicating with stakeholders
- Reviewing progress
- Monitoring cost and time
- Controlling quality
- Managing changes

Termination Phase

This phase marks the completion of the project wherein the agreed deliverables are installed and project is put in to operation with arrangements for follow-up and evaluation.

Life Cycle path

The life cycle of a project from start to completion follows either a "S" shaped path or a "J" shaped path (Figure 2 and 3). In "S" shape path the progress is slow at the starting and terminal phase and is fast in the implementation phase, for example, implementation of watershed project. At the beginning detailed sectoral planning and coordination among various implementing agencies etc, makes progress slow and similarly towards termination, creating institutional arrangement for transfer and maintenance of assets to the stakeholders progresses slowly

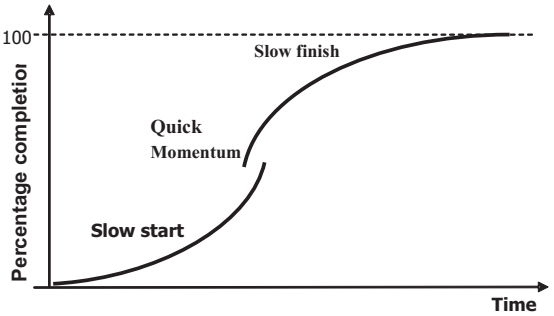

Figure 2. Project life path –"S" shape

In "J" type cycle path the progress in beginning is slow and as the time moves on the progress of the project improves at fast rate.Example, development of plantation.In this, the land preparation progresses slowly and as soon as the land is ready, transplantation of seedling is under taken. This is shown in figure 3.

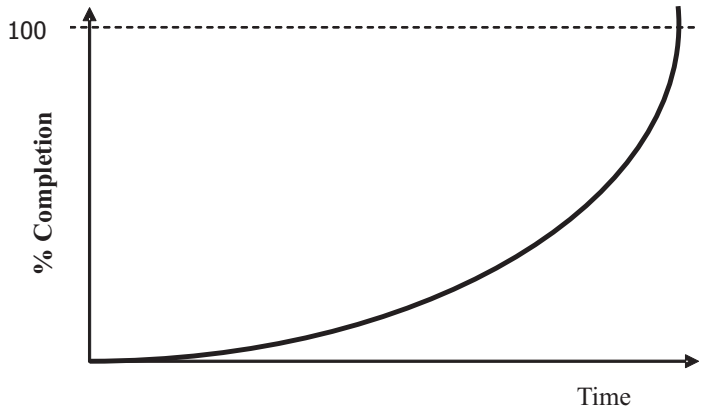

Figure 3. Project life cycle path - "J" Shape

Project Classification

There is no standard classification of the projects. However considering project goals, these can be classified into two broad groups, industrial and developmental. Each of these groups can be further classified, considering nature of work (repetitive, non-repetitive), completion time (long term, shot term etc), cost (large, small, etc.), level of risk (high, low, no-risk), mode of operation (build, build-operate-transfer etc).

Industrial projects also referred as commercial projects, which are undertaken to provide goods or services for meeting the growing needs of the customers and providing attractive returns to the investors/stake holders. Following the background, these projects are further grouped into two categories i.e., demand based and resource / supply based.The demand based projects are designed to satisfy the customers' felt as well the latent needs such as complex fertilizers, agro-processing infrastructure etc. The resource/ supply based projects are those which take advantage of the available resources like land, water, agricultural produce, raw material, minerals and even human resource.Projects triggered by successful R&D are also considered as supply based.Examples of resource based projects include food product units, metallurgical industries, oil refineries etc.Examples of projects based on human resource (skilled) availability include projects in IT sector, Clinical Research projects in bio services and others.

Development projects are undertaken to facilitate the promotion and acceleration of overall economic development. These projects act as catalysts for economic development providing a cascading effect. Development projects cover sectors like irrigation, agriculture, infrastructure health and education.

The essential differences between Industrial projects and Developmental project aresummarized in the following table 1.

