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21 Days National Training Course (NTC)

On

Entrepreneurship Strategies in Agriculture, Horticulture, Animal Husbandry & Allied Sectors for Economic Development of India

Venue: By Virtual Mode (Zoom Video Conferencing App)

01- 21 December, 2021

Organized by

Directorate of Extension Education
Uttar Banga Krishi Vishwavidyalaya, Pundibari,
West Bengal, India
(www.ubkv.ac.in)

Agro Environmental Development
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Training Manual

Editors

Prabhat Kumar Pal
Chhatarpal Singh
Md. Nadeem Akhtar

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Editors

Prabhat Kumar Pal
Director of Extension Education, Uttar Banga Krishi Vishwavidyala, Pundibari, W.B., India

Chhatarpal Singh
President, AEDS, Majhra Ghat, Rampur, U.P., India

Md. Nadeem Akhtar
Scientist, BAU, Sabour, Bhagalpur, Bihar, India

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Uttar Banga Krishi Viswavidyalaya (UBKV)
Pundibari, Cooch Behar 736165, W.B. India
Dr. Swarup Kumar Chakrabarti
Vice-Chancellor-UBKV
Chief Patron-21 Days National Training Course

Message

It is a immense pleasure that Directorate of Extension Education, Uttar Banga Krishi Vishwavidyalaya, Pundibari, West Bengal, India is going to be organized 21 Days National Training Course on **"Entrepreneurship in Agriculture, Horticulture, Animal Husbandry & Allied Sectors for Economic Development of India"** along with Agro Environmental Development Society (AEDS), Rampur, Indiaduring December01- 21, 2021 via virtual mode.The idea to host the 21 Days National Training Course by Directorate of Extension Education 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, 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.

[Dr. Swarup Kumar Chakrabarti]

Uttar Banga Krishi Viswavidyalaya (UBKV)
Pundibari, Cooch Behar 736165, W.B. India
Prof. P. K. Pal
Director of Extension Education, UBKV
Organizing Chairman-21 Days National Training Course

Message

I am pleased to knowthat Directorate of Extension Education, Uttar Banga Krishi Vishwavidyalaya, Pundibari, West Bengal, India is organizing 21 Days National Training Course on **"Entrepreneurship in Agriculture, Horticulture, Animal Husbandry & Allied Sectors for Economic Development of India"** along with Agro Environmental Development Society (AEDS), Rampur, India during December01- 21, 2021 via virtual mode.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 to entire organizing team and other associates for kind support during the training course to make this event a grand success.

[Prof. P. K. Pal]

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)
(Registered Under the NitiAayog, Reg. No: UP/2020/0263654)

डॉ. छत्रपाल सिंह
Dr. Chhatarpal Singh
President, AEDS
Organizing Director, 21 Days National Training Course

Phone: 91-6394082801
E-Mail: cpsingh.2012@gmail.com
Website : www.aedsi.org

Message

I warm welcome to all the committee members, speakers and participants of 21 Days National Training Course on **"Entrepreneurship in Agriculture, Horticulture, Animal Husbandry & Allied Sectors for Economic Development of India"** is going to be organized by Directorate of Extension Education, Uttar Banga Krishi Vishwavidyalaya, Pundibari,West Bengal, India&Agro Environmental Development Society, Majhra Ghat, Rampur, Uttar Pradesh during December 01- 21, 2021*via* 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 as agriculture is the back bone 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 this 21 Days National Training Course on **"Entrepreneurship in Agriculture, Horticulture, Animal Husbandry & Allied Sectors for Economic Development of India"** will provide innovative ideas of entrepreneurship in the field of agriculture and allied sectors to all the participants.

I am again pleased to welcome you all to this 21 days training course and I wish a great success of this training.

[Dr. Chhatarpal Singh]

Agro Environmental Development Society (AEDS)
Majhra Ghat, Rampur-244922, Uttar Pradesh, India

Md. Nadeem Akhtar
Course Director-21 Days National Training Course
Scientist (Plant Pathology), BAU, Sabour, Bihar
Mobile No. : 8579934693/785603411
Email : nadeemgbuat@gmail.com

Message

It is a matter of great honor for me that Directorate of Extension Education, Uttar Banga Krishi Vishwavidyalaya, Pundibari,West Bengal, India &Agro Environmental Development Society, Rampur U.P., is organizing jointly 21 Days National Training Course on "**Entrepreneurship in Agriculture, Horticulture, Animal Husbandry & Allied Sectors for Economic Development of India**" by virtual mode during December 01- 21, 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 stake holders 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

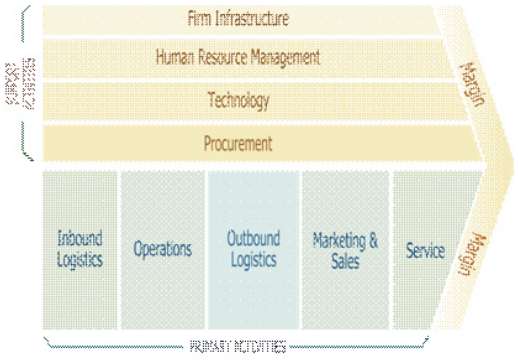
Horticultural Value Chain: Prospects, challenges and opportunities

Ankita Sahu*, Ipsita Kar[2] and Monika Patel[3]
*ICAR-Central Institute for Women in Agriculture- Bhubaneswar, Odisha
[2]All India Coordinated Rice Improvement Project, Odisha University of Agriculture and Technology, Chiplima, Odisha
[3]Department of Floriculture and Landscape Architecture, Horticulture College, Khuntpani, Birsa Agricultural University, Ranchi
*Corresponding author e-mail- sahuankita29@gmail.com

Horticulture is a lucrative sector in agriculture, contributing immensely towards agricultural growth and economic development. The sector encompasses broad spectrum of sub-sectors which supports several agro-based industries and provides livelihood to a substantial segment of the population. The sector possesses tremendous potential to contribute towards agricultural export, however, the quality of produce is often an arguable issue in global markets.The quantum of export of horticultural produce is meagre due to gap in fulfilling the global quality standards, excessive use of agro-chemicals and sometimes due to inadequate popularization of Indian produce at international platform. Hence enormous attention is required to be paid in enhancing the horticultural export through strengthening 'quality production'. The quality of horticultural produce can be strengthened through adoption of suitable Good Agricultural Practices and through value addition. The term value chain comprises a series of activities including arranging raw materials, production, distribution, processing, transportation and value addition. The value chain analysiscomprises of identification of possible involvements of activities and various players at each segment from input to output. It is not only the quality produce which ensures assured marketability, the certification of the product is also vital to ensure its sustenance in the market layout. The marketing of the produce needs to be ensured through suitable market linkages and further the export potential of the produce should also be ascertained. Hence, in order to sustain the horticultural production and consumption system, it is necessary to revolutionize the input-output dynamics by broadening several unnoticeable segments. Now-a days, the focus has drifted from quantity production to quality production, organic farming and branding of produce through suitable certification procedures to make the product more reliable for consumers' acceptability.Overall, value chain analysis will be fundamental in understanding the constraints at each level of the production, value addition and transportation. With diverse agro-climatic regions, a wide range of horticultural crops are produced commercially in India, however, different challenges are imposed which limits profitability of the sector and for which a streamlined bottom-up regional approach is to a great extent required for effective development of the sector.

Understanding the value chain system:

A value chain is a series of events that a specific firm in a sector operating in a specific industry accomplishes in order to deliver an optimal product (goods and/or service) to the end users. The idea was first used in business management and was first described by Michael Porter in his 1985 best-seller, Competitive Advantage: Creating and Sustaining Superior Performance. The Porter's value chain comprises of a set of activities categorized into primary activities and secondary activities. The primary activities encompass- Inbound logistics, Operations, Outbound logistics, Marketing and sales and Services. The components such as procurement, human resource management, technological development and infrastructure are categorized as secondary activities.



Primary activities

Inbound logistics in the primary activities comprises of sets of activities which are done prior to production which include gathering of all critical inputs, material handling, gathering an overview of the distribution layouts, constructing the primary infrastructures and other detailed organization for implementation of a complex operation. It deals with management of the flow of things between the point of origin and the point of consumption. The operation aspect of the fundamental or primary activities include management of designing and regulating the course of production and reforming business processes for the creation of products and services. As a part of primary activities in a value chain system, outbound logistics emphasises the demand angle of supply-demand dynamics. Storing of products, its movement and distribution in the market outlay including order placement, packing, shipping, delivery and customer service are some of the activities included in outbound logistics

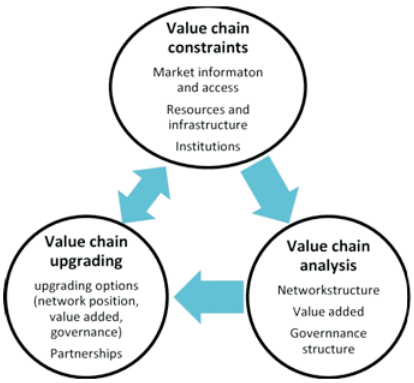
Marketing is the process of targeting a deliberate stimulation of demand for the acquisitions of goods and services, it involves selection of targeted costumers and a strategy to expand the customer niche through purposive selection of certain attributes or themes for advertisement in order to popularize the product. Packaging is another dimension of marketing in order to attract the buyers. An ideal packaging gives an aesthetic sense to the consumers. Now-a-days, packaging with some add-on-information, pertaining to nutrition information, procedure of use also fascinates the customers and provide a sense of reliability and integrity of the product. Other aspects of marketing includes selection of the terms of sale, such as price, discounts, warranty, and return policy, product placement, agreements with retailers, wholesale distributors and resellers.Sales are activities associated with selling of goods in a given targeted time period and customer service refers to the provision of service to customers before, duringand after a purchase.

Secondary activities

The infrastructure accomplishment includes laying out the physical logistics required for operation of the firm. As a part of human resource management, skill-upgradation, training and capacity building of the manpower involved in carrying out the operation is also a critical aspect in maintaining and enhancing the value of the commodity. Time to time update with latest technical know-how or any breakthrough innovation are also essential segment of value system.

Since Horticultural commodities are perishable in nature, the value chain management is highly intricate. It deals with value addition of fresh produce as well as post-harvest management and adding worth to it through endorsement of several processed products. Besides, a paramount of waste is generated from horticultural production and post-harvest operation, hence waste recycling and conversion into value added products are becoming business avenues for many agro-based and pharmaceutical industries.

The series of activities in value chain management starting from arranging inputs to final consumption requires a strong linkage between the stakeholders. Convergence between public and private organizations are also essential in supporting the small holders' value chain. In India, since a huge proportion of farmers are small and marginal, it is difficult to initiate commercial farming at individual level. A paramount emphasis is given in organizing Farmer Producers Organizations (FPOs) to support small farmers to initiate farming on a larger scale with ease in penetrating their produce in the market channels. Moreover, since horticultural crops are highly perishable in nature, the Govt. schemes and policies and financial benefits from banks in the form of easy loan availability, reduced rate of interest and the subsidy pattern of schemes, encourages the FPOs to set up cold storage facilities, godowns and refrigerated vans. The marketing is also sought through adequate market studies



Humble and Reneby, 2014

and market intelligence. The Govt. of India has also facilitated the e-marketing provision through National Agriculture Market or eNAM which is an online trading platform for agricultural commodities in India. The e-market facilitates farmers, traders and buyers with online trading of commodities. To assists entrepreneurs in developing their business and solving constraints associated with it, especially in the initial stages, Agri-incubation Centres are also opened in several places throughout the country, which provides the initial assistance in setting up the agri-business by providing an array of business and technical services, advisories, laboratory facilities, marketing network and linkages.

Analysing the operationalization, economic relevance and practical feasibility of value chain is highly crucial for ensuring the sustainability of the system. Hence to ascertain the viability of any value chain it is essential to understand the existing value chain and the associated constraints pertaining to logistics, technology, man power, sales etc. At the same time a next level planning in upgrading the value chain is critically essential for keeping in pace with future input availability and market demand.

Quality Certification of Horticultural crops

Quality management systems and contiguous quality assurance schemes gain some benefits associated with aspects of internal and external business in agriculture. Quality production is significantly important keeping in view environmental concerns and consumers' acceptability. The certification process adds value to the produce and enhance the product reliability and overall acceptance.

GAP certification:Good agricultural practice (GAP) is a certification system for agricultural products, specifying protocolsthat must be adhered to create food for consumers or further processing that is safe and wholesome, using sustainable system. The Food and Agricultural Organization of the United Nations (FAO) uses good agricultural practice as a collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economic, social and environmental sustainability.

Objectives of GAP

1. Ensuring safety and quality of produce in the food chain
2. Capturing new market advantages by modifying supply chain governance
3. Improving natural resources use, workers health and working conditions, creating new market opportunities for farmers and exporters in developing countries.

Key Elements of GAP:

1. Prevention of problems before they occur
2. Risk assessments
3. Commitment to food safety at all levels
4. Communication throughout the production chain
5. Mandatory employee education program at the operational level
6. Field and equipment sanitation
7. Integrated pest management
8. Verification through independent, third-party audits

Following modules for GAP requirements are adopted:

- Food Safety Module (FSM)
- Environmental Management Module (EMM)
- Produce Quality Module (PQM)
- Worker Health, Safety and Welfare Module (WHSM)
- General Requirement Module (GRM) (Legal issues, producer register, training of staff, audit)

APEDA (Agricultural & Processed Food Products Export Development Authority) is the national implementation structure for GAP in the country and India Good Agriculture Practices (INDGAP) Certification Scheme (Quality Council of India) takes care of Certification and accreditation for GAP.

Organic certification

Organic certification is a certification process for organic food and other organic agricultural products. Organic Certification permits a farm or processing unit to sell, labeland denote their products as organic. The organic brand provides consumers a sense of integrity and wholesomeness of the product. With increasing health concerns, the demand for organic food is increasing globally. The National Centre of organic farming facilitates the operation of organic management practices in agriculture through several schemes and projects such as 'National project on organic farming', 'Paramparagat Krishi Vikas Yojna' and 'Jaivik-Kheti-E-marketing'. The organic certification can be done by Indian and international certification agencies. In India for encouraging the organic farming and in facilitating the certification procedure of organic produce, a National Programme for Organic Production (NPOP) is implemented by APEDA (Agricultural and Processed Food Products Export Development Authority), Ministry of Commerce & Industries. The programme constitutes the accreditation of Certification Bodies, standards for organic production, promotion of organic farming and marketing etc. The NPOP standards for production and accreditation system have been recognized by European Commission and Switzerland for unprocessed plant products as

equivalent to their country standards. With these recognitions, Indian organic products duly certified by the accredited certification bodies of India are accepted by the importing countries. India Organic is a certification mark for organically produced food products produced in India. The certification is granted by testing centres accredited by the APEDAunder the National Program for Organic Production of the Government of India.Besides, FSSAI (Food Safety and Standards Authority of India) the food regulator in the country is also responsible for regulating organic food in the domestic market and imports. FSSAI had notified the existing certification system through Food Safety and Standards (Organic Foods) Regulations in 2017. Another organic certification procedure is the PGS-India certification (Participatory Guarantee System), which is a quality assuring initiative that is locally relevant, which emphasizes the participation of relevant stakeholders including producers and consumers and function outside the frame of third-party certification. It is a de-centralized organic farming certification system. The PGS-system of certification is of two types: PGS-India Green, for (products obtained from the agriculture fields under process of conversion) and PGS-India Organic (products obtained from the agriculture fields which are completely converted into organic). The PGS-India certifies producers based on active-participation of stakeholders and are built on a foundation of trust, social networks andknowledge exchange.

FSSAI Certification:

Food Safety and Standards Authority of India is an autonomous body established under the Ministry of Health and Family Welfare with an objective of ensuring food safety in India. The FSSAI Registration is the legal process for the Food Business Operators (FBOs) in India for getting the certificate in order to ascertain that the sold food item is safe for human consumption. The FSSAI registration is issued to food products to ensure public health, through a mechanism of regulation and supervision for food safety in India.

Types of FSSAI registration:

- Basic FSSAI Registration: It is for the business whose turnover does not exceed the limit of □12 lac per annum.
- State FSSAI License: This license is mandatory for the food business with annual turnover between □12 Lac - □20 Crore per annum
- Central FSSAI license: Central FSSAI license is mandatory for the food business whose annual turnover is above □20 Crore

Agri-export zones:

The concept of Agri Export Zone (AEZ) was introduced in 2001 Export and Import policy (EXIM Policy). It is quite evident that the export of agricultural produce from India is very meagre. Despite, India being the 2nd largest producer of fruits and vegetables worldwide, lack of quality production of horticultural commodities has rendered its share in global market quite insignificant, accounting for only 1.7 % of global trade in vegetables and 0.5 % in fruits. Hence, the need to augment the agricultural export resulted in formation of Agri-export zones. Presently there are more than 20 AEZs across 20 states. The AEZs aims at producing and sourcing the raw materials, their processing/packaging, leading to final exports. The convergence of existing central and state Government schemes facilitatesfinancial assistance required at various stages of value chain and partnership among various stakeholders results in economic and operationalsustenance.

Conclusion: The inclusion of quality enhancement while targeting the agricultural production is becoming pertinent, because it is not only the food security which is to be ensured, economic security is also becoming quite paramount in agriculture sector. Since a large proportion of population depend upon agriculture to derive the livelihood, it becomes significant to re-orient farming into agri-business, which could reward the farming community with financial benefits and economic profitability on a sustainable mode. Keeping the interest of rural youths in

agriculture abreast, it is quite pivotal to make agriculture profitable by adding value in the production and distribution system. With wide array of horticultural crops grown nationwide, it will be fascinating for agrarian population to adopt a single or a collective crop and strengthen its farming through value chain analysis. With changing time there is a need for appreciation in agriculture and allied activities, hence value chain analysis and implementation will be a key in addressing livelihood security and economic profitability for many farmers in rural and peri-urban areas.