Table 1. Difference between Industrial and Developmental Projects

Dimension	Industrial Project	Developmental Project
Scale of Project	Limited	Large
Promoters	Entrepreneurs or corporate	Government, Public Sectors, NGOs
Investment	---	High
Gestation Period	---	High
Profitability	High, Considered on IRR (Internal Rate of Return)	Modest, Considered on ERR (Economic Rate of Return)
Finance	Stringent debt equity norms	Operates on higher debt -equity norms
Source of fund	National stock markets and from domestic financial institutions	International organizations like World Bank, IMF,ADB,DFID and others mostly as loan,yet times providing for some grants
Interest rates and repayment period	Market rate and the repayment period is generally 7 to 10 years	Very low for borrowed funds and the repayment period extends up to 25 years and even beyond

Project Appraisal

The project appraisal is the process of critical examination and analysis of the proposal in totality. The appraisal goes beyond the analysis presented in the feasibility report. At this stage, if required compilation of additional information and further analysis of project dimensions are undertaken. At the end of the process an appraisal note is prepared for facilitating decision on the project implementation

The appraisal process generally concentrates on the following aspects

- Market Appraisal: Focusing on demand projections, adequacy of marketing infrastructure and competence of the key marketing personnel.
- Technical Appraisal: Covering product mix, Capacity, Process of manufacture engineering know-how and technical collaboration, Raw materials and consumables, Location and site, Building, Plant and equipments, Manpower requirements and Break-even point.
- Environmental Appraisal: Impact on land use and micro-environment, commitment of natural resources, and Government policy
- Financial Appraisal: Capital, rate of return, specifications, contingencies, cost projection, capacity utilization, and financing pattern
- Economic Appraisal: Considered as a supportive appraisal it reviews economic rate of return, effective rate of protection and domestic resource cost.

- Managerial Appraisal: Focuses on promoters, organization structure, managerial personnel, and HR management
- Social Cost Benefit Analysis (SCBA): Social Cost Benefit Analysis is a methodology for evaluating projects from the social point of view and focuses onsocial cost and benefits of a project. There often tend to differ from the costs incurred in monetary terms and benefits earned in monetary terms by the project. SCBA may be based on UNIDO method or the Little-Mirriles (L-M) approach. Under UNIDO method the net benefits of the project are considered in terms of economic (efficiency) prices also referred to as shadow prices. As per the L-M approach the outputs and inputs of a project are classified into, (1) traded goods and services, (2) Non traded goods and services; and (3) Labor. All over the world including India currently the focus is on Economic Rate of Return (ERR) based on SCBA assume importance in project formulation and investment decisions.

Project management

Project management is a distinct area of management that helps in handling projects. It has three key features to distinguish it from other forms of management and they include: a project manager, the project team and the project management system. The project management system comprises organization structure, information processing and decision-making and the procedures that facilitate integration of horizontal and vertical elements of the project organization. The project management system focuses on integrated planning and control.

Benefits of Project Management Approach

The rationale for following project management approach is as follows.

- Project management approach will help in handling complex, costly and risky assignments by providing interdisciplinary approach in handling the assignments.
- Project management approaches help in handling assignments in a specified time frame with definite start and completion points.
- Project management approaches provide task orientation to personnel in an Organization in handling assignments.

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Chapter - 20

Entrepreneurial Opportunities for Rural Youth in Livestock Sector

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Introduction

Livestock entrepreneurshipis associated to livestock (dairy, poultry, goat and pig) farming / business, production of raw materials related to livestock farms and livestock related processing industries. Livestock along with agriculture, continue to be an integral part of human life since the process of civilization started. These activities have contributed not only to the food basket and draught animal power but also by sustaining ecological balance. Livestock ownership also significantly impacts on farm productivity through provision of draft power and manure for fertilizer in crop production. It is a major form of investment and a source of livelihood for many farmers at times of drought, flood and other form of natural calamities. Livestock is also important in the social and cultural lives of millions of small-scale farmers as a symbol of wealth and for use in many ceremonies (Sansoucy et al., 1995).

India has vast resources of livestock and poultry, which play a vital role in improving the socio-economic conditions of rural masses. There are about 302.79 million bovines, 74.26 million sheep, 148.88 million goats, 9.06 million pigs and about 851.81 million poultry, as per 20th Livestock Census in the country. Presently, milk production of India is 198.4 million tons and per capita availability of milk is 407 grams / day which is increased by 5 percent from the last year (Economic Survey of India, 2019-20). Livestock play a significant role in generating lucrative employment and entrepreneurial opportunities in the rural sector, particularly among the landless, small and marginal farmers, women and rural youth, besides providing cheap and nutritious food to millions of people of the country.

Functions of Livestock Entrepreneurship

- Introduction of new product (Designer Egg, Crossbred cows, Hybrid fowls, etc.)
- Introduction of methods of production (Slated floor rearing of Goat, Integration in poultry farming, etc.).
- Developing new markets (Urban areas) and finding fresh source of raw materials (animal waste recycling), and Making changes.