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https://enam.gov.in/web/

Chapter - 2

Agriclinic and Agribusiness Centers for Rural Youth Employment

Dhiraj K. Singh[1] and Ujjwal Kumar[2]
[1]Scientist (Agril. Extension), Division of Socio-Economics & Extension, ICAR-RCER, Patna
[2]Head, Division of Socio-Economics & Extension, ICAR-RCER, Patna

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.

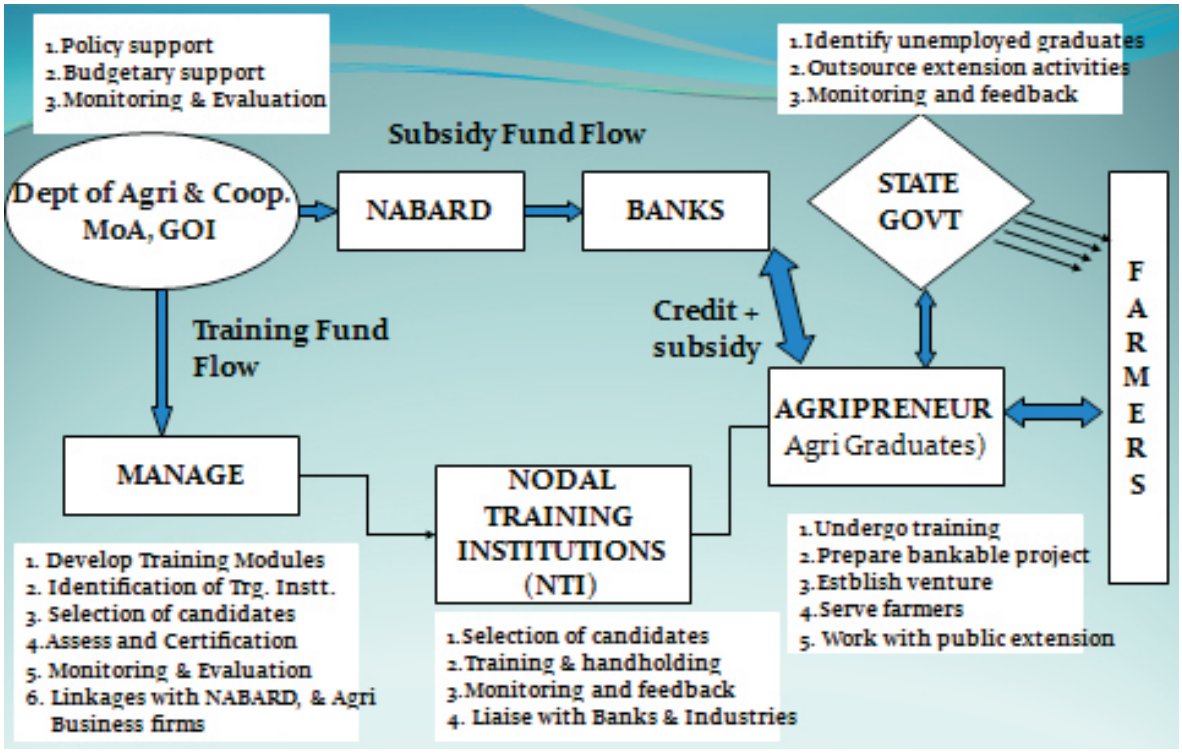


Fig.: AC & ABC Model with all stakeholders and their functions

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.

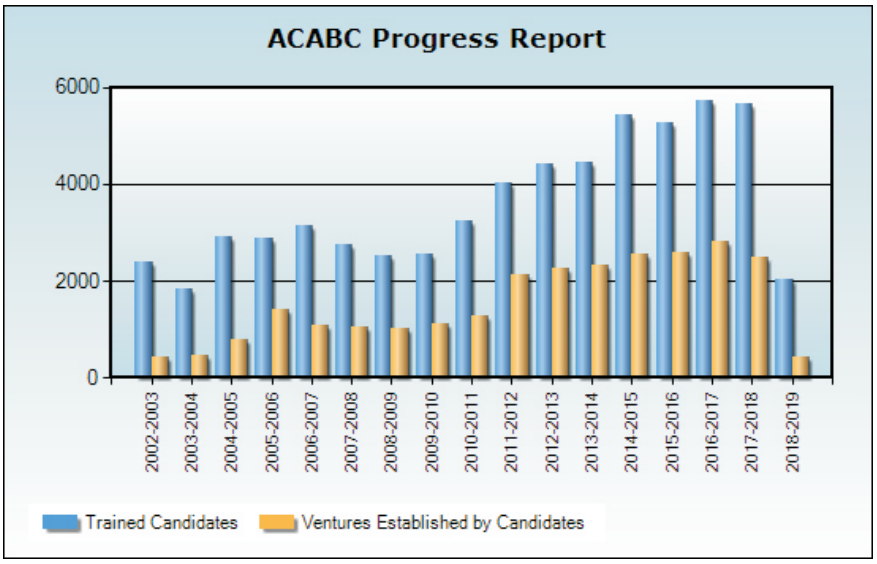
Table 1: State wise progress report till 29/09/2020

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 - 3

Application of MS Excelfor Agricultural Data Exploration

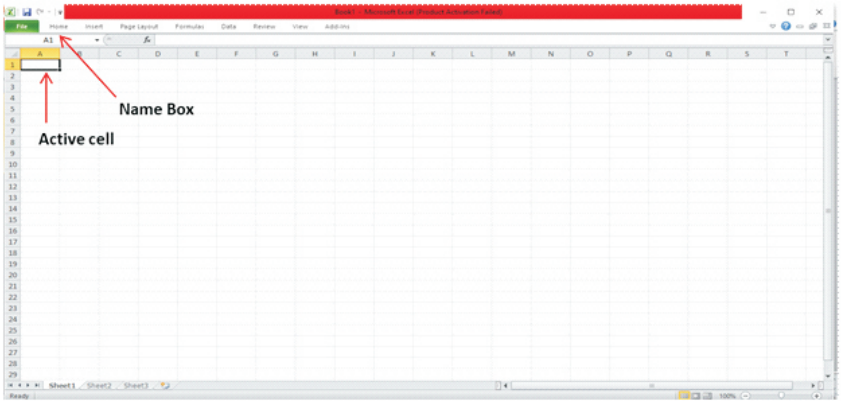
Rohan Kumar Raman[1], Anil Kumar Yadav[2], Abhay Kumar[1] and Ujjwal Kumar[1]
[1]ICAR Research Complex for Eastern Region, Patna-800014
[2]Central Inland Fisheries Research Institute, Regional Centre, Guwahati-781006
Email. : rohan4741@gmail.com

Introduction

Microsoft Excel is application software, available in Microsoft Office Suite,that's designed 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 labelled with 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. Excelalso has 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:



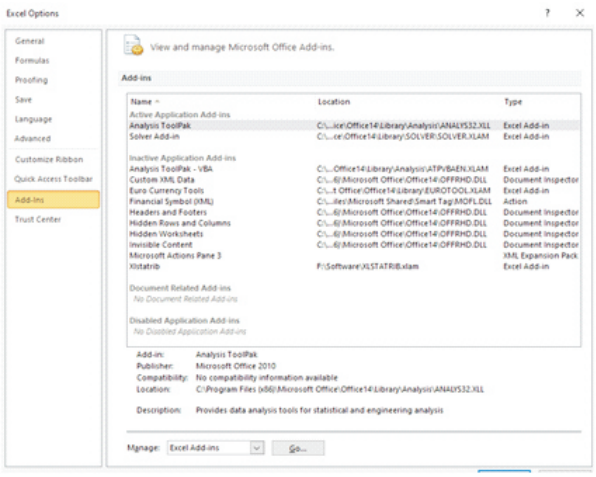
The user can enter data and formulae in the cell. The power of Excel is hidden in formulae. We can create a formula based on some values in the worksheet. We can then change any or all of these values. Excel automatically updates the results. We do not need to create new formula for new values. All formulae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

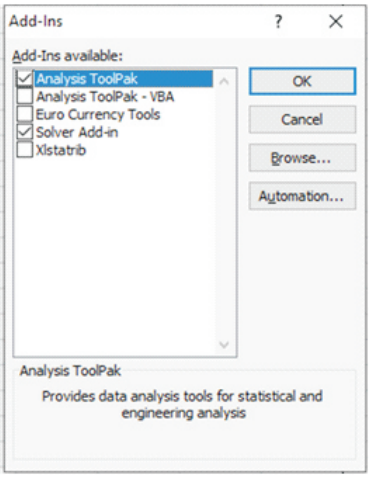
- All types of simple as well as complex arithmetic calculations
- Creating a wide variety of exciting charts/ graphs
- Allows importing data from a wide variety of sources
- Allows to use as a database program to collect and record data
- Creating macros in Excelto perform a tedious task
- Allows performing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



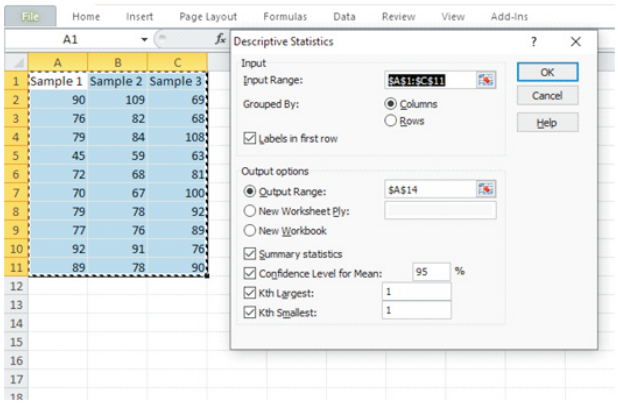


Descriptive Statistics

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.



Under Input, we tell Excel about the data to be analyzed. The Input Range is given by selecting data from A1:C11. Click on the Grouped by Column check box, if each column represents a sample/ variable. Sincethe row 1 includes the sample names,click the Labels in First Rowcheckbox.Further,we convey 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.

Descriptive Statistics	Sample 1	Sample 2	Sample 3
Mean	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.The procedure for carrying these tests of significance in Excelis described below.

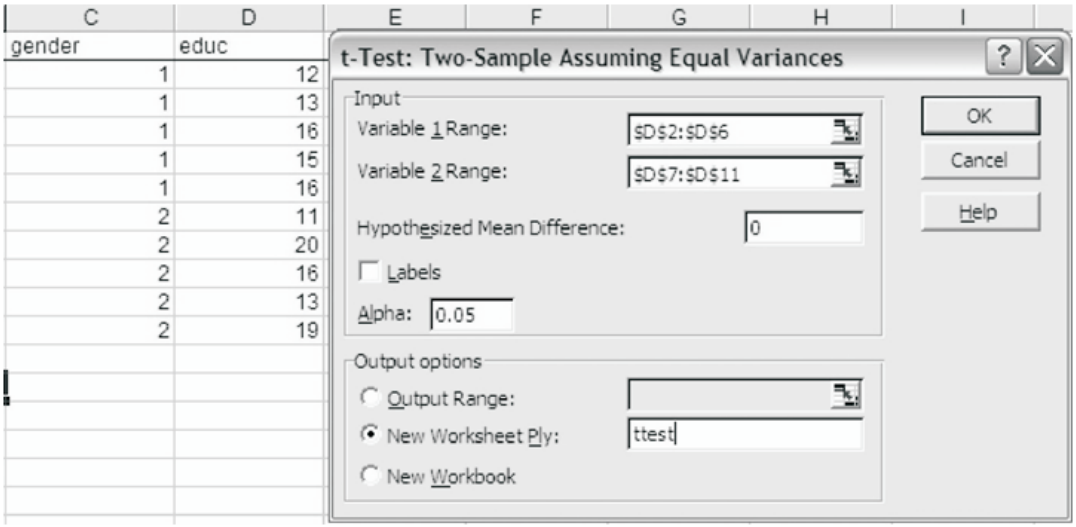
Two-Sample t-test: Assuming equal variances

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 labelled with 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 theboxfor Hypothesized Mean Difference.Here, we need notclick 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.Click OK.The Excel will produce result in the new worksheetnamed ttest:

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.

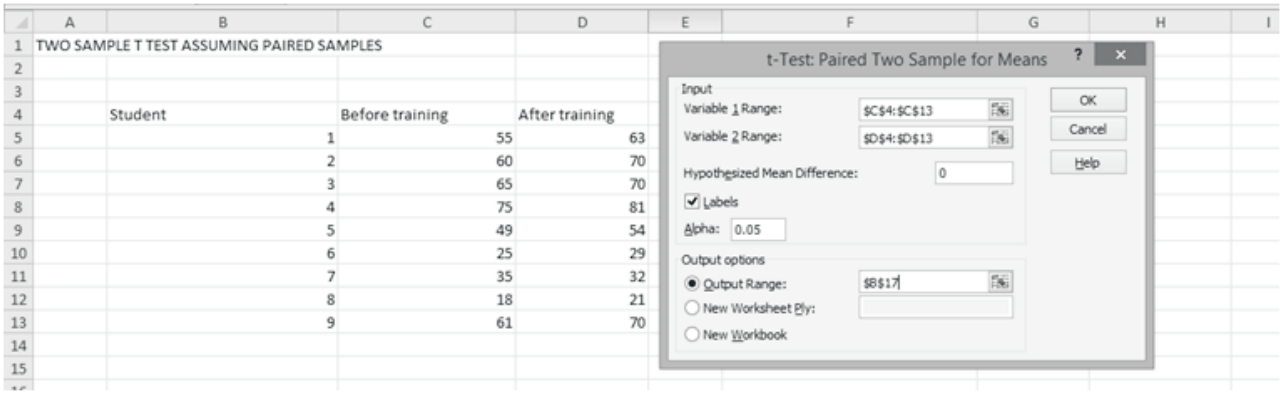
t-test: Paired two samples for means

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 for pairedt-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,we enter the Variable 2 Range by selecting the cells fromD4:D13. Under null hypothesis, enter '0' inthe box for Hypothesized Mean Difference.This indicates that the sample mean scores of participants before and after training are hypothesized to be equal. Click the Labelscheckbox,it conveys 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

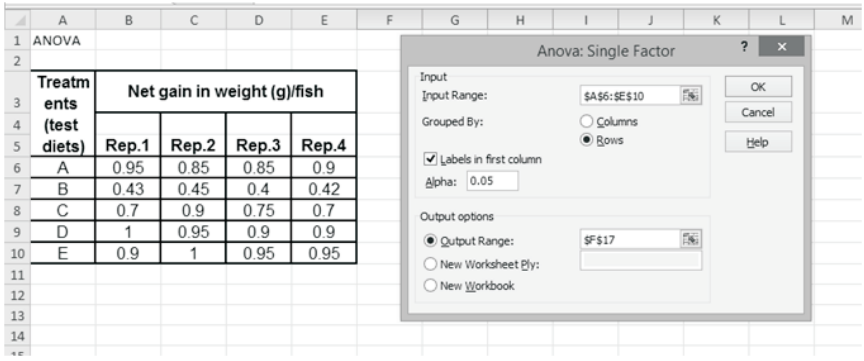
homogeneity of the experimental material is an important feature of CRD.Laboratory studies, pot culture experiments, animal feeding experiments, green house experiments, etc. are examples of CRD. The data for ANOVA: Single Factor (CRD) is entered in the Excel either in rows or columns in such a way that 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

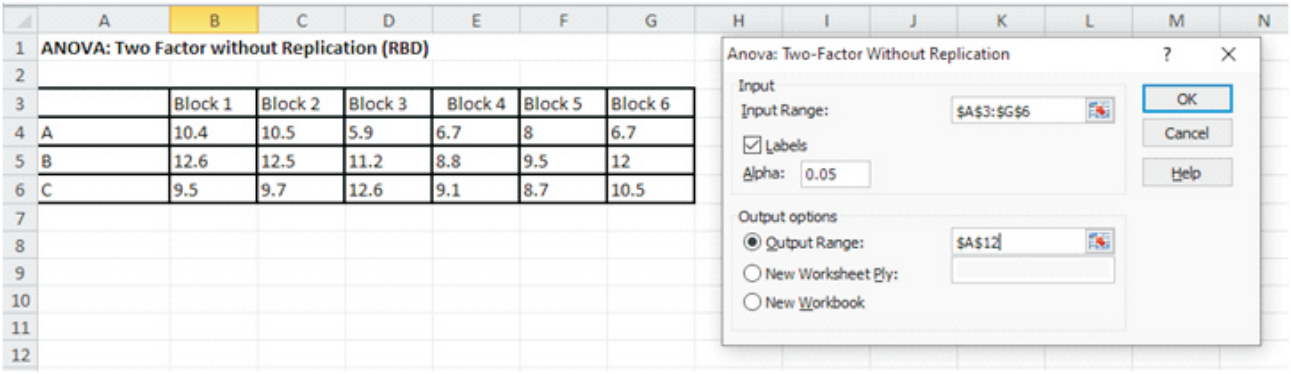
It is used for the analysis of two-way classification data with single observation per cell or the data generated from a complete randomized block design (RBD). Suppose there are 'v' treatments and each treatment is replicated 'r' times. Each treatment occurs once in each block. We need to prepare a 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.

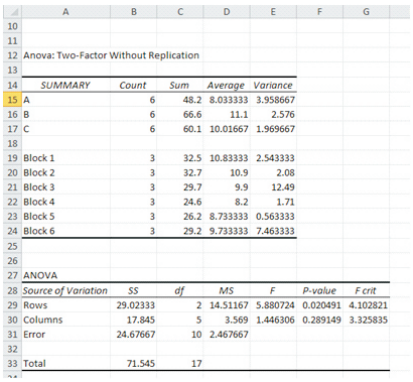
Alternative Hypothesis, H1: Atleast one of the treatment means differ significantly from others.

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



	A	B	C	D	E	F	G
1	ANOVA: Two Factor without Replication (RBD)						
2							
3		Block 1	Block 2	Block 3	Block 4	Block 5	Block 6
4	A	10.4	10.5	5.9	6.7	8	6.7
5	B	12.6	12.5	11.2	8.8	9.5	12
6	C	9.5	9.7	12.6	9.1	8.7	10.5

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.

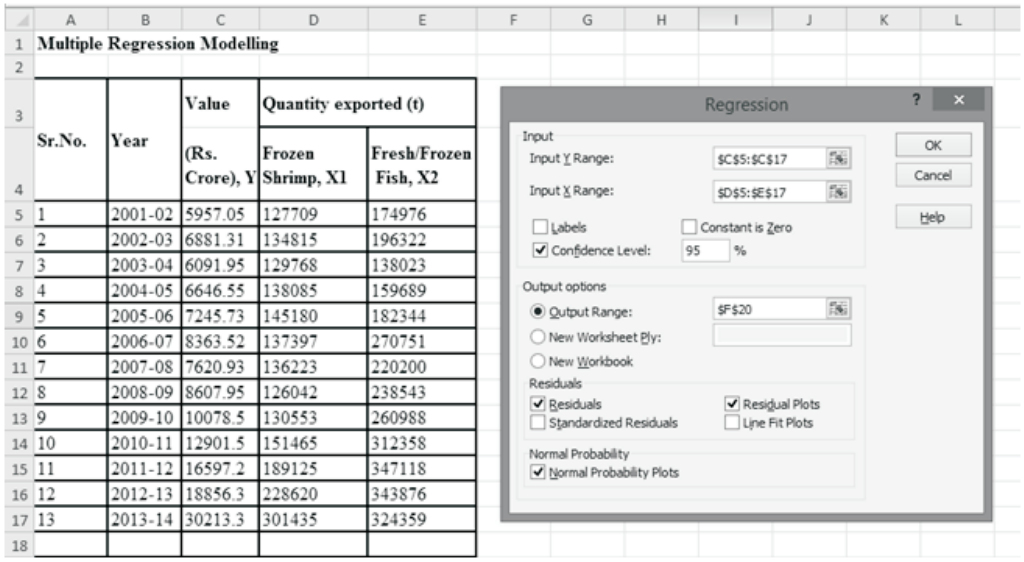
Regression Analysis

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.



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 Range box.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.Click theconfidence levelcheckbox(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.For solving 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)

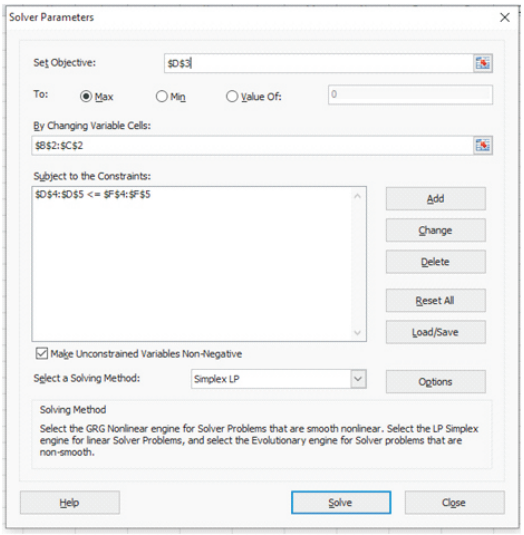
$20X + 25Y \leq 3300$ ……. Constraint for available labour-hours

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

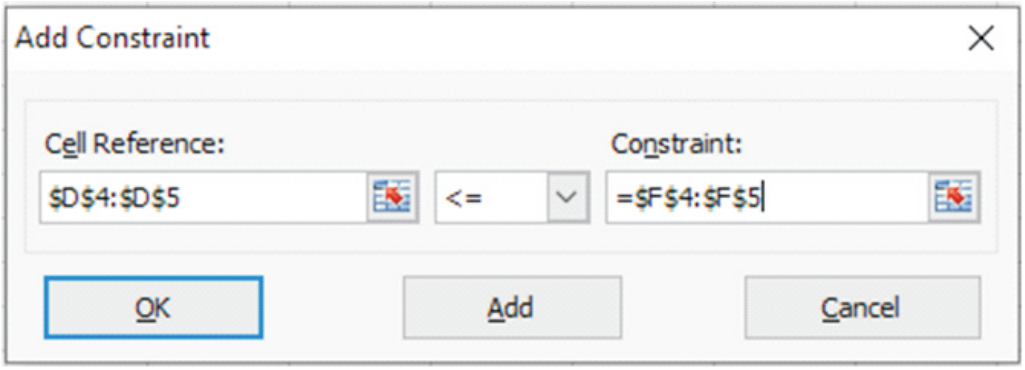
Enter the LPP in the Excel as given below. It is clear that the given LPP contains 2 decision variables (X and Y) and two constraints (Cost and labour-hours). The first row contains the labels of the variables. The second row is the “Changing variable cells” wherein the Solver will display the final values of each decision variable. The third row is objective function and contains the coefficient of variables in Objective function.Cells from B4:C5 refersto 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								

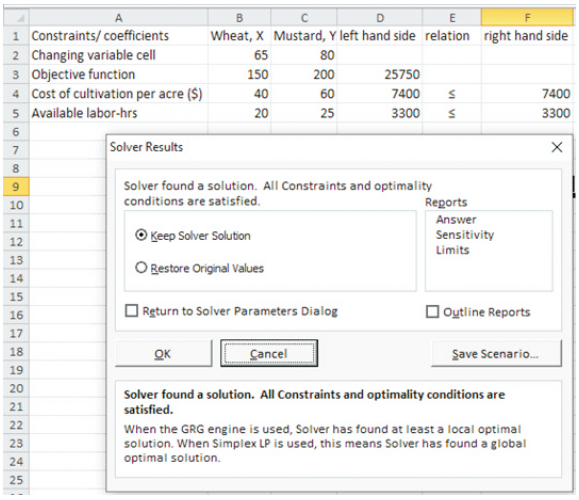
Click on Data → Solver.The Solver Parameters daialogue box shown below will open up. Here, weneed to enter all the necessary parameters for solving the given LPP.



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.



	A	B	C	D	E	F
1	Constraints/ coefficients	Wheat, X	Mustard, Y	left hand side	relation	right hand side
2	Changing variable cell	65	80			
3	Objective function	150	200	25750		
4	Cost of cultivation per acre ($)	40	60	7400	≤	7400
5	Available labor-hrs	20	25	3300	≤	3300

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 rearrangethe data 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.This makes Excel inconvenient in doingsame analysis on several columns.
- There no log or record of analyses performed in the Excel.
- Further, it lacks variousessential features 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.

Reference:

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Microsoft Excel 2010.

Chapter - 4

Livestock: A Game Changer in Agricultural Farming Practices

Avijit Haldar
Principal Scientist, ICAR- Agricultural Technology Application Research Institute (ATARI),
Bhumi Vihar Complex, Block- GB, Sector- III, Salt Lake, Kolkata- 700097
West Bengal, India

Introduction

India has an agrarian economy with half of its labor market representing agriculture-related sectors and more than 54 percent of the nation's land categorized as arable. India is the world's third largest economy after the US and China. India secured the top 10 list of agricultural produce exporters in 2019 with a sizeable share in the export of rice, cotton, soya beans and meat, according to a World Trade Organization (WTO) report in the past 25 years. India's production of food grains has been increasing every year. However, it is a matter of fact that over the past few decades, the manufacturing and services sectors have increasingly contributed to the growth of the economy, while the agriculture sector's contribution has decreased from more than 50% of gross domestic product (GDP) in the 1950s to 20% in 2020-2021 (at constant prices). According to the economic survey, the share of agriculture in GDP has reached almost 20% for the first time in last 17 years making a sole bright spot in performance during financial year 2020-2021 (Shagun, 2021).Modern farms and agriculture operations have been changed over the years primarily because of advancements in technology, including sensors, devices, machines, and information technology (USDA, 2021).

India is the world's largest producer of milk, pulses and jute. It is the second-largest producer of rice, wheat, sugarcane, cotton and groundnuts, as well as the second-largest fruit and vegetable producer. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops. Although India has attained self-sufficiency in food staples, the production is, resource intensive, cereal centric and regionally biased and the productivity of its farms is below that of Brazil, the United States, France and other nations. Indian wheat farms, for example, produce about a third of the wheat per hectare per year compared to farms in France. Rice productivity in India is less than half that of China. Other staples productivity in India is similarly low. Indian total factor productivity growth remains below 2% per annum; in contrast, China's total factor productivity growth is about 6% per annum, even though China also has smallholding farmers.

Key issues affecting agricultural productivity in India include the decreasing sizes of agricultural land holdings, continued dependence on the monsoon, inadequate access to irrigation, imbalanced use of soil nutrients resulting in loss of fertility of soil, uneven access to modern technology in different parts of the country, lack of access to formal agricultural credit, limited procurement of food grains by government agencies, and failure to provide remunerative prices to farmers.

During last five decades, agricultural research and extension have focused on the development of higher productivity of crop varieties and animal breeds, better farm implements and machinery, increased fertilizer use and other production technologies which enabled the farmers to grow more food, but at the same time it over exploited the resources and resulted in decreasing farm productivity and profitability. Interestingly, the livestock sector is growing at an appreciable and sustainable rate and is ahead among all sub-sectors of agriculture. It is remarkable to mention that the Indian livestock sector has never attained a negative growth in any of the years during the span of past 35 years. Thus, the livestock sector is likely to

emerge as an engine of growth of agricultural sector and can be relied upon for risk mitigation and loss minimization for the farmers in case of even worst outcomes from other sub-sectors.

The global livestock sector contributes to the livelihoods of around one billion of the poorest people in the world (Hurst et al., 2005). About 90% of them are found in Asia and sub-Saharan Africa. It is also the fact that about two-thirds of the rural people in developing countries are smallholder farmers having agricultural lands smaller than 2 hectares (Lowder et al., 2014). In the world, the smallholder farmers represent the largest proportion of 570 million farms (Lowder et al., 2016). India is a land of smallholder farmers, constituting more than 85% of the country's farmers (Agricultural Census, 2015- 16). Nearly 98% of the farmers in China and 90% of the farmers in Ethiopia and Egypt and 50% of the farmers in Mexico are smallholders (Rapsomanikis, 2015). In the world scenario, the smallholder farmers produce and supply a considerable quantity of food to the global population. Hence, it is need of the hour to find proper policies and strategies that will help to accomplish greater productivity and return in smallholder farming.

Livestock as game changer

The acquisition of livestock in developing countries is widely recognized as a pathway out of poverty, a major income generating activity, a financial instrument, and a means of income diversification (Otte and Upton, 2005). Livestock act as a crucial food resource in the case of crop failures (IFAD, 2007; Kabubo-Mariara, 2009), especially in low-income areas and marginal habitats that are unsuitable for crop production. The livestock sector is being considered as one of the promising sectors for enhancing farmers' incomes, especially in the less- developed regions. Hence, there is renewed interest in reintegrating crops and livestock because of concerns about natural resource degradation, loss of diversity within agricultural systems, environmental protection, the profitability and stability of farm income and long-term sustainability. Livestock husbandry on grassland systems contributes to the conservation of rangeland eco-systems and the promotion of the use of land-preserving forages (Janzen, 2011). Livestock also have the ability to recycle nutrients (Röös et al., 2017). Integrated systems inherently would utilize animal manure, which enhances soil fertility, and C sequestration. Integrated crop- livestock systems could foster diverse cropping systems, including the use of perennial and legume forages to achieve multiple environmental benefits (Russelle et al., 2007), as well as, food security to meet the needs of massive surges in the human population (Jabareen, 2013).Organic agriculture is again a growing sector in India. India has 6,50,000 organic producers, which is more than any other country (Paull and Hennig, 2016). Thus, it requires the growth of animal husbandry in India.Livestock sector in India has strong backward and forward linkages and promote many industries like livestock-based food processing and leather industries (Kumar et al., 2007).

Today, not only does the White Revolution's contribution to farm incomes surpass that of the Green Revolution, but every fifth rupee generated in the farm sector- which includes the total output value of crops livestock produce and fisheries- comes from milk.Milk not only surpasses the total value of foodgrains (cereals plus pulses), but also stands way above the crop value of paddy or wheat.Milk has become India's No. 1 farm crop by value.India contributes 20% of world milk production equals to 28 European countries. Milk provides the largest value-added products like pasteurised milk, milk powder, baby food, condensed milk, yoghurt, ice-cream, cheese, curd, paneer, khoa etc. Milk production growth rate in India is 4.5%, while an average milk production growth rate in world is only 1.8%. The growth of Indian dairy sector mainly depends on two factors. First, the consumption of milk has been increased tremendously. Till the 70s, per capita consumption was 110 gram per person per day and presently it is 360 gram which is expected to be

800 gram per person per day in another 50 years. Secondly, a shifting of people from unorganized to organized sector like co-operatives/ FPCs/ FPOs has been taken place. Dairy co-operatives, which was first started in Gujarat and spread throughout the country with the Operation Flood programme, are the largest player in the organized segment of the value chain. The Amul in Gujarat, with a single marketing cooperative, is India's largest food brand and self-sustaining industry and its largest rural employment provider. Successful implementation of the Amul model has made the road map to establish other milk marketing cooperatives, such as Nandini in Karnataka, Verka in Punjab, Saras in Rajasthan etc.which are playing a significant role in production, marketing and processing of milk and dairy products (Cunningham, 2009).

Goats and sheep play significant role in food and nutritional security of the rural poor. Goat rearing has distinct economic and managerial advantages over other livestock species because of its less initial investment, low input requirement, higher reproductive rate, early sexual maturity, and ease in marketing (Kumar et al., 2010). Poultry is one of the fastest growing segments in the livestock sector. This industry has grown largely due to initiative of private enterprise, huge indigenous poultry genetic resources, and considerable support from complementary veterinary health, poultry feed, poultry equipment and poultry processing sectors (Priya et al., 2015). A significant feature of India's poultry industry has been its transformation from a mere backyard activity into a major commercial activity in just about four decades, this transformation has involved the sizeable investments in breeding, hatching rearing and processing. Contract farming in poultry has emerged in big way for taking the poultry farming down to the path of industrial farming (Birthal, 2008).

Nutritious food availability is continuously rising with the increase of the world population. The farmers are also responding to signals from consumers who are increasingly demanding food richer in proteins and nutrients like milk, egg, fish, meat,fruits and vegetables.Meat, milk and eggs provide proteins with a wide range of amino acids that match human needs, as well as many bio-available micro-nutrients such as iron, zinc, vitamin A, vitamin B12 and calcium, for which many malnourished people are deficient (Górska-Warsewicz et al., 2018). Livestock has already taken immense role in nutritional security. Considering the nutritional importance of such high value products, the dietary patterns have changed overtime in India and world as a whole. The global market for animal based foods has been expanding rapidly (Birthal and Taneja, 2006), livestock trade has an important economic activity in present days. The demand of nutritious foods has already been increased for enhancing immunity during the pandemic situation of Covid-19.The use of E-Commerce has also expanded dramatically. Since the COVID-19 pandemic in 2020, Indian customers turned to E-Commerce platforms to get food supplies through Swiggy, Zomato etc due to lockdown restrictions and social distancing norms. The sector is expected to grow rapidly over the next few years, due to expanding internet connectivity and rising consumer demand for convenience, value, safety/hygiene, ease of payment, and product variety. In many developing countries, a shift from a predominantly vegetable-based diet to a greater amount of livestock source food and other animal products has already been seen over the last few decades. The demand of livestock products is expected to increase by 62% for milk and by 77% for meat by the year 2050 as compared to 2005-07 and the global livestock production needs to be doubled by 2050 from the present levels (Alexandratos and Bruinsma, 2012). The average per capita meat consumption is projected to rise from approximately 34 kg in 2015 to 49 kg in 2050 (Yawson et al., 2017). Based on household data of various rounds of national sample survey (NSS), Kumar (2016) projected the demand and supply of major food commodities in India by 2020 and 2030. The study indicated that the consumption pattern is changing towards high value commodities

including livestock. A recent study by NITI Ayog reported that demand for liquid milk for household consumption is projected to reach 78 million kilolitres in 2021-22 and 90 million kilolitres by 2032-33, further the aggregate demand for milk will touch 220 million kilolitres in 2032-33; while demand for eggs, fish and meat will be 25 million tonnes (NITI, 2018). To meet this growing demand, it is required to produce more products from livestock. Under rapid urbanization dynamics, livestock production is inevitably playing an instrumental role in achieving sustainable food security in developing countries (Godber and Wall, 2014). India thus needs to improve its management of agricultural practices on multiple fronts. Diversification of agricultural livelihoods through agri-allied sectors such as animal husbandry and fisheries has enhanced livelihood opportunities and strengthened resilience that could be justified through few case studies.

Case Studies

Case Study 1: Shri. Bapi Shaikh is a young farmer of village Mirjapur, Post Office- Nandai, Block-Kalna-I of District- Burdwan in West Bengal, India. He has total of 5.0 acres of land which he used to cultivate jute in 3.0 acres of land and rest of the land for paddy cultivation. But proposition of jute and paddy cultivation, was gradually becoming cost-ineffective due to high labour requirement, low market price and non-availability of suitable retting water etc. Bapi had a lack of irrigation facility in his 5.0 acre of land. He had to bring water from some distance for irrigating the crops which was becoming rather laborious and costly proposition. Encouraged by success of pond-based integrated farming system (IFS) and aided by Krishi Vigyan Kendra (KVK) of Burdwan, he converted 0.66 acre of his land into a pond. Having had training from KVK Burdwan, he started using the pond for multitier carp culture prior to retting and air breathing fish culture in the post retting period. Bapi introduced ducks along with fish culture for integration in the pond. He planted various fruit plants like mango, guava and banana in bund area of the pond, while he used the pond water to irrigate crops in the adjoining bund area. He diminished the area under paddy and diversified it towards cultivating various other crops like kharif onion, brinjal, early cauliflower, coriander, radish, cucurbits etc that has helped him to fetch good amount of additional income. Bapi purchased two dairy cows for milk production purpose. He constructed one vermicompost unit besides havingbackyard poultry birds for meat and eggs. As a result, his total income was doubled during 2015-16 to the tune of Rs. 3.6 lakhs/annum from a mere Rs. 1.7 lakhs/annum prior 2013.As recognition for his expertise in various niche areas of agriculture, he was awarded the Best Farmerby Ministry of Agriculture and Farmers Welfare, Govt. of India in 2017. For his expertise, he was being regularly hired by the State Agriculture Department and KVK for farmers training at various locations. He also inspired 60 progressive farmers/rural youths to follow his cue for sustainable and profitable farm management.

Case Study 2: Sri. Danbhushan Lakra, 43 years old, hails from a tribal dominated village, Mardanpur, Post Office- Ar of District- Chatra in Jharkhand, India. Rainfed agriculture is common in this area. Rice, maize and redgram are the important crops of Kharif and in some areas farmers grow wheat and mustard in rabi season where water body is available. Sri. Danbhushan Lakra used to cultivate rice, wheat, maize and redgram in his 5.0 acre farm and earn around Rs. 67,000/- per annum. Once Sri. Danbhushan Lakra got training from KVK, Chatra and came to know about IFS, he first converted 0.5 acre of his land into a pond for fish production and irrigation purposes. He developed a unique model of IFS and designed a layout of IFS in such a way that the area under field crops is 2.0 acre, fruit plants 1.0 acre, vegetables 1.0 acre, piggery 0.5 acre, diary 0.25 acre, poultry 0.25 acre and pond 0.5 acre.He used cow dung for vermicomposting which increased crop production by 40% and in pond for filter feeding of omnivorous fishes such as silver carp, catla etc.He also adopted the best practices of farming i.e. drip and sprinkler

irrigation, plastic mulching, reducing chemical fertilizers by using vermicompost, cow urine, biogas slurry application, azolla cultivation and use of bio-pesticides etc. After adoption of IFS and introduction of livestock at his farm, Sri. Lakra could able to augment his income by 5 times and started to earn Rs. 3,40,000/- per annum. He also employed 5 persons at his farm. Sri. Lakra set an example of developing a livestock based IFS in rainfed area for enhancing income.

Livestock sector in Indian agriculture: Unrecognized or unnoticed

Wherever global populations and their incomes have increased, per capita consumption of animal origin food has also augmented. Though livestock sector has already been emerged as a big player in agricultural farming and business, there are some reasons that highlight why livestock sector has gone relatively unrecognized or unnoticed in Indian agriculture:

As livestock produces like milk, meat, eggs etc are harvested not from the fields, but from animals, these lose the ability to be seen as "crop".

Unlike paddy, wheat or sugarcane, livestock produces like milk and eggs are marketed not in quintals, but in litres or numbers, respectively.

The farmers sell milk, meat and eggs round the year, which is not the case with normal field crops.The harvesting and marketing of the field crops is a conspicuous one-time annual event which is celebrated through a harvest festival such as Makar Sankranti, Baisakhi, Magh Bihu, Thai Pongal, Uttarayana etc.

The policymakers have always viewed livestock farming as an activity "subsidiary" to regular agriculture. This may partly have to do with the animals mostly being fed on the by-products of agricultural crops: wheat and paddy straw, sugarcane tops, and the protein-rich cake left after extraction of oil from mustard, groundnut or cottonseed.

Conclusion

Vast livestock and poultry resources play a vital role in improving the socio-economic conditions of rural masses. Livestock development represents a promising opportunity to enhance farmers' income, especially in the less- developed regions (Saxena et al., 2017). The sector is also being considered to play promising role in the ambitious goal of the government to double the farmer's income by 2022 (Chand, 2017; Das and Kumar, 2017).The studies have highlighted the growing importance of livestock towards enhancing food and nutritional security, increasing agricultural growth, reducing rural poverty and mitigating farm households' vulnerability to shocks in production (Akter et al., 2008; Birthal and Negi, 2012). The studies have also reported that growth in livestock has greater potential to reduce poverty as compared to the similar growth in crop sector (Birthal and Taneja, 2006). Women also play important role in livestock management. It is important to identify and support women's role as livestock owners and processors and in promoting their economic and social empowerment along with strengthening their decision-making power and capabilities (IFAD, 2003). Livestock sector is unique in terms of providing employment and empowerment opportunities to women. Two-third of female workforce in rural India is engaged in livestock rearing (Kumar and Singh, 2008). Further, women being in control of asset and having role in household decision lead to an improvement not only in their own welfare but also in household food security along with child nutrition and education (World Bank, 2010; Quisumbing and Maluccio, 2003; Smith et al., 2003). Huge animal population with adaptability to wide range of agro-climatic conditions in

the country is a vital asset and provides scope for diversified agriculture. The State Governments in conjunction with research institutions have to play a major role in ensuring that livestock development programmes and services enable the poor livestock keepers to take full advantage of this opportunity. Specific priorities to foster investment on sustainable livestock development need to be listed for promoting livestock intensification amongst smallholders after addressing their concerns appropriately. The State Governments need to play a catalytic role in mainstreaming livestock development as an entry point for poverty reduction, especially in the disadvantaged regions. This need to be coupled with enhanced access to rural financial and marketing systems.

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Chapter - 5

Designing and Implementation of Effective Training Programmes in Krishi Vigyan Kendra

Pragya Bhadauria*, Y.S Jadoun[1] and Rajbir Singh*
*ICAR-Agricultural Technology Application Research Institute, Ludhiana, Punjab
[1]Guru Angad Dev Veterinary and Animal Sciences University, Punjab

Introduction

Agriculture is the back bone of Indian economy as about 70 percent population of the nation depends on it. Indian agriculture sector accounts for 18 per cent of India's gross domestic product (GDP) and provides employment to 50% of the countries workforce. The country is the world's largest producer of pulses, rice, wheat, spices and spice products. This spectacular growth in the sector is the result of innovativeness and progressiveness of our farmers who are engaged in farming at gross root level.Still majority of the Indian farmers are smallholder and marginal at a subsistence level using their traditional methods of farming. Moreover, the agricultural sector is under crisisdue to increasing challenges oferratic weather patterns, soil fertility, new resistant pests and diseases etc. In order to counter these challenges, smallholders need to change the way they farm. They should further enhance their knowledge and skills in order to increase their yields and the quality of their produce- particularly if they want to harness their maximum potential. Farmers require ongoing knowledge to stay aware of fast-moving developments in technology, science, business management, and an array of other skills and fields that affect agricultural operations. In addition lack of planning skills, financial management skills and understanding of the value of a business approach prevents smallholders from achieving their full potential productivity. All these alarming developments lead to one conclusion: farmers need to adapt their farming practices to the new circumstances. It is important to equip farmers with capacity to respond to the changing agricultural environment, through extension support, training on techniques and sharing of best practices through their capacity building. Capacity building can be defined as activities which strengthen the knowledge, abilities, skills and behaviour of individuals and improve institutional structures and processes such that the organization can efficiently meet its mission and goals in a sustainable way (Hilderbrand, 2008). Training is one of the essential components of capacity building. Training is a process of acquisition of new skills, attitudes and knowledge in the context of preparing for entry into a vocation or improving one's productivity in an organization or enterprise. Lynton and Pareek (1990) stated that training consists largely of well organized opportunities for participants to acquire necessary understanding and skill. Farmer training is directed towards improving their job efficiency in farming. The training should be based on principles of "learning by doing"' and "teaching by doing". The training prepares an individual to earn the living through accusation of specific skills of a profession, an occupation or a vocation. It should provide experience to the participants in the real- life situation either on the demonstration units or farmer's fields. Effective training requires a clear picture of how the trainees will need to use information after training in place of local practices what they have adopted before in their situation.

Need of Training

Many countries and communities have remained poor and still have weaknesses in their development projects as investment alone cannot lead to the desired level of development. Eade (2007) highlighted that the sad reality is that most development aid has least priority of building the capacities of “The Poor” to transform their societies. Therefore, improving the capacity building of individuals, groups, organizations and communities is necessary for rural development, poverty alleviation and environment

protection. Building the capacity of local people, groups and organizations is vital because they must have the ability and responsibility to resolve their problems and develop their communities. Many international studies indicate that smallholder and poorer farmers could make a major contribution to national economic growth if they received opportunities to become more productive (NAFES, 2005).Farmer training is an important tool widely utilized by development programs in developing countries (Birkhaeuser et al., 1991, Van den berg et al., 2007, Delia et al., 2008).The basis of development is strengthening people's capacity to determine their own goals. The focus has been on encouraging participation and giving opportunities tothe needy peopleto incorporate the latest scientific advances and technology tools into their daily operations. Along with men, women also play an important role in contributing to all activities in rural development, particularly in agriculture areas such as livestock production, fisheries, cropping, forestry, irrigation and horticulture. Farm women are faced with several challenges and lack technical knowledge and skills to produce their products (e.g. technical skills in harvesting or value adding).Women must also be empowered by enhancing their awareness, knowledge; skills and technology use efficiency, thereby, facilitating overall development of the society.

Role of Krishi Vigyan Kendrain Imparting Training

The Indian Council of Agricultural Research (ICAR) has established Krishi Vigyan Kendras (KVKs)all over the country as an institutional innovation forapplication of agricultural science and technology onthe farmer's field with the help of a multi-disciplinaryteam of scientists. The KVKsare playing strategic role in technology backstopping,knowledge management, capacity building and advisory to the differentstakeholders like farmers, farm-women, rural youths andextension personnel. KVK scientists, as mandatory has to communicate the research findings, new innovations and technologies to the farmers and needy people (Venkatasubramanian et al, 2009b). It involves conducting On Farm Trials and Front Line Demonstrations of the new technologies as well as training the technology users for providing with required knowledge and skills for adopting the recommended technologies. Training is an essential component of KVK mandates for successful dissemination and adoption of latest agricultural technologies in a social system particularly among farming communities. Therefore, farmer's training isan education that most often takes place outside the formal learning institutions. It differs from education in schools because it is geared towards adult learning. It is directed towards improving their job efficiency in farming. The KVKs organized following types of trainings (Venkatasubramanian et al, 2009a) based on the clientele:

1. Training for farmers (On and Off Campus)
2. Training for rural youth (On and Off Campus)
3. Training for extension personnel (On and Off Campus)
4. Sponsored training programmes (On and Off Campus) - For farmers, rural youth and extension personnel
5. Vocational training programmes (On and Off Campus) - For farmers and rural youth
6. Skill development trainings

Based on duration, the KVK trainings can be classified to:

1. Short duration trainings (1-7 days)
2. Medium duration trainings (8-14 days) and

3. Long duration trainings (3-4 weeks)

Steps Involved in Conducting Training Programme

Training is a circular process that begins with needs identification and after a number of steps ends with evaluation of the training activity. A change or deficiency in any step of the training process affects the whole system. Effective training requires a clear picture of how the trainees will need to use information after training in place of local practices what they have adopted before in their situation. Caffarela (2002) noted that a systematic process of farmers training must include; needs assessment, goal and objectives setting, organizing instructional methods and techniques, monitoring and evaluation.

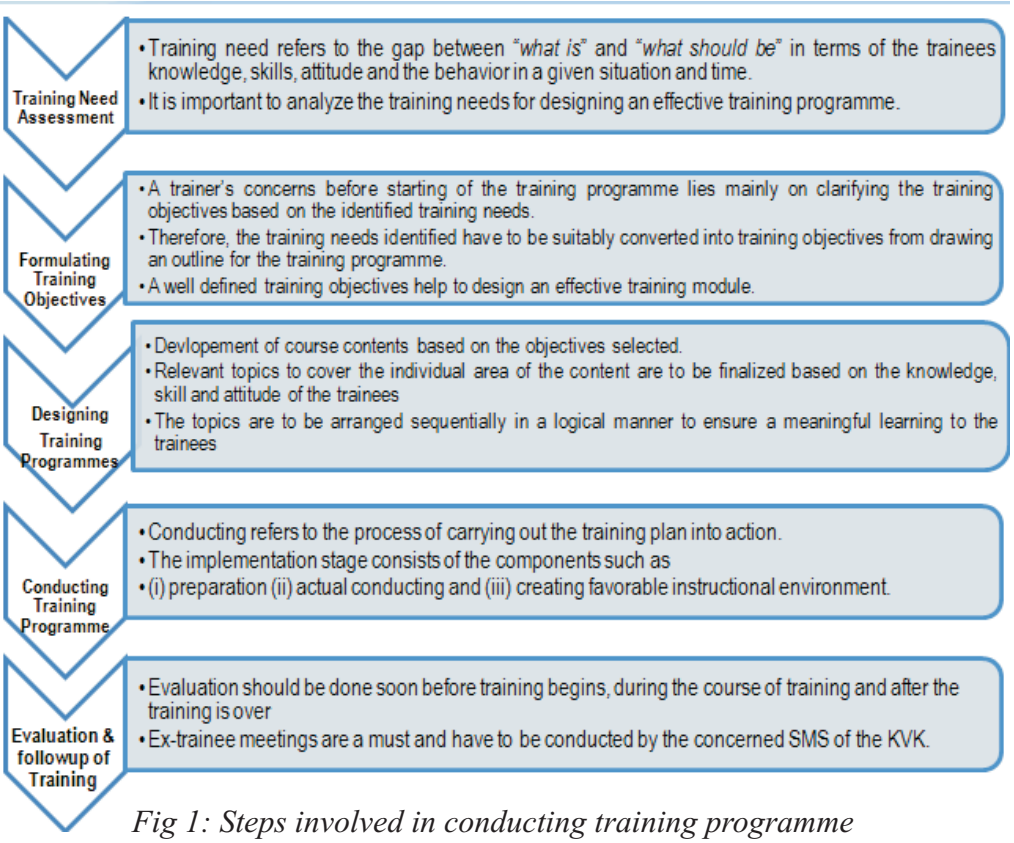

Fig 1: Steps involved in conducting training programme

Training Need Assessment

The training can be more valuable and significant when analysis of training needs prior to beginning of training programme is carried out. Training need refers to the gap between "what is" and "what should be" in terms of the trainees knowledge, skill, attitude and the behaviour in a given situation and time. It is important to analyze the training needs for designing an effective training programme as the programme must address the training needs of the trainees. As systematic procedure for planning and implementation of training programme, KVKs in general starts with identification of training needs of farmers/farm woman/ rural youth/extension personnel, and hence becomes the most important step in any training programme. Training need is the expressed level of training needed by therespondent in each of the training areas. It can

be assessed by various methods, although the most frequently used is survey method to know the individual perception and opinion of the individuals for whom the training programme is organized. Data will be collected through structured schedule, questionnaires and interviews. This method is fast and inexpensive. After conducting the training need assessment, it is important to link the training to the priorities based on feedbackreceived from farmer's preference and training demand. Accordingly appropriate training programmes will bedesigned and implemented, giving due consideration to the needs of the farmers.

Formulating Training Objectives

A trainer's concerns before starting of the training programme lies mainly on clarifying the training objectives based on the identified training needs. Through the training needs identified we can know the gap in performance. Therefore, the identified training needs have to be suitably converted into training objectives from drawing an outline for the training programme. A well defined training objectives help to design an effective training module. The training objectives gives the direction to the entire training programme.In general the training objectives can be classified into specific and general based upon their intensity of reference. The general objectives refer to the overall impact of a training programme. The specific objectives give the details of different components of a training programme. The training objectives deal with the changes in knowledge, skill/practice and attitude of the trainee that needs to be achieved through the programme. While formulating the training objectives care must be taken to ensure that the objectives are formulated based on the needs identified. Similarly, the objectives should also be well defined in-terms of condition, performance and standards with a specific reference to the type of behavioural changes attempted.

Designing of the Training Programme and the Training Process

Training has been conceived as a process consisting of three phases, viz. pretraining, training and post training (Lynton and Pareek, 1990). Pre-service training and in-service training are the types of training generally organized.

- Pre-Training: Preparatory phase prior to the actual training process is very much essential. The trainer usually assesses the training needs of the intended trainees and designs appropriate course content as well as methods to realize the objectives set for the programme. Arrangements for selection of participants, appraisal of course details and necessary preparations for conducting the training programmes are completed during the pre-training phase.
- Actual Training: The training is organized as per the training plan/schedule. The activities such as reception of trainees, board and lodging, inauguration, guest lectures, organization of instructions, demonstration skill training, field trip, evaluation etc. are conducted during this phase. Due care is to be taken for creating proper training climate (favourable learning situation) for the participants to learn new ideas and skills. Good rapport and team building among the trainees need to be encouraged.
- Post training: The success of the training programme largely lies with the follow up activities undertaken after the conclusion of training. Post training tie up with related line departments for continuity, making arrangements with financial institutions for linking up trainees for getting financial assistance, providing them with information about further opportunities available in the field for their improvement, and impact analysis are must for making the training programme successful. The post training evaluation needs to be done and based on the feedback, necessary

corrections for bringing about further improvement is a must.

Training Approach and Method

For making the training most effective one should be very keen in choosing the most effective and suitable approach and method of training according to the need of the target group. The training approaches can be classified into traditional, participatory and performance based approaches. In the traditional approach the trainer designs the objectives, contents, teaching techniques etc. and the participants have no say in the process. In the participatory approach the trainer and trainees jointly decide the programme. In case of performance-based approach, the emphasis is given to acquiring of specific observable skill or attainment of a specific level of proficiency before clearing the trainee for successive levels.

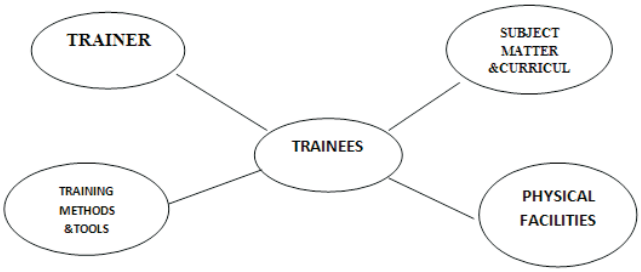

Fig 2. Requirement of an ideal training programme

The selection of appropriate training methods is important for an effective learning. The training methods refer to a combination of various instructional media used for conducting the training to achieve the learning objective efficiently and effectively.The methods should be multidimensional, to involve learning objectives, the learner's needs, the availability of instructors and training materials, the urgency of training, the norms of the organization and the money available for the training. There are different methods of training or teaching involved for better learning such as lectures, interactive lecture reading, interactive demonstrations, field trips, group discussions, question answer panel, case studies, small group tasks, workshops and role playing (Dugan Laird 1985). An ideal training situation is the one where all the five training elements are present in a given training programme. These elements are trainees, trainers, curriculum, training methods and tools and physical facilities. Various types of training methods are given below:

SI. No	Training methods	Number of participants
1.	Lecture	10-40
2.	Group Discussion	3-10
3.	Case Study	3-10
4.	Role play	5-7
5.	Seminars and syndicate	15-30
6.	Demonstrations	5-15
7.	Simulation method	8-15
8.	Structured exercise	5-15
9.	Instrumented exercise	8-15

Strategies for Effective Training Programme

- Target groups. Selection of trainees as per the demand and objectives of the training.
- Goals.General goals of the training program are the improvement of professionalperformances of the stakeholders and transfer of acquired knowledge to thefarmers with direct implementation of new technology in the field. Specifically, thetraining program should focus as per the objective of the training programme.
- Relevant topics. With regards to the topic identification process (interviews andquestionnaires) and consistently with the above mentioned goals, main thematic areas should be selected.
- Approach. Theory and practice should go together, that means class room lectures should befollowed by on-farm experience. In line with this aspect, the theoretical lesson shouldpresent to the participants exercises in order to test their problem solving capacities andgive them the possibility to face directly the issue on a subsequent on-the-ground phase.The issue, firstly presented at the 'class' and later on checked on the 'field' is ultimatelydiscussed together back in the teaching room. Moreover, to optimize trainingefforts and maximize outputs, the candidate trainers should coordinate in order to set upthe program more efficiently and effectively.
- Linkage and Collaboration. Useful links with other existing training programme should be sought in order tocapitalize on previous and current efforts and to increase networking and learningpossibilities for the involved beneficiaries.
- Scale up. In view for future knowledge and technology transfer tofarmers, a training of trainers' component should not be disregarded. Hence, it is alsocrucial the training program will not only transfer technical competences but will alsoinculcate the other necessary skills on public relation and communication, networking, task organization,priority setting etc.

Evaluation and Follow Up of Training

To improve the training efforts at each stage; a feedbackshould be obtained to ultimately learn any important lesson. Therefore, a completetraining program evaluation form should be prepared.Evaluation means assessment of value of merits of a programme. Evaluation can help in assessing gain in knowledge, skills or attitudes due to training. Reactions of participants can be known. Above all, overall impact of training on work performance and production can be measured. Evaluation should be done soon before training begins, during the course of training and after the training is over; Pre-training evaluation helps in understanding level of participants at entry point. Observations and data collected during the process of training point out lacunae and merits in implementation of training. Post-training evaluation is meant to measure impact.

Many KVK training programmes end up without evolving expected impact because of lack of adequate follow up support to the trainees. Ex-trainee meetings are a must and have to be conducted by the concerned SMS of the KVK. The trainees require repeated persuasion, guidance and support put into practical application of the newly acquired skills. Linking up with the financial institutions, state departments, rural development institutions, marketing agencies etc., is a must for KVK trainees to sustain themselves in the field. Most of the time we can see the trainees could not do practically because of lack of financial assistance or continued technological support or marketing support. Such field level constraints need to be addressed carefully by providing them with adequate post training support as per their needs.

Conclusion

Considerable efforts have been made in training of farmers in the common vocations and areas of interest; still there remains a gap which needs to be addressed. The KVKs have to re-orient their trainings based on the feedback received from the training beneficiaries to fill the gap existing with respect to imparting need based training. The KVKs have to re-orient their trainings to reduce the existing technological and adoption gap among the farmers. The concerned stakeholders should pay relatively higher emphasis and care on those specific most important needs, as identified by the feedbacks through concerted efforts while formulating different training strategies and programmes for the farmers in different agro-climatic and farming systems of the country. Therefore, the trainings are conducted at various levels for which the programmes are designed based on the clientele problems and their needs and interests. Both extensive and intensive hand on-training programmes should be emphasized for farmers and rural youth through proper assessment of their training needs. Moreover, as the Subject Matter Specialist are the resource persons for the agricultural knowledge management and information sharing with the farming community. In this context, SMSs of the KVKs should be competent enough to perform such multidimensional tasks and improve their work effectiveness, which would make frontline extension system more visible, vibrant, demand driven and client oriented. Therefore, the capacity building of KVK professionals is crucial to increase their visibility and vibrancy of KVK system. The primary requirements for effective training programmes at KVK level are assessment of needs, support of the management, co-operation from networking and allied institutions and adequate finance and resources. Then only the goal of strategic, skill-building training will leads to a meaningful lasting behavior change in the beneficiaries.

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Chapter - 6

Agriculture post COVID: decoding an opportunity for evolution

Dr. Mohammad Zubair Ahmad
Entrepreneurship Coach & Business Consultant (Agribusinesses)
Integrated Facilitation Services (https://ifsbiz.in)

Abstract

The paper presents the possible solutions which could solve the countless problems associated with agriculture which were previously prevailing and their further growth happened because of COVID 19. The focus is on developing a holistic solution incorporating all stake holders of agriculture eco system and also to change the stake holder's outlook for agriculture as a commercial activity not merely an occupation. Through this write up author has tried to present his humble view point on how we could decode an opportunity for evolution of agriculture in India post COVID.

Keywords:

Entrepreneurship, holistic intervention, regional economies, cluster approach, innovation, technology integration, Aatmanirbhar Bharat, PMFME, ODOP, economic empowerment, COVID 19

Not only is the majority of population in India associated with agriculture but India is also a top producer and exporter of several agricultural commodities,and hence we may term agriculture as the bloodline of whole economic set up. And agriculture holds huge potential for economic empowerment of country in future. On agricultural front, India faces multiple challenges not only in its core agricultural activities but also in its allied activities and COVID 19 has further worsened this situation. Ray of hope! Originates from various positives like increased government support, massive growth in AgriTech ventures, growing start-up ecosystem and rising digital and technology adoption among rural farming population. Through this humble submission an attempt is being made to compile the way outs which we can adopt to transform our agriculture as a major contributor and torch bearer of economic growth in India.

I am of a firm belief that outbreak of Corona and resulting global lockdowns and related unexpected macro economic developments are a big true blessings in disguise which we as industry practitioners, educationist, consultants and related stake holders of agriculture eco system have to remold and re channelize in order to transform the prevailing worsened and pathetic conditions into big competitive advantages.

India traditionally and predominantly has been an agricultural economy since ages and there are strong reasons for same. We have the rarest combinations of resources, competencies and capabilities to take our agriculture to newer heights.

We have successfully planned and implemented white revolution (milk), we have benchmark organizations/ brands like Amul, LijjatPapadetc; we are self sufficient in managing the food requirements of second most populous nation of world; we are biggest and prominent exporters of various edible commodities; we enjoy the most diversified and rich agro climatic zones, we have one of the best minds of the world and what not.

In spite of all this we saw major failure of the overall system with respect to so many factors of production during COVID 19 and so much misery and challenges prevailed as its outcome.

We are on verge of fourth industrial revolution in India which will further revolutionize the overall structure and systems of economy, there would be major job losses, the prevailing competencies and skill sets will become redundant, the overall life style and human living will drastically change because of this.

Now having talked about major positives and negatives associated with agriculture and allied industries I would like to submit the solution or way out which I believe is going to transform it to zenith of success and that is:

Developing holistic solutions in comprising all stake holders of agriculture eco system through two major factors i.e. innovation and technology and transforming their mindsets towards agriculture as a business not as occupation or activity.

Various successful strategies associated with businesses like cluster approach, quality management, optimum utilization of resources, latest functional techniques related to marketing, operations, finance etc., value chain integration, etc. needs to be imbibed with caution so as to harness the true potential of our agriculture in coming days.

Government on its part has tried to deal positively with these global pandemic and resulting situations by launching policy initiatives like Aatmnirbhar Bharat, loan waivers, livelihood promotion initiatives and supporting the agriculture community in various other forms. The three controversial farm laws which were recently launched by Indian Government are a means to further transform this agriculture as a business. Launch of a flagship scheme through Ministry of Food Processing i.e. Prime Minister Formalization of Micro Food Processing Enterprises (PMFME) which takes into account the competitive advantage of each district of country with respect to the agriculture produce of that district and transform it into economic transformation of that district through food processing. One District One Product (ODOP) scheme which harnesses the potential of handicrafts of each district in Uttar Pradesh and recent call by our Hon'ble Prime Minister Shri Narendra Modi to develop each district as a hub for exporting so as to achieve the targets of 5 trillion dollar economy all support my claim that Government is willing to support agriculture and economy.

Other responsible stake holders like academic & research institutions, extension organizations, industry associations etc. are all trying their level best to come up with solutions to these burgeoning problems of agriculture but the outcome on ground is not very much visible.

The major reason behind this non performance or failure in my view is the existing mindset or orientation of all the stake holders including the farmers themselves (who are the most crucial component of eco system) for agriculture. We generally take this as an activity instead of business.

I would like to substantiate my views through few practical explanations:

1. Farmers treat it as a means of livelihood not as business. They don't have any inventory of their existing resources, don't follow planning and other managerial inputs into their operation neither they have much control and focus towards their customers.

2. Agriculture Universities and research institutions are not motivated enough to commercialize the latest researched techniques and findings on mass level because the financial implications related to whole system is not performance driven. Neither they have interest to work on the real time issues and challenges being faced by agriculture and to bring in innovative solutions for these.

3. The systems and procedures applicable with respect to complete value chain of agriculture i.e. mandis, cooperatives, financial institutions, government departments etc. are working more on government prescribed norms and rules as compared to market driven forces.

Contrary to this if we observe the best practices and procedures of the most advanced nations in agriculture like Israel we find that they have successfully transformed their agriculture as a profitable business and all the components of agriculture eco system work on contributing to their best of abilities for industry growth and in return reap benefits proportionately.

Conclusion:

I would like to conclude my write up with a tentative model which is something to be tried and tested rigorously before implementation; which in my view is a solution that could decode an opportunity for evolution:

We need to develop an innovative technology based agriculture eco system in India that unites and coordinates all stake holders on the basis of creating substantial value and getting their return in form of proportionate share of the returns.

For example if agriculture university develops a customized solution to the problem of burgeoning prices of cattle feeds raw material and subsequent price rise in cattle feed prices, it gets a financial share of resulting profits to the cattle feed companies and this should be regulated and ensured through an umbrella organization (which could be government ministry or ICAR) which is vested with powers and authority to deal with all business organizations operating in this category.

Similarly farmers are roped into beneficial association through FPOs or other legal entity and they reap the benefits of economies of scale as well as develop into bigger supply power for the industries which procure their produce.

Latest technological advancements like artificial intelligence, internet of things, robotics, machine learning etc. should be extensively utilized to create this holistic solution.

Chapter - 7

A way for sustainable development in fresh water fish culture

Dr.K.Sivakumar, Assistant Professor (Fisheries)
ICAR - KrishiVigyan Kendra
Tamil Nadu Veterinary and Animal Sciences University
Kattupakkam – 603 203, Kancheepuram District, Tamil Nadu, India

Introduction

Aquaculture is currentlyone of the fastest/most growing food production sectors 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. Owing to not growing fish catches from many capture fisheries and growing demand for fish and fishery products, opportunities for aquaculture to increase its portionsto the world's production of aquatic food are very high, and there is also expectation that aquaculture will keep onto strengthen its role in contributing to food security and poverty relief in many developing countries.However, it is also acknowledged that aquaculture incorporates 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 interferences in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc., Farming also entails individual or corporate - proprietorship of stock being cultivated.Two essential factors together distinguish aquaculture from capture fisheries.

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

Practicesinvolving in Aquaculture:

As aquaculture is known by the following activities:

- 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.
- Culturing of seaweeds
- 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.Consequently there were self-governingorigins 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 text book of first aquaculture 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, phytoplankton 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 depend on wild plants and animals.

Only a few fish varieties have been domesticated. Following are the example of fish varieties that have been domesticated such as Common carp, Atlantic salmon, Rainbows trout, Tilapia speciesand Channel catfish. Many other aquaculture varieties are established 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. Consequently, there is minimal potential for selective breeding becauseunless the production cycles are closed selective breeding cannot take place.

Top five inland fish producing countries (2020). China was the top producer of fish through aquaculture. The other four countries in the top five positions are given in the table below.

Sl.No	Name of the Country	% of total
1	China	16
2	India	14
3	Bangladesh	10
4	Myammar	7
5	Cambodia	4

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%
Brackishwater	7.60%	13.3%

Species

Carps, barbels and other cyprinids are considering for a quarter of global aquacultureproduction quantity (112 million tonnes) and value (USD 250 billion) in 2018 (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	% of 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 vital 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.

The top 10 countries with freshwater resources are as follows;

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 richest biodiversity of fish varieties. Only a few of the fish found in India have been used for fish culture or are known suitable for fish culture. The following varieties/species of fish

are either used for fish culture or can be used for fish culture.

(i) 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.
- Improved fish varieties such as Jayantirohu, Improved catla and Amur common carp

(ii) 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.

(iii) 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.

(iv) Molluscs

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

(v) 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 and Salvelinus fontnualis
- The tenchTincatincais also suitable so also the common carp, Cyprinuscarpio

(vi) Tilapia fish

- Farming of Genetically Improved Farmed Tilapia (GIFT) in farm ponds, cages and tanks

Status of freshwater Aquaculture in India

Freshwater fish farming 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.

Ornamental fish culture

Ornamental fishes of our country is contributing 1% of the global ornamental fish trade. India has a great resources in ornamental fish production based on the presence of rich biodiversity of species, complimentary climatic situations and availability of labour resources. Maharashtra, Kerala, Tamil Nadu

and West Bengal mainly practice ornamental fish rearing in our country.

The ornamental fish varieties are categorized into indigenous and exotic. Due to better availability of fishes in huge number of native species has contributed considerably to the development of ornamental fish industry in the country. Currently, nearly about 100 native species have reared as aquarium fishes. There is also most demand for exotic varieties due to its colour, shape and appearances, etc. more than 300 exotic species are covered in the ornamental fish trade. But a great demand for this exists. About 200 species are bred in our country. 90% of India exports come from Kolkata followed by 8% from Mumbai and 2 % from Chennai.

Aquarium fishes are mainly categorized into two groups namely, egg layers and live-bearers. Majority of aquarium fishes are egg layers and normally external fertilization occurs. Commercially important indigenous and non-indigenous ornamental fish varieties are as follows Reticulated loach, Zebra fish, Glass fish, Honey gourami, Pencil gold labeo, All black shark, Balck knife fish, Hi fin barb, Rosy barb, Deninson, S-barb and Dwardgournami, etc. Commercially important exotic egg layers are as follows Oscar, black/silver shark, Siamese fighting fish, gold fish, firemouth cichlid, koi carp, kissing gourami, red-tailed black shark, cardinal tetra, neon tetra, angel fish, rasbora, Asian arowana, discus, three spot gourami, etc. and the commercially important exotic live-bearers are as follows guppy, molly varieties, sword tail and platy.

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 currentlyshows 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.Rising 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.

(i) 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.

(ii)Organic based aquaculture

Sustainability is one of the chief goals of organic food production. Some of the elementary principles of organicaqua culture 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.

(iii)Polyculture- Integrated fish culture

Polyculture and integrated fish culture are methods of raising various varieties within the same farming systems,where each species utilizes a distinct niche and distinct resources within the farming system. This may include the 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 improved conversion rates of input materials. The waste from one animal is used as input to another resulting in the optimal use of resources and less pollution overall.

(iv) 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 production endeavour 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 sustainable aquaculture practices that provide long term social and economic benefits to communities.

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Chapter - 8

Entrepreneurship development through beekeeping

Nripendra Laskar, Samrat Saha and Riju Nath
Department of Entomology
Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal – 736165
E-mail : nripendralaskar@yahoo.co.in

Bees are insects that have wings closely related to ants and wasps belonging to order Hymenoptera and well known for their role in pollination. In the superfamily Apoidea there are descriptions of around 20,000 species of bees. Anumber of common traits are shared among them. These traits are unique to bees and separating them from the rest of the Hymenopterans. Bees are completely herbivorous and derive all of their nutrition from nectar and pollen of flowers (but there is an exception in which when bees face nutritional stress, worker bees can kill and consume larval stage, thus they conserve the protein), but incase of ants and waspsat least in some stage(s) of their life cycle they are carnivorous. For the collection of food from flowers their anatomy and morphology arehighly modified.

Besides being producers of honey, all the honey bee species are very efficient pollinators.In addition to honey bees, more than 20,000 species of other bees arealso there which help in pollination. It needs to be clear that all bees are not comes under honey bees. Batra (1992) has separated a group for non- Apis bees called'pollen bees' which includes all bees that help in pollination except honey bees.

Role of bee and honey bee in pollination

Pollination is the most important activity that bees perform. A good number of plants depend solely on bees or some other insect pollinators for their reproduction. During collection of nectar for their hives, bees move from one plant to another and thereby they spread pollen which is collected on their furry bodies and legs. Bees can pollinate near about 85% of food crops which are used for human consumption. Bees are important pollinators because of the following facts-

- They have furry legs and bodies which enable them to collect pollen easily and thereby facilitating transfer of pollen from male parts (anther) to female parts (stigma).
- Thousands of bee species are present worldwide which are highly adapted for entering into and pollinating millions of different flowers irrespective of shape, sizeand colours. There remain a number of very tiny bees which enter into small, delicate flowers.
- There are certain flowers which do not release pollen easily. Bees have evolved different methods to deal these flowers, for example by techniques like buzz pollination.
- It is necessary for bees to visit flowers as because they require nectar for honey production and pollen.
- The time of emergence is different for different bee species in a year which will suit varying periods of flowering.

- The pollination service provided by bees isabsolutely free!
- There is no injury of plants caused by bees.
- They can forage even in extreme weather condition also.

A wide range of agricultural crops are pollinated by western honey bee (Apis mellifera Linn.) which provides highly valuable pollination services and as a single species it is the most frequent pollinator for different crops worldwide . Fruit crops like strawberry, almond, apple, guava, jamun, date palm, coconut, cashew, phalsa, plum, apricot, litchi, peach; field crops like maize, millet, lentil, buckwheat, pigeonpea, Cambodia cotton; vegetables like cabbage, cauliflower, onion, cucumber, radish, pumpkin, turnip, peas, brinjal, beans, okra, sweet potato, coriander; oil seed crops like mustard, rapeseed, sunflower, gingelly, safflower, niger; timber trees like soapnut, arjun, sal, neem, eucalyptus, mahua, wild cherry, sandal wood, house chestnut, Acacia, semele, kachnar; ornamental flowers like cosmos, wild rose, hydrangea, golden rod, poctulaca, dandelion, poinsettia and fodder crop like lucerne, clover are benefited by bee pollination.

Bee pollination helps in improvement of quality of crops and increases yield in terms of yield (fruit or seed). Bee pollination is must for some incompatible crops. Some plants such as peas, figs, chrysanthemum, seasonal flowers and many ornamental crops would not produce any fruit until they get pollinated by bees.Particularly in oilseed crops bee pollination increase the oil content and yield to a great extent.

Table-1: Impact of pollination on yield of different important crops.

Crop	Percentage yield increased due to bee pollination
Rapeseed	128.8-139.3
Mustard	128.1-159.8
Niger	38.5-260.7
Sunflower	48.2-155.0
Soybean	18.1
Sesame	22.0-33.0
Safflower	4.2-114.3
Linseed	1.7-40.0
Castor	30.6

(Source:Role of Honey Bees in Pollination of Oilseed Crops -Vikaspedia)

Management of honey bees for pollination

- Bee hives need to be placed close to the crop field to save honey bee's energy.
- At the time of 10% flowering of crop, colonies need to migrate near the field.
- Incase of A. mellifera 3 colonies/ha and incase of A. cerana indica5 colonies/ha has to be placed for proper pollination.
- Colonies has to be provided with 5-6 frame of bee strength along with young mated queen and sealed brood.
- In hive, sufficient space should be kept for honey and pollen storage .

Scope of bee keeping in India

In India a total of 50 million hectare area contain crops which are dependent on bees for successful pollination. To meet this requirement near about 150 million bee colonies are required at the rate of 3 colonies/ hectare. At present in India there are only existences of only 1.2 million bee colonies. Hence there is a great scope for expanding bee keeping for pollination purpose in India.

According to the United Nation it has been projected that in around 2024 India's population could cross China's population and by 2030 the projected population is 1.5 billion. Because of this great rise in population two major challenges will be faced by India, i.e. generating employment for youth and providing nutritive food to people in adequate quantity. To tackle these problems beekeeping industry can perform an important role. As per the National Commission on Agriculture, India require minimum of 200 million colonies of honeybeeonly for pollinating and increasing productivity of 12 major self-sterile crops which are completely dependent on insect pollination. A total of 215 lakh people can get employment through this and it will produce about 10 million tons of honey.Recently it is estimated that, based on the current inputs price status,an apiary unit containing 100 colonies that are kept under diversification plan can provide a profit of Rs. 3, 19,150 per year.

In India if international standards are met, then honey industry can be a major earner of foreign exchange. Thisindustry is a lucrative business and it provides employment. In Indian market about 70% of the honey and bees wax is provided by this informal sector. Honey produced in India has a good market for export. By using modern collection technique, storage processes, beekeeping equipments, bottling technologies and honey processing plants the potential export market can easily be captured .

Brief perspectives of beekeeping in India

In our country beekeeping has been mainly basedon forest. So, the raw material required for the production of honey is freely available in nature. In India beekeeping is a tradition carried out from time immemorial, but in most of the areas it is considered as a no-investment profit making venture. Later it has been found that beekeeping has the potentiality to develop as a major agri-horticultural and forest-based industry.During 1882 in Bengal first attempt of rearing honey bees in movable frame hives was made and then attempt was made in Punjab during 1883-84 AD.Over centuries, beekeeping techniques have developed by farmers who lived in inaccessible and remote areas of the Himalayan region for benefiting from the indigenous bee,A. cerana indica. By using simple resources these Indian bees can be maintained in hives and they can be kept at higher altitudes up to 3000 m as they are well adapted to tolerate the harsh conditions of the present in high mountain areas. A. cerana indicasuites well to the climatic conditions of the

region as well as the farming practices which are typical for these marginal areas.

In India initiation of beekeeping industry take place after 1910 when Rev. Newton developed a small hive suitable for rearing of Apis cerana indicaand the hive was named as 'Newton Hive'. Rev. Newton also trained a number of people from southern part of India and helped them to develop beekeeping as an economically profitable business. Mahatma Gandhi also realized that beekeeping had a significant importance in human life and included beekeeping in his development programs of rural areas and inspired freedom fighters of those areas to choose beekeeping for their livelihood .In 1962A. melliferawas introduced to India which has 4-5 times higher honey producing potentiality compared to other bees. In modern bee keeping both the hive species are utilized and lot of honey is also collected from the wild bees (A. dorsata and A. florea). An estimated amount of 85,000 metric tons of honey produced annually in India and substantial quantity of this production is also being exported to other countries.

Beekeeping

Beekeeping or apiculture is a method of artificial rearing of honey bee colonies mainly in hives. For some people beekeeping is a hobby where many people has chosen beekeeping to maintain their livelihood in order to collect different hive products such as honey, bee wax, propolis, bee venom etc. and for pollination purpose or to produce bees for selling to other beekeepers. A site where bee hives are kept is called apiary site.

In India three types of bee hives are used like, Langstroth bee hive, Newton bee hive and Jeolikote Villager bee hive. Honey from apiary hives are harvested by using honey extractors. Other equipments used in beekeeping are queen cage, queen excluder, hive tool, pollen trap, smoker, feeding tray, queen cell protector, decapping knife, bee brush etc.

Major aim of commercial beekeeping is production of honey. But modern beekeeping technique also include production of propolis, beeswax, pollen collected by bees, royal jelly, bee venom, as also of queen bees, package bees and nucleus colonies. For these proper management practices for bees are required by utilizing the locally available plant resources and adopting the climatic conditions .

Benefits of beekeeping

a) Beekeeping is neither expensive nor require any expensive tool for management.

b) No requirement of any sophisticated technologies.

c) Helps in generating self-reliance.

d) Provide honey, beeswax, bee venom, propolis and other valuable products.

e) A good way of generating employment.

f) Beekeeping provides business opportunities for non-beekeepers and those who are willing to choose an alternative way of earning.

g) In the integrated agricultural system beekeeping suits well as an allied activity for increasing the economic condition of farming community.

h) As honey bees feed only on pollen and nectars of flowers, so there is generally no requirement of providing any special food supply. So chance of competition with other crops is not there.

i) It is easy to learn the basic techniques of beekeeping.

j) No competition with crops for land. Wasteland areas and wild cultivated areas also have value for beekeeping as bees collect pollen and nectar from anywhere.

k) Bees are major pollinator of wild and cultivated plants.

l) People of all ages can be engaged in bee keeping regardless of gender. Daily care is not required for bee keeping and people can engage themselves in other works also.

m) Beekeeping generate income without destroying habitats.

Activities in beekeeping

There are five tiers of activities in beekeeping. A person can perform any activity for earning a livelihood. These five tiers of activities are as follows:

i) Production from hive activities

ii) Multiplication activities

iii) Fabrication and construction activities

iv) Processing activities

v) Service activities

i) Production from hive activities

Main objectives of beekeeping is to obtain various bee products that honey bee yield, such as honey, beeswax, propolis, bee venom, royal jelly, pollen etc. All of these products has animpact on human life and fetch a good market worldwide. A lot of revenue come from these products as well as it generates employment.

a) Honey

Honey is a very sweet and viscous fluid which is produced by honey bees by using the nectars that they have collected from different flower nectaries. Sometimes they collect nectars which is secreted from different plant parts other than flowers, called as extra floral nectaries.

Honey bee particularly field bees collect nectar by using their modified lapping tongue which is known as proboscis. This nectar is carried in their crop which is also called as honey stomach. Then the field bees regurgitate this collected nectar and collected by the hive bees which later on deposited in the honey cells of comb. The enzyme invertase plays its role and converts nectar into honey. Nectar generally contains 20-40 percent sucrose. This sucrose is converted into glucose (dextrose) and fructose (levulose) by the action of the enzyme invertase. Invertase is present in saliva of honey bee as well as in nectar also. Once the honey is deposited in the honey cells, the worker bees fan with their wings at a very high speed at the rate of 11,000 times per minute above the honey cells which results in evaporation of water from the honey and finally it reaches only 18% moisture content. As a result sugar content increases which is important for preventing fermentation in the honey. Then the honeycomb cells are capped with wax .

Table-1:Composition of honey.

Constituent	Average (%)
Water	17.2
Fructose	38.19
Glucose	31.28
Sucrose	1.31
Disaccharides, calculated as maltose	7.31
Higher sugars	1.5
Free acid as gluconic	0.43
Lactone as gluconolactone	0.14
Total acid as gluconic	0.57
Ash	0.169
Nitrogen	0.041
Minerals	0.2
Amino acids, proteins	0.3
pH value	3.9

(Alvarez-Suarez et al., 2010)

Benefits honey

- Honey is a good source of antioxidants. An array of plant chemicals contained in raw honey which act as antioxidants.
- Honey is a source of carbohydrate having high energy. Honey is a good source of heat and energy providing over 5,500 calories per kg. Estimated energy value of honey equal to 65 eggs, 13 kg of milk, 19 kg green peas, 8 kg plums, 20 kg carrots and 12 kg apples.
- Compared to other foods, honey provides wholesome nourishment.
- Ayurveda and Unani system of medicine use honey extensively. Ayurvedic and Sidha system of medicines use honey as a carrier for enhancing the properties of drugs.
- Honey is used for purifying blood; cold, coughs and fever preventing agent; curative for eye sores, tongue ulcer, throat ulcers and burns; used as laxative.
- Traditionally, for the treatment of eye diseases, bronchial asthma, tuberculosis, fatigue, constipation, thirst, hiccups, hepatitis, worm infestation, dizziness, piles, eczema, and wounds honey is used.

- Honey is used as tonic for both athletes and infants.
- Honey is useful in weight management.
- Honey nourishes both skin and face and boost the memory power.
- Since ancient time honey is acclaimed as a health giver and restorative healer.
- Honey has antibacterial and antifungal properties.
- Honey is considered as 'Food of the God'.

b) Beeswax

Beeswax is natural wax that is produced by the worker honey bees. Wax glands are located on the ventral side of the last four visible abdominal segments in 8 numbers. When the worker bees are about 14-18 days old they starts secreting wax. They secret wax in liquid form, but when exposed to air it get solidified and form scales. Hive bees collect these scales and use it for comb building. It is estimated that a honey bee need to consume about 10-15 kg of honey for producing 1kg of wax. In India most of the beeswax is collected the comb of wild bees (Apis dorsata). It is estimated that for every 100kg of honey production is corresponding with 1-2 kg of wax production. It is evident that wax costs more than honey. 22kg of honey can be supported by 1 kg of wax, which is 20 times of its own weight.

c) Bee venom

Bee venom is obtained from the poison glands of worker honey bees. Their sting is connected with the poison sac. Incase of newly emerged individual the sting is not fully chitinized, so they can't sting. Also in their venom sac a little amount of venom is stored. A bee contains maximum venom in their poison sac when they are two weeks old.

Properties and composition of bee venom

Bee venom is a clear liquid. It has a aromatic odour, bitter taste, and acidic reaction. Bee venom composed of apamine, histamine, hydrochloric acid, tryptophan, lecithinase, acithinase, formic acid, phospholipase, hyaluronidase, orthophosphoric acid, calcium, copper, magnesium and sulpher.

Use of bee venom

- Apitherapy is used to cure rheumatism in which patients are sting with bees.
- Bee venom is also used as a sub-cutaneous injection to treat rheumatism.
- Ointment is prepared by mixing apitoxin with vasaline and salicylic acid at the rate of 1:10:1 and applied on affected areas.
- Bee venom lower the blood pressure, decrease the cholesterol level and stimulate the heart muscles.
- Bee venom can cure endoarteriosis, endoarthritis, neurosis and neuroglia
- It can neutralize alcohol poison.

d) Propolis

Propolis is a solid dark substance which bees collect from the gums and resin that plants and tree

secrets. Propolis is used by bees for the construction and repairing of combs in a combination with beeswax. It protects colonies from unpleasant odour, bacteria. Propolis is collected by scrapping it from frames.

Use of propolis

- Propolis is used for preparation of ointments to treat cuts, wounds and abscesses of cattle.
- Combined with vasaline to treat burns.
- It has antiallergic and antibacterial properties.
- Effective against herpes virus and useful for tissue regenaration.
- Propolis extracts are useful to cure many dermatological disorders.
- It also posses antituberculosis properties.

e) Pollen

There are certain natural raw materials are utilized by honey bees. Pollen and nectar are those natural raw materials (Seedley, 1985). At the time of collection of nectar, pollens get attached with the honey bee and therefore they are present in the honey. Bees also collect pollen as a source of protein. Pollen is collected by placing pollen trap in the hive entrance.

Use of pollen

Pollen is used in human diet as a source of protein and it is assumed to have antiallergic and antibiotic properties.

f) Royal jelly

Royal jelly is secreted from the hypopharyngeal gland of nurse bees of 5-15 days old. Royal jelly is fed to the queen bee for her entire life and also to larva of worker and drone for a certain period. It is a nutritious food. Colour of royal jelly is milky or light pale.

Use of royal jelly

- Royal jelly contain 10-hydroxy decenoic acid which posses antibiotic properties against many bacteria and fungi.
- Royal jelly is used as a general tonic and as a cure for common cold.
- It is also used as face cream and to skin to treat blemishes and eczema.
- Reports suggest that it increase potency, vitality and delay aging in humans.

ii) Multiplication activities

Multiplication activities include queen bee production and package bee production. For establishing a new honey bee colony in require a healthy good quality queen with few drone and a number of worker bees. This multiplication activity is an efficient way of generating employment.

a) Queen bee production

Doolittle (1889) method of rearingqueen is employed for production of large number of queen cells.

In this method young larvae from worker cellsare transferred to artificial queen cups bygrafting. For selection of breeder colony the best performing colony in the apiary is selected and broods of this colony is used for the raising of better quality queens. Selected broods are taken in a queen cap containing sufficient amount of royal jelly and transferred to a frame. These frames are placed to a queen less colony containing sufficient brood cells and destroy the queen cells produced by the honey bees. After some days new queen will emerge. Upon emergence the queen can be used for marketingand the colony is united with strong colony.

b) Package bee production

Persons who want to adopt bee keeping require bee colony containing a healthy good quality mated queen and a number of worker bees along with the hive. This packaged bee production is an efficient way of income generation.

iii) Fabrication and construction activities

Beekeeping require a lot of equipments such as hive, hive stands, brood and super frames, queen cage, queen gate, queen cell protector, synthetic comb, comb foundation sheet, hive tool, dummy division board, pollen collector, bee veil, smoker, honey extractor etc. For harvesting of honey from A. dorsataneed specialized tools. Production unit of these equipments required for beekeeping can be an efficient venture for rural people. Production of different packaging materials required for marketing of honey and other bee products is also a good way of generating employment in rural area. Manufacturing of processing plant is another way of income generation.

iv) Processing activities

Different hive products need to be processed before consumption or use. As honey, beeswax contains a number of impurities, raw honey is prone to crystallization and this need to be undergo through certain processing activities before release it for marketing. So the processing activities of honey, beeswax and other valuable products generate employment.

a) Processing of honey

After collecting frames from the hives, decapping of honey cells is carried out manually or by using uncapping machine. Then the frames are taken into a honey extractor which uses centrifugal force to extract honey. The honey drains out the bottom and collected in a vessel. In a screw press the remaining wax can be pressed to extract the remaining honey.

Raw honey is sticky and viscous, sodifficulties will be faced during filtering. Honey is heated at a temperature of 66°–77°C to decrease its viscosity before filtration. Some honey is pasteurized at 72°C or higher. The heating process delays crystallization,destroys yeast cells and enhance shelf life of honey. During heating process the brown color of the honey increases. Heating can be carried out in tanks or by using an infrared heater or using heat lamp above the honey product.

After heating process filtration is carried out. The primary objective of filtration is to reduce crystallization of honey and produce a clear product. There are various types of filtration processes are availablefor different types of honey, in which most frequently used is membrane filters. The membrane permits some of the compounds to pass through the pores and others to compounds to remain behind which depends on the pore size and pore distribution of the membrane. Macro-filtration (10–1,000 μm) is used to

remove dust, bubbles, insect parts and crystals. For this cheesecloth or nylon or metallic screens are used. If this process is used without applying heat, then the honey is considered as raw honey. Microfiltration (0.1–10 μm)removescoal dust, yeast cells, and some bacteria.

b) Processing of beeswax

Beeswax is collected from cappings that is retained during honey extraction. It is also collected from older combs which are not suitable for use and also from the combs which get damage during honey extraction. Cappings where recovery percentage is higher give the best grade wax. In India major amount of beeswax is collected from combs of Apis dorsata.

For processing, collected cappings are first washed by rinsing in water and then air dried, otherwise it will be converted into a big fermented mess. This cappings are then melted and passed through sieves to remove different impurities.

c) Processing of bee venom

Commercially bee venom is produced by use of electric shock. Copper wires are used through which electric shock passes. Below the copper wires a thin nylon cloth is provided. As the bees get shock, they irritated and release the venom by inserting the sting into the nylon cloth. Below the nylon cloth a glass plate is provided in which venom is collected. After this the venom is dried and scrapped from the glass plate. Near about 1mg of bee venom is obtained from an Apis mellifera colony.

d) Processing of royal jelly

For collection of royal jelly the queen cell is trimmed upto the level of royal jelly. After 2-3 days larvae is gently removed by using forceps and the royal jelly is collected using a royal jelly spoon. Then this is stored in refrigerator. 200 mg of royal jelly can be obtained from anApis mellifera queen cell. Production of royal jelly worldwide is about 500 tonnes.

e) Processing of value added products from honey and other bee products

Different value added products can be obtained from the honey. This value added products include different foods and liquids such as honey gums, nougat, torrone, caramels, honey candies, honey beer, honey liqueurs, honey milk, honey spreads, honey jelly, syrups, rose honey, gingerbread, marzipan, honey bakery products; cosmetics such as lotions, creams etc. Except honey value added products from beeswax like candle, comb foundation sheets can be obtained. Processing of this value added products can be an efficient way of earning.

v) Service activities

In beekeeping, various kinds of service activities are there. It will generate employment for even those who are not directly associated with beekeeping. These activities include-

- Pollination activities: Transportation of bee hives to the fields at the flowering period of crop to enhance the chances of pollination for increasing yield of crop.
- Bee colony migration and transport: Incase of migratory beekeeping bee hives need to be transported to long distanceand proper packaging of bee hives. Sometimes it requires more than a day. Transportation services of colonies can provide employment.

- Consultancy services to small beekeepers and cooperatives: Small bee keepers are unaware about the modern and improved management strategies of beekeeping. So they need to educate about the improved practices. Cooperatives which want to initiate beekeeping need knowledge regarding the beekeeping. So consultancy service to them can be provided by the educated unemployed persons.
- Transport of produce and manufactured equipments: Transfer of bee products from processing unit to the market and equipments from market to processing units require well transportation facilities. So, transportation service can be an efficient way of employment.

Table-2: Man days generated for fabrication of 10,000 bee colonies

Sl. No.	Particulars	Man days
1.	Bee hives	33,000
2.	Carrying cages	400
3.	Nucleus hives	12,000
4.	Package hives	500
5.	Wiring board, queen cage, queen cage etc.	600
6.	Hive stand	1,100
7.	Ant proof bowls (iron and earthen)	1,100
8.	Hive tool	1,100
9.	Honey extractor	2,000
10.	Uncapping tray	500
11.	Bee veil	200
12.	Swarm bag	250
13.	Hand gloves	250
14.	Honey containers	1000
15.	Comb foundations	4000
16.	Honey processing unit (15 number needed) 100 per unit	15000

Activity	Description	Per year man-days
Apiary maintenance	Handling including extraction of honey and wax (average 1 hr per day per 10 colonies) 300 workers per year	3,00,000
Manufacture of appliances	For 10,000 colonies	56,000
Multiplication of bee colonies	Taking 5 per package and 10 queens per 10 bee colonies package per year i.e. 5000 colonies and 10,000 colonies. 1 hour per day per 10 colonies for 100 days in a year i.e. 100 hours per year for 10 colonies	1,00,000
Processing of honey and wax	A conservative estimate of 4 persons handling 100 kgs of honey and wax total estimated production of 1,60,000 kgs from 10,000 colonies	6400

Beekeeping and conservation of nature

Above all, beekeeping is a process of conserving nature through-

- Direct production of honey and other bee products
- Pollination and increasing farm production
- Creation of jobs in maintenance, manufacture and value added products and marketing
- Utilising nature's gift which is hitherto going waste
- Production without any suffering to nature
- Productive job to millions and protection of nature
- No other production process helps conserve the nature to the extend as beekeeping does
- Protection of vegetation and forests and for more honey
- Grow more crops full of nectar for more honey as well as for increased crop yield
- Protect environment against pollution for better and productive beekeeping industry

Economics of beekeeping

After studying the different aspects of beekeeping it is important to find out the economical aspects of this enterprise for those who want to go for commercial bee keeping. It requires information regarding expenditure and income that will require and generate from a unit of an apiary. For commercial bee keeping it is suggested that one need to start with minimum of 100 bee colonies. Details regarding expenditure and income are given below:

Expenditure for 100 Apis mellifera bee colonies (Gupta et al., 2012)

Non recurring expenditure:

	Number	Rate/unit	Total amount (Rs)
Bee hives	**100**	**Rs 2200/hive**	**2, 20,000.00**
Bee colonies	100	Rs 350/frame x 4	**1, 40,000.00**
Honey extractor	1	Rs 2500/-	**2,500.00**
Smoker, bee veil, Hive tool etc	1 set	Rs 500/-	**500.00**
Miscellaneous (honey cans,mating nuclei etc)	-	Rs 7000/-	**7,000.00**
Total			**3,70,000.00 (A)**

Recurring (per year)
a)For stationary bee keeping
b) For migratorybeekeeping

Transportation	No. of trips	cost per trip	Total
Truck	4	Rs 2500/trip	**10,000.00**
Total cost (a + b)			**98,800.00 (C)**

Labour (full time)	**1**	**Rs 3900/month**	**46,800.00**
Comb foundation sheets	1000	Rs 20/sheet	**20,000.00**
Sugar for feeding	500 kg	Rs36/kg	**18,000.00**
Chemicals for pest control	-	Rs 20/colony	**2,000.00**
Miscellaneous	-	-	**2,000.00**
Total			**88,800.00 (B)**

Details of expenses

a) Stationarybeekeeping

Interest on non-recurring cost @15%	**55,500.00**
Recurring cost (B)	**88,800.00**
Interest on recurring for 6 months @15%	**6,660.00**
Depreciation on permanent articles exceptbees @10%	**23,000.00**
Total	**1,73,960.00 (D)**

b) Migratorybeekeeping

Commodity	No/average	Quantity	Rate	Amount
Honey	35kg/colony	3500 kg	Rs80/kg	**2,80,000.00**
Sale of divided colonies	40 % colonies	40 colonies	Rs1400/colony	**56,000.00**
Beeswax	2% of honey produced	70 kg	Rs200/kg	**14,000.00**
Commercial queen production(two breeding seasons)	from 10% colonies	200 queens	Rs400/queen	**80,000.00**
Total				**4,30,000.00(G)**

Net income

Stationary beekeeping (F-D) 214000-173960= Rs 40,040.00

Migratory beekeeping (G-E) 430000-184710=Rs 2,45,290.00 additional benefits.

Increase in crop yield

Boost for employment in bee equipment related industry

Economics if loan taken from bank for purchase of non-recurring items (migratory bee keeping)

Years after start of bee keeping

	I	II	III	IV	V	VI
a. Income	430000	430000	430000	430000	430000	**430000**
b. Annual reducing interest on non recurring (expenditure @ 15% after payment of bank installment)	55500 (on 370000 as in A)	43500 (on 370000-80000)	31500 (on 370000-160000)	19500 (on370000-240000)	7500 (on 370000-320000)	**nil**
c. Bank installment (on principal amount as per A)	80000	80000	80000	80000	50000	**nil**
d. Recurring cost & interest on recurring & depreciation	129210	129210	129210	129210	129210	**129210**
Net income a-(b+c+d)	**165290**	**177290**	**189290**	**201290**	**243290**	**300790**

Conclusion

Beekeeping is obviously a very lucrative, attractiveand fascinating rural Agri-horticulture based entrepreneurship. Hence, beekeeping can play pivotal role in mitigating burgeoning unemployment problems of a nation like us. In addition to that it also has the potentiality to enhance yield of various crops by several fold that may ensure food and nutritional of a populous country like ours. Keeping in mind these perspectives the national policies may be formulated and implemented accordingly.

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Chapter - 9

Farm Entrepreneurship – The Way Forward

P.P. Pal*, S.K. Roy and S. Ghosh*****
* Principal Scientist, ICAR-ATARI, Kolkata
**Director, ICAR-ATARI, Kolkata
*** Sr. Research Fellow, ICAR-ATARI, Kolkata

A report published in Tutors India on the 11th June, 2020 states that in India, among every two Indians, one is considered to be dependent on agriculture for one's livelihood. The vast availability of land area under cultivation (around 52% against 11% in the world) in India has made it possible to depend on agriculture as the most preferred livelihood. However, considering the drastic change in the agricultural landscape, there is a need for new approach and technology to bring another Green Revolution in this country to reduce the problem of unemp0loyment exists due to minimum productivity.

The base for India's growth and development depends on the significant contribution for the economy from rural area through agriculture. It favours the growth and development of other sectors farming a chain to relentlessly supply of raw materials, manpower etc.

In the same way, entrepreneurship also helps in developing a nation's economy, improves production and labour market, creates job opportunity and finally increase employment rate that influenced most of the developing countries including India to encourage and support entrepreneurship for their economic development and reduced unemployment. India focussed on entrepreneurial development which is nothing but an organized and regulated growth of an individual towards an entrepreneur employing cultivating entrepreneurial skills in terms of knowledge, financial support, marketing and other approaches.

WHO IS AN ENTREPRENEUR?

An entrepreneur is a person who conceives a unique idea or concept to start an enterprise and brings it into reality. He is the person who bears risks and uncertainties of the business.

The venture established by the entrepreneur is known Startup Company which is formed for the very first time in terms of idea, innovation or business process. He/she is the one who always leads the market no matter how many competitors will come later, but their position will remain untouched. In economics, the entrepreneur is considered as the most important factor of production, which assembles and mobilizes the other three factors of production i.e. land, labour and market. In the long-run, these entrepreneurs become businessmen.

Entrepreneurs are known for their creative approach. They introduce innovation and coordinate the resources. They offer such product and services which bring about a change in the world.

WHO IS A BUSINESSMAN?

A person who is engaged in carrying out any activity, related to commercial and industrial purposes is known as businessman. He sets up his business as a new entrant in the market as for the existing business. When it comes to originality of ideas, most of the businessmen go for a business which is highly in demand or can make huge profit for them irrespective of uniqueness.

A businessman faces tough competition because there are hundreds of rivals already existing in the market doing the same business. However, the risk factor is comparatively low as he walks on a path that is already tested by the rivals. Hence, the chances of failure are relatively low.

The main objective of a businessman for conducting economic activities is to greater revenue by employing the human, financial and intellectual resources. This leads to treating customers as the King of business by the businessmen.

Key differences between businessman and entrepreneur:

The following are the differences between businessman and entrepreneur

1. A person who brings his unique idea to run a startup company is known as an entrepreneur. A businessman is a person who starts a business on an old concept or idea.
2. A businessman makes his place in the market with his efforts and dedication, whereas an entrepreneur creates the market for his own business.
3. The businessman is a market player while Entrepreneur is a market leader because he is the first to start such a kind of enterprise.
4. The nature of a businessman is calculative, but an entrepreneur is intuitive.
5. As the businessman follows the footsteps of other businessmen, the possibility of failure is very less which is just opposite in the case of the entrepreneur.
6. A businessman uses traditional methods to run the business. Conversely, an entrepreneur applies unconventional methods for the same.
7. A businessman is oriented towards profit, however, an entrepreneur is a people focused in essence, he gives more importance to its employees, customers, and the public.
8. The businessman faces extreme competition because it is very difficult to gain a competitive position in an already existing market, which is not in the case of an entrepreneur.

WHY AGRO-PRENERUSHIP?

Agro entrepreneurship solves the following problems:

1. Reduced agriculture-related burdens.
2. Assures employment opportunities especially to rural people
3. Reduced migration of youths from rural to urban
4. Increased economy rate
5. Reduced industrial development
6. Reduced urban pressure

SCOPE FOR AGRIBUSINESS IN INDIA

1. Agricultural commodities such as temperature, sub-tropical and tropical are the gifted ago-climate of India.

2. Agricultural inputs like inorganic and organic fertilizers, feed and fodder, etc., will be in demand forever.

3. there is an increasing scope for biotechnology application in the field of agriculture to seed, bio-resist agents, microbes harvesting for bakery items etc.

4. The improved export rate for increasing the economic growth of the country. India has vast export market potential according to World Trade Organization for their agricultural commodities such as oil, fruits, vegetables, spices, cereals, etc., both in raw or processed form.

5. There is a scope for secondary and tertiary processing from the primary level for agricultural commodities during the rise in standards of productions.

6. Production of Inland, marine and ornamental fish culture due to the vast coastal line gains interest among the Indians due to their boundless opportunities and increased rates.

7. Livestock also provides tremendous scope for the rural population.

8. Bio-waste from the forest can also be utilized for production.

9. There are massive scale opportunities for beekeeping and apiary.

10. Mushroom cultivation is also taken into hands using the well-established methods.

11.Organic products demands are increasing as people have become equally health-conscious due to the increased use of pesticide in farming which creates an opportunity for farmers to shift towards the traditional way of farming.

12. Need for bio-pesticides and bio-control agents is increasing, on the other hand, for crop protection.

13. There is more potential for seed, and hybrid crops in India as most varieties of crops have attained the stage of the plateau.

14. Shift towards micro-irrigation systems and equipments that reduces the human resources have fairly good opportunities due to reduced groundwater and labour demand in rural areas.

15. Exports of vegetables and flowers cultivated under greenhouse conditions.

16. Consulting services from trained human resources will be taking care of extended agricultural systems due to the reduced resources in terms of funding from the state as well as central government.

17. Agricultural production always provides employment opportunities in terms of marketing, transport, storage etc.

BARRIERS IN AGRI-ENTREPRENERUSHIP DEVELOPMENT

1. Small illiterate owners face difficulties in converting their farm into enterprise due to lack of information, investment, innovation and market exposure.

2. Service awareness needs to be created first among farmers before promoting the same through self-employed groups.

3. Impact of free services extended by government organizations to the farmers is enormous in the promotion of services which makes the farmers neglect the services offered by self-employed teams.

4. Need of back up services by self-employed experts in terms of technical and business-related information, access to marketing agencies, essential input and tools suppliers and monitoring stations to undergo modern

technological development.

5. Agri-Entrepreneurs face more legal barriers as created by specific organizations, cooperatives and private traders.

6. Hesitations from people's organizations in utilizing huge investments and state of the art technologies affect the profitability of their organizations and ultimately results in losing the interest towards their enterprises and leaders they follow.

FARMERS AS ENTREPRENEURS

It is often argued whether small-scale farmers can become entrepreneurs or not. A close look into the world perspective closely indicates that the farmers have shown a remarkable ability to adapt any venture. They always look for better ways to organize their farmers. They try new crops and cultivars, better animals and alternative technologies to increase productivity, diversify production, reduce risks and to increase profit. They have become more market oriented and have learned to take calculated risks to open or create new markets for their products. Many small-scale farmers have many qualities of an entrepreneurs.

However, to become entrepreneurs they need more other qualities alongwith the existing ones. They need to be innovative and forward-looking. They need the ability to manage their business as long-term ventures with a view to make it making them sustainable. They need to have the ability to identify opportunities and seize them.

If we look at the characteristics of small farmers, it is observed that usually they form for one of four reasons mentioned below:

- Exclusively for home consumption with rarely any surpluses produced
- Mostly for home consumption, but with the intension of selling surpluses in the market
- Partly for the market and partly for home consumption; or
- Exclusively for the market

The first category of farmers generally struggle with the basic survival of themselves and their families. They usually lack security in terms of health, water, food and shelter. They are rarely in the position to commit their minds to entrepreneurial tasks. They might be entrepreneurial in spirit but lack the opportunity to farmer as entrepreneurs.

The next category of farmers has greater opportunities to produce beyond just survival. They may be termed as 'pre-entrepreneurs' who require support to move into a more independent position. They are yet to see their farmers as business. Long-term investment is not yet a priority for them. They are comfortable selling surpluses of their food crops. They are even hesitant to shift to cash crop owing to greater risk involvement.

The farmers of the third category understand the value of farming for the market, but are often limited by access to finance, labour or market information. Though the elements are all there, they cannot risk family food requirements without greater certainty of income from cash crops. The choice between producing primarily for the market with some produce utilized for home consumption or the vice-versa depends on their circumstances and their willingness to take risks.

The farmers of the last category are fully market-oriented. Their primary reason for farming is to make profits by producing for the markets. They are interested in profits, not food production. However, to

become successful at market-oriented farming, farmers need greater farm management and entrepreneurial skills.

THE ENTREPRENEURIAL ENVIRONMENT

Being an entrepreneur is a way of life and a way of looking at the world. Entrepreneurs enjoy independence and freedom. They decide for themselves what to do and when to do it. Entrepreneurs also face risks, work under pressure and are immediately accountable for the outcomes – good or bad – of their decisions.

While farmer-entrepreneurs are free and independent, they do not work alone. They operate in a complex and dynamic environment. They are part of a larger collection of people including other farmers, suppliers, traders, transporters and processors, each of whom has a role to play in the value chain.

For farmers to cope with the risks they will face in the complex world in which they compete, they need to develop an entrepreneurial spirit. A farmer with an entrepreneurial spirit energetically, enthusiastically and carefully makes many different decisions about his farm in the context of the value chain that influences the profits of the farm business. This is all happening in a dynamic, ever-changing and uncertain setting.

To make sure their farm businesses develop and adapt in response to these changes, farmer-entrepreneurs need to:

- Stay focused on their purpose;
- Do their best to turn every event to their advantage;
- Seize every opportunity and make the best of it;
- Make the whole system work in their favour.

GROUP ENTREPRENEURSHIP

Entrepreneurship can also occur among groups of farmers who want to form a business together. These farmers have similar goals and objectives and a willingness to share the benefits and risks. Ownership and control of the enterprise are divided among the group members. The group is the financial investor, employee and risk- taker.

Group entrepreneurship is particularly attractive among those farmers who would not be able to start an entrepreneurial business on their own. Often these are the poorest farmers in the community or the farmers with the weakest links to the economy. They seek security through group activities which allow them to pool their resources, share the risks and develop a social 'safety net'.

To be successful, group enterprises must have the same entrepreneurial skills and spirit as individual entrepreneurs. Group members need to have the desire to be self-employed, the motivation to undertake something new, the willingness to take calculated risks and the mind-set of always looking for opportunities. They must be willing to work together in a common productive activity and to take full responsibility for the outcome.

There are many advantages to group entrepre neurship. Key among them are:

- Group solidarity
- Greater power from pooled resources

- Drawing on shared life/business experience
- Protection from shared 'enemies' in the form of exploitive traders and markets
- Drawing on the common desire to progress and advance economically

ENTREPRENEURSHIP DYNAMICS

The idea of entrepreneurship is complex. When a farmer introduces a new enterprise into his farming system, there are different stages of development that the enterprise goes through. The skills of the farmer must also change and develop to meet the management demands of the enterprise.

The development of a farm enterprise as a business occurs in five phases:

- Establishment
- Survival
- Early growth
- Rapid growth
- Maturity

Establishment: The organisation of the business at this stage is usually quite simple. Challenges relate to market potential, the motivation of the farmer, the availability of resources and basic business skills. Farmers require skills to negotiate with banks and other agencies in order to get the assistance they need to establish their new enterprise.

Survival: Starting a new enterprise shows that the farmer has some entrepreneurial skills. Surviving the first stage shows that the new enterprise has short-term viability. In the survival stage, the focus is on the relationship between the income earned and the costs entailed.

Early growth: If the farmer decides to take his new enterprise beyond survival, the enterprise needs to grow. To achieve this, the farmer needs to develop a broader product and buyer base while ensuring that the farm business remains profitable. He must also ensure that farm operations are efficient, find the information needed for better management and hire more skilled staff to cope with the increased production, marketing and management activities.

Rapid growth: Once the farm enterprise is working as a well-integrated farm business, it is in a position where it can achieve rapid growth. One way to grow is by increasing the amount of land planted and/or raising more livestock. This will give more product to sell. Another way is to add value to the product by processing it and/ or packaging it.

Maturity (and possible decline): Eventually, the farm business reaches maturity. This means that it stops growing or expanding. It reaches a point of balance where land size, market opportunities and the scope of activities are in balance with the skills and vision of the farmer. As long as the farmer and the farm business continue in this balance the farm business will continue. If the enterprises are profitable and the farm is well managed, the business can be sustained.

Conclusion

There are number of opportunities for agri-tech start-ups to solve key farm-related challenges, which ranged from providing a fair price to the farmer to the creation of yield estimation models that can be used by farmers to bolster productivity by removing inefficiencies. Building system for data-driven diagnostics for

determination of soil and crop health to enhance farm productivity as well as creating new technology to find alternative to pesticides and insecticides to prevent pre-harvest losses are the concerns that call for innovations on a large scale. Also, agriculture tools and equipment renting as well as easy access to certified micronutrients, seeds through online interface can be the attractive areas for agri-tech start-ups.

In north India stubble burning is a big menace. So, ways to find alternate usage of paddy straw can be one of the important solutions needed to be addressed urgently. Besides, innovations to inform farmers about timely and accurate estimation of sowing and harvesting in accordance with the market demands, technology to test adulteration of fresh produce, automated farming techniques and development of warning system for unpredictable weather patterns and pest infestation can be used to improve farming system. Last but not the least, entrepreneurial intervention in the food processing and packaging can protect farmers hugely from price volatility of commodity markets and help earn additional money through exports. Agriculture entrepreneurship has potential to revolutionise the entire food chain, benefitting small land holding poor farmers and marginalised communities in a long term.

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Chapter -10

Role of Krishi Vigyan Kendras in Doubling of Farmers' Income

Pragya Bhadauria and Rajbir Singh
Agricultural Technology Application Research Institute
Zone-1, Ludhiana, Punjab

Introduction

Indian agriculture has made rapid strides since independence; from food shortages and import to self-sufficiency and exports. Today, India is the front ranking producer of many crops in the world, witnessed through the green, white, blue and yellow revolutions. The past strategy for development of the agriculture sector for India focused primarily on raising agricultural productivity and improving food security. According to NITI Aayog, since from the adoption of green revolution, India's food production multiplied 3.7 times while the population multiplied by 2.55 times. The net result has been a 45 per cent increase in per person food production, which has made India not only food self-sufficient at aggregate level, but also a net food exporting country. The past strategy did not define the need to raise farmers' income and did not mention any direct measure to promote farmer's welfare. The experience shows that in some cases, growth in output brings similar increase in farmers' income but in majority cases farmers' income did not grow much with the increase in output. The net result has been that farmers' income remained low and has been affected by a serious agrarian crisis, leading occasionally to farmers' suicides.The decline in the growth of agriculture has now led to a climate of despair among farmer families, policy makers and the general public.The time has therefore come when we should focus more on the economic well-being of the farmers than just on production.

Why to double farmer's income

The pressure on Indian agriculture to provide food and nutritional security for its huge population is becoming a difficult task in a scenario of plateauing genetic potential in all major crops and declining productivity of rain fed areas. The fragmentation of land holdings has also caused an acute shortage of green fodder thereby adversely affecting livestock and dairy farming. The rural areas are facing food and livelihood crisis, more specifically the shortage of fodder and drinking water. The declining size of landholdings without any alternative income augmenting opportunity is resulting in fall of farm income, and causing agrarian distress. A large number of smallholders are compelled to migrate to urban areas or shift to non-farm activities to augment their incomes.

Looking at the present situation and based on the recommendations of National Commission on Farmers, Government announced measuring agricultural progress by real income of farmers and not by gross production of agricultural commodities. The Finance Minister in his Budget 2016 speech mentioned about doubling farmer's incomes. Later the Prime Minister of India gave a call to the nation of doubling farm incomes by 2022 by spelling out 7 points strategy. The time of declaration was considered most appropriate as the contribution of agriculture to the country's GDP was only about 18 percent, even as agriculture accounted for 50 percent of employment. Also the average annual real growth rate of agriculture and allied sectors has stagnated at 2.9 percent, in the past five years. Accordingly,ICAR has been entrusted with the

important responsibility of implementation of this targetat the ground level in the aspirational districts as well as in the potential areas by ensuring involvement of the ICAR Research Institutes, ATARIs & Krishi Vigyan Kendras (KVKs) along with Agricultural Universities and the State Govt. departments. The Krishi Vigyan Kendras (KVKs), previously known as Farm Science Centre, a grass root level scheme has been designed and nurtured by ICAR for the past few decades. So far, ICAR has established 721 KVKs across the country under different host organizations like SAUs, ICAR Institutes, Central institutes/Deemed Universities, State Government, Public Undertakings and NGOs. Presently, across the country the Krishi Vigyan Kendras (KVKs) playing an active role to address the issue of doubling farmer's income in the following way.

Role of Krishi Vigyan Kendras in Doubling Farmers' Income

1. Increasing productivity of crops

The KVKs are actively involved in quality seed production and timely supply of good quality of sufficient seeds prior to season. Along with this timely availability of other necessary inputs like fertilizers, pesticides etc. They are testing and demonstrating the short duration high yielding varieties of wheat and paddy crops in farmer's fields. In order to reduce the labour cost and increase the production efficiency various extension programmes are organized by KVKs to popularize farm mechanisation especially in the era of COVID 19 where there is acute shortage of agricultural labour due to reverse migration. Adoption of machines and implements like DSR/Zero Tillage/SRI, awareness and capacity building programmes on application of Integrated Nutrient Management and Integrated Pest Management were also popularized among the farmers to increase the productivity by taking care of the environmental issues also. Protected and Precision farming – Promotion of polyhouse technology; use of technology to manage the inputs at the micro level – hydroponic, minimum tillage, micro-irrigation and fertigation, promotion of intensive vegetable production by using improved varieties, organic manure and drip irrigation is providing higher annual income to the farmers as demonstrated by the KVK experts.

2. Increase in production of livestock

To diversify the agriculture farming from the monoculture of wheat-rice system, livestock sector comes first as next best alternative. The livestock sector is important remunerative enterprise which provides a regular income and employment to the rural households especially to the small and marginal. KVKs of various districts are the front runner in dissemination of need based livestock technologies developed by various academic and research institutions to the farmers doorsteps as well as serving as feedback system to theseinstitutions. They are actively demonstrating the high yielding breed of various livestock and also promoting indigenous breeds of cattle like Sahiwal, Tharparkar, Red Sindhi etc as part of promotion of Paramparagat Krishi among farmers. The KVKs are working in strategic way as in hilly area livestock farmers are mostly literate and devoid of knowledge on scientific rearing of animals. Therefore, the KVKs of such districts are mostly focusing on dissemination of scientific livestock practices, breed upgradation and nutritional intervention like use of area specific mineral mixture, Urea Molasses Mineral Block and use of locally available feed resources for formulating balanced ration to increase the productive and reproductive performance of the animals. In rained and temperate areas emphasis is on grassland management and fodder production. Along with oraginsingregular veterinary camps to address the health issues of the domesticated animals. In plain area where the sector is well developed,diversification of dairy farmers towards alternate enterprises likes commercial piggery, goatry and Integrated Farming System to enhance their income sources. KVKs also raised mass awareness for the national flagship scheme of

National Animal Disease Control Program (NADCP) for FMD and brucellosis and AI launched on September 2019. In fisheries sector, efforts are also done by KVKs to promote fisheries and shrimp farming, integrated fish cum livestock farming in different nonconventional areas of Punjab. Similarly, rejuvenation of abandon pond for fisheries in village and trout farming in hilly and temperate area of north zone. Development of good nursery of fishes and availability of good species of fingerlings is also been taken care by KVKs. Awareness through workshop and webinar on Pradhan Mantri MatsyaSampada Yojanais also dulyacknowledge and promoted by KVKs.

3. Improvement In Efficiency of Input Use

KVKs are actively involved in production and supply of hybrid variety of seeds quality seed/ planting material/Improved breeds of animals and poultry in light of market price. Encouraging farm mechanization by KVKs by providing appropriate farm machines like DSR/paddy transplanters/zero-tillmachines/Weeders/Combine harvesters/Thrashers/other appropriate tillage tools/Machines use for harvesting, grading, packaging, storage of horticultural products/Dryers etc. through custom hiring centersestablished at KVKs by paying nominal charges. For proper maintenance of soil health promotion of soil and water testing at KVK labs and celebration of World Soil Health Day on Dec 05thby distributing soil health cards to the farmers is also proactively done by all the KVKs. Along with this they are promoting use of organic fertilizers and green manuring like Dhaincha, Moong, Cowpea, Sunhempand bio fertilizers like Rhizobium, PSB, Azotobactor etc. under Bhartiya Prakritik Krishi Padhati (BPKP) for exclusion of synthetic chemical inputs and promotes on-farm biomass recycling with major stress on biomass mulching; use of cow dung-urine formulations; plant-based preparations and time to time working of soil for aeration. Farmers are also been educated for in-situ management of crop residues and zero tillage technology.through various extension programmes. Under conservation of resources through use of Gobar/Bio gas, water conservation by delineation of all possible sources of water, strengthening of existing water resources, rejuvenation of dwindling water resources and creation of new possible water resources for strengthening drip/sprinkler irrigation facilities/facilities for various agricultural and animal husbandry operations. Various awareness programmers in the form of Jal Sakhti Melas were also organized by the KVKs of rainfed areas from funding received from Department of Drinking Water and Sanitation (DDWS) and Ministry of Water Resources and Ganga Rejuvenation. Large scaledemonstration of the water conservation method by increasing irrigation facilities & enhancing water-use efficiency, promotion of micro-irrigiation through sprinkler and drip methods and construction of different water harvesting methods were also popularized among the farmers under the Jal SakhtiAbhiyaan during 2019 onwards.

4. By Increasing Cropping Intensity

KVK are promoting short duration hybrid/HYV seeds,crop intensification with the promotion of different crop rotations like Basmati-wheat-summer moong or Paddy-gobhisarson-summer moong or Paddy-potato-summer moong or Paddy-potato-spring maize or Paddy-potato-mentha or Paddy-potato-melons for enhancing farmer's income.Introduction of vegetable (Jhaar karela) in crop rotation- Paddy-cauliflower-bitter gourd (jhaar karela)-cauliflower (2 year rotation). Intercropping of cabbage, cauliflower and root vegetables like carrot, radish and turnip under apple orchards in high hill regions is providing addition income to the farmers of the districts and raising their standard of living also.Along with this use of rice fallow land and promotion of High Density Plantation (HDP) in Apple, Almond, Mango, Guava etc. is also duly taken care by KVKs.

5. Diversification towards high value crops

KVKs are encouraging crop diversification among farmers so that they allocate larger proportion of their cultivated land to crops having more comparative advantage rather than growing rice or wheat alone.Promoting Crop diversification - high value crops, niche specific cropping, floriculture, medicinal, aromatic plants, Organic farming, Integrated Farming System, Protected Cultivation among farming community through trainings/field visits/awareness programs etc and making available to them right type of technology and resources. KVKs have developed successful IFS model for enhancing the farmer's income by integration of Horticulture-Poultry in Apple Orchards, Fish-Pig Integration, Crop-livestock integration and many more at KVK premises as well as farmer's fields. Along with this KVK scientist's are promoting cultivation of oilseed and pulses and offseason vegetable cultivation under protected conditions which are gaining momentum in the northern states as they are more remunerative to the farmers. KVKs are promoting offseason cultivation of tomato, capsicum, cucumber, cabbage, cauliflower, root vegetables like carrot, radish and turnip in the hilly and plains areas. Production of offseason vegetables like pea, potato, cabbage and cauliflower are providing remunerative prices to the farmers. With the help of KVKs, floriculture industry has picked up pace in the various districts of HP and farmers are fetching remunerative returns out of it.Systematic growing of trees along with agriculture crops and growing of medicinal plants like Aconitum heterophyllum, Inularacemosa and Saussureacostus in apple orchards are prompted by KVKs under Har Medh Par Pedh as considered to be a viable and feasible alternative for diversification. Another important system is cultivation of fodder trees in crop farms to increase the production of green fodder playing an important role in sustaining rural livelihood. As by integrating fodder trees with agriculture and horticulture crops there is increase the production of milk and hence the income of farmers. The main enterprises promoted by KVKs for diversification includes:

- Cash crops- Sugarcane, Betel leaf and Vegetables
- Spices - Turmeric, Ginger, Dhania, Garlic, Ajwain and Saunf
- Mushroom Cultivation
- Rearing of honey bee
- Agroforestry
- Integrated Farming System
- Small animal and poultry rearing

6. Improved price realization by farmers

KVKs are creating awareness about various e-marketing platforms including e-NAM and thus linking the farmers to a common market for ensuring remunerative returns to them. KVKs particularly in the aspirational districts are engaged as Cluster Based Business Organizations (CBBOs) for promotion of farmer producer organization (FPOs) in different commodity funded by National Cooperative Development Corporation (NCDC). They are also promoting special commodity markets for SHGs, FIGs and FPOs operating in their districts. Encouragement of the farmers for contract farming particularly in poultry sector where farmers themselves find assured return on their investments. Selected KVKs are also working with private agencies in Public Private Partnership mode in creation of farm level infrastructure and marketing facilities. Use of ICT in dissemination of Knowledge and resolving their queries by different platform like

Kisan Call Centre operating in ATIC and various SAUs, KVKs along with Common Service Centre (CSS). Through platform like m-Kisan and District Agrometerological Units (DAMU) funded by IMD KVKs are providing timely,need based, location specific agrometand other related advisories, weather alerts and other important information to their registered beneficiaries. The innovative platform of Krishi Vigyan Kendra Knowledge Network Portal also provides real time information and activities of different KVKs across the country. KVKs experts are also available all the time through their phones, WhatApp groups and social media.

7. Shift of cultivators to non-farm jobs

Looking at the present scenario and government policies, KVKs are more focussed toward developing agri-business through transforming farming into agri-enterprises performing multiple functions at one point of time. Encouraging processing and building value chains would help create non-farm jobs in rural areas. KVKs