Key Challenges in Livestock Sector

- Livestock farming is performed by poor farmers with limited resourcesthat are not likely to benefit directly from advanced technologies.
- Majority of livestock farmers/youth are merely at subsistence stage/level.
- Increasing family needs and demand: pressure on farmers to commercialize their farming operations due to declining land.
- Livestock farming as livelihood activity but does not run the enterprise as a business person.

Problems of Entrepreneurship Development:

- Absence of adequate knowledge, resources, technology and connectivity with the market.
- The concept of free service makes the farmers/youth reluctant to avail of paid services, offered by the local self-employed persons.

- The self-employed person needs regular back up services.
- Farmers/rural youth often hesitate in taking the risk of making heavy investments and adoption of modern technologies.

Critical Gaps in Improving Livestock Productivity

- Livestock production is mostly resource driven than demand driven
- Mindset of people to manage animals under low/negligible input system
- Huge non-descript livestock population exists
- Low genetic improvement in organized and unorganized rural herds
- Poor productivity of native/indigenous animals
- Inadequate availability of superior germplasm to the end users
- Inadequate feed and fodder supply to the livestock keepers
- Indiscriminate breeding of animals in field conditions
- Huge stray animal population exists
- Inadequate availability of vaccines, cold-chain andother health measures
- Unorganized marketing of animal products (Milk, meat, eggs and their by-products)
- Problems in diffusion and adoption of new livestock technologies because of weak forward and backward linkage

SWOT Analysis of the Indian Livestock Sector:

Strengths;

- Vast livestock population, with adaptability to wide range of agro-climatic conditions, is a vital asset for the country and offers scope for diversified animal agriculture.
- Good number of high-quality buffalo germplasm offers a unique strength to produce high market value products like mozzarella cheese.
- Abundant crop residues and common property resources ensure adequate availability of roughages for animals.
- Low cost of production compared to the most other parts of the world, strengthens the possibility of reaping the benefits of comparative advantage.
- Animal protein, especially milk, consumption is regular part of the diet of the people and hence there is presence of large market.
- Rapidly increasing number of processing plants, especially in dairy sector is expected to boost value addition on the livestock sector.
- Considerable number of educated youths/non-livestock-based companies and organizations venture into livestock, especially dairying, which is a strength to improve the quality of the produce.

Weaknesses:

- Though cross breeding programs have improved animal productivity, at least in cattle, generally the country is still largely dominated by low yielding non-descript animals.

- Lack of cold-chain and poor support infrastructure, e.g. roads and erratic power supply remain a major challenge for procurement and supply of good quality raw animal products.
- Inadequate knowledge and low adoption of scientific livestock farming and clean milk/meat production practices.
- Non maintenance of proper records by the farmers constrains the availability of comprehensive and reliable production data for proper planning.
- Investments in livestock research is not proportionate with returns and potential.

Opportunities:

- Purchasing power of the consumers is on the upswing with growing economy and continually increasing population of middle class.
- Expanding market will see creation of enormous job and self-employment opportunities.
- Demand for livestock products is income elastic.
- Continued rise in middle class population will see shift in the consumption pattern in favour of value-added products.
- Untapped potential of improved technologies in certain areas leaves ample scope for improving productivity.
- Mostly, marginal farmers and those who have quit farming are joining the livestock business.
- About 70 per cent of the livestock market in India is owned by 67 per cent of the small, marginal and landless farmers.
- Prosperity is now more dependent on per capita livestock ownership than on agricultural farms
- Global market for animal products is expanding fast, and there is an opportunity for India to improve its participation in global market.

Threats

- Excessive grazing pressure on marginal and small community lands has resulted in degradation of land.
- Indiscriminate crossbreeding for raising productivity could lead to disappearance of valuable indigenous breeds and germplasm.
- Entry of multinationals could result in a large portion of milk being diverted towards value added products which, though it argues well for the producers, is likely to affect the availability of liquid milk supply for mass consumption especially for the poor urban class.
- Export of quality feed ingredients, viz., cakes, molasses, etc. is making the domestic producers rely on low energy fodders.
- With intensive industrialization of livestock sector in response to market forces, the small producers will find it increasingly difficult to compete with the industrial sub-sector and thus risk losing a significant means of livelihood.

Entrepreneurship: good opportunity for rural youth:

Strengths of Rural Youth

- More educated than their elders
- More knowledgeable due to internet and electronic media

- Much more enterprising
- Looking for a change in lifestyle
- Willing to work hard
- Enthusiastic

Strategies to start a Livestock Enterprise

- Selecting the right enterprise/species/breed according to the area, weather and soil condition.
- Proper financial planning with cost and ROI (return on investment) calculations.
- Fixing the financial resources properly.
- Applying for the Government subsidy/grants.
- Ability in securing a credit/loan.
- Relevant skill, knowledge, and expertise.
- Using proper equipment and upgraded technology.
- Risk management ability.
- Proper marketing planning for livestock produce

Effective Approaches and Strategies to Create Entrepreneurial Opportunities for Rural Youth in Livestock Sector

The Indian livestock sector is constantly looking ahead and promises to take greater strides in making livestock production more remunerative to the farmer. There is a need of effective approaches for enhancing livestock productivity and entrepreneurial opportunities through livestock sector.

General Approaches & Strategies

- Helping farmers/rural youth to identify their production, processing & market related constraints through awareness, exposure visits, exchange of information withprogressive farmers, extension officers and other stakeholders.
- Continuous contact with farmers/rural youth shall be established to provide knowledge & information empower & facilitate them to demand & access services; redress their concerns & grievances; and capture ground reality for use in policy making & improving delivery through; Farmers portal, Kisan Call Centers, Common Service Centers, Short message services and Community radio stations etc.
- Promoting Farmer Producer's Organizations (FPOs), to facilitate the platform for value chain and ensures investment of various stake holders involved in animal husbandry sector to improve the production and profitability.
- Assisting farmers/rural youth to make best use of livestock technologies & support services through capacity building.
- Establishing linkages through information source on livestock produce, new technologies and market related information such as, demand, supply and prices.
- Building capacities and skills of the farmers/rural youth to empower them to adopt good practices of improving livestock produce.
- Full potential of KVKs shall be harnessed for the capacity building of farmers/rural youth of particular

district.

- Knowledge generators (public & private, formal & informal systems) should develop knowledge portals for capturing, collating and disseminating knowledge through all channels including print & electronic media, farm journals, regular meets etc. for the farmers/rural youth.
- Reaching out to and connecting farmers/rural youth and other stakeholders so that they communicate with each other.
- Test all indigenous technical know-how (ITKs), identify farmer innovators, recognize their skills and leverage for field extension as farmer consultants.
- Promotion of Livestock based Farmers Field Schools for the Livestock farmers/rural youth.
- Demand-Driven or Farmer-Led & Market-Led Extension Approach & Farmer to Farmer Extension.
- Introduction of ICT in delivery of extension messages and market information to the farmers/entrepreneurs.
- Establishment of proper Research-Extension-Farmer-Market-Linkage for the existing and emerging livestock entrepreneurs.
- A mechanism may be put in place to provide weekly/ daily personalized information (thru SMS/MMS) to the farmers through Veterinary Universities/ Departments of Animal Husbandry/ KVKs etc..
- A stakeholder directory of Institutions/ Agencies, Experts / Livestock Magazines/ Journals/ Newspapers / channels shall be prepared and linked on to Farmers Portal.
- A comprehensive Livestock-Knowledge Portal may be designed and developed to host information about the happenings/innovations in Livestock sector
- The e-procurement of inputs and services required by the livestock farmers may be promoted to give them negotiating power to get the livestock inputs at the most competitive rates without transaction costs.
- Path-breaking methods such as Kala Jathas, Extension Buses can be tried successfully to deliver the message effectively on a large scale.

Specific Approaches to Effective Transfer of Technology for Higher Livestock Productivity

Approaches/strategies at Input/production level

- Capacity building/awareness of farmers, extension functionaries, institutions and other stakeholders through a network of Knowledge Centers like; KVKs, Livestock Research Stations etc.
- Establishing milk cooperative societies for livestock farmers at village level
- Conducting skill-oriented & long term training programs (dairy farming, poultry farming, goat farming, pig farming, value addition of milk, meat & egg)
- Helping Entrepreneurship through Micro Financing
- Scheduling regular deworming & vaccination programs
- Establishment mobile livestock breeding and extension services for existing and emerging livestock entrepreneurs.
- Supply of good quality of livestock input services
- Provide specialized skill based training programmes on milk & meat products
- Promotion backyard poultry farming & goat farming for rural youth/ farmers

- Promotion Livestock based Self Help Groups (SHGs) or Farmers Interest Groups (FIGs)
- Promotion Livestock based Producers Organization/Producers company
- Approaches/strategies at processing level
- Provide capacity building/awareness programmes for the farmers (value addition of milk and meat products)
- Promote formation of livestock based Self Help Groups (SHGs)
- Provision of processing plant and cold storage facilities at field level
- Value addition to traditional milk products
- Establishment of custom hiring centers for the livestock farmers
- Promotion of on organized farm, dairy/ meat/egg market
- Approaches/strategies at marketing level
- Capacity building of the rural youth/ Farmers
- Promotion of Group/participatory approach for the rural youth/ Farmers
- Focus on Nutritional Value & Appeal to the Organic Market
- Introduce New or Unknown Products
- Promotion of livestock based innovative farmers association
- Promotion of species wise breeders' association for availability of good quality of germplasm to the end users at village level
- Rigid enforcement of quality control and hygiene requirements
- The technical skills and ability of the livestock entrepreneurs should be evaluated
- Extension Agencies and Farmers Organizations should give wider publicity
- Encourage the farmers/rural youthentrepreneurs by introducing various concessions and incentives.
- Networks of farmers/rural youth entrepreneurs may be established
- Promotion of direct marketing by establishing close interaction between producers and consumers
- Promote organized road side display models of milk and meat products for the existing and emerging livestock farmers/rural youthentrepreneurs.
- Development of various livestock-based ICT tools and applications for advertisement and marketing of milk & milk products, meat & meat products and egg & egg products for the livestock farmers/entrepreneurs.

Entrepreneurial Opportunities for Rural Youth in Livestock Sector

Livestock Sector Input Enterprises;

- Establishment of commercial dairy farming, pig farming, goat farming, poultry farming (layer/broiler), backyard poultry farming and integrated livestock farming units.
- Rearing of male buffalo calves for meat purpose.
- Establishment of commercial breeding units/farms (cattle, buffalo, goat, pig or poultry).
- Establishment of semen bank.

- Contract farming in poultry; A risk free venture for income generation
- Feed manufacturer and supplier
- Establishment of cattle/poultry feed unit
- Commercial feed and fodder manufacturer/supplier.
- Hydroponic fodder production unit.
- Growing fodder crops commercially round the year
- Commercial hay/silage preparation
- Establishment of area specific mineral mixture unit
- Commercial dry fodder enrichment unit (preparing urea-treated straw)
- Establishment of fodder seed bank.
- Throughout year green fodder production unit
- Livestock breeding farms
- Livestock first aid clinics
- Doorstep artificial insemination facilities by trained rural youth

Livestock Sector Output Enterprises;

- Milk and milk byproducts enterprises (Eg. Milk and milk products-based enterprises)
- Meat enterprises (Pig, poultry, goat, sheep meat and meat products-based enterprises)
- Leather enterprises (Leather products-based industries/enterprises)
- Egg enterprises (Egg and egg products-based enterprises)

Livestock Waste (Dung and Urine) Based Enterprises

For Agriculture

- Manure production (Cow dung, Goat Dung)
- Vermicompost production
- Cow dung paper production
- Bio powder
- Bio pesticides
- Cow urine/goumutra of native cows is used as manure for organic farming

For Poojan

- Panch-gavyaDiya
- Incense Sticks
- Samidha
- HawanSamagri

- Dhoop cones
- Cow dung Ganesh
- Hawan cups

Personal Care Products

- Panch-gavya soap
- After save
- Hair sampoo
- Face cream
- Liquid soap
- Tooth powder

For Household and Home Care Products

- Dung cakes/Upla
- Biogas production
- Electricity production
- Household fuel
- Phenyl
- Mosquito coil
- Vedic paints
- Utensil cleaner
- Cloth whitener
- Glass cleaner
- Toilet cleaner

Nutrition and Health

- Cow Ark
- GaumutraAsava
- Arjun herbal tea
- ChavanParash

Medicinal Products

- Ghanvati-Piles
- Skin Ointments
- Medhor-Obesity
- MadhumehChuran

- Nari Priyadarshini
- Rasamrita
- Pain Reliever Oil
- Pachanamrita
- Balm
- Massage Oil
- Netra Jyoti
- Nasal/Ear Drops
- Distilled cow urine (medicinal values and serves as detoxifier)

Epilogue:

There is a vast employment opportunity for the rural youth in livestock sector and there are various workinglivestock-based entrepreneurship models which includes;dairy farming, poultry (layer/broiler/backyard) farming, pig farming, goat farming, integrated farming system (IFS), value addition of milk/meat/egg based enterprises etc. and also,there are several successful innovative models existsfor linking farmers/rural youth to markets, but these are localized, which includes; contract farming, self-help groups, producer associations, farmer producer organizations, farmer field schools and public-private partnership etc. and needs replication taking into consideration the regional specificities. Apart from this, there is a need of regular capacity building programson management skills, professional competence and leadership skills to be provided to the rural youth.Prediction of the future demand, introduction of modern technologies, cost control and business expansion are the important areas, where entrepreneurs/rural youth need regular support and it is the need of hour to promote livestock-based enterprises in rural areas, as the local people/rural youth have the required skills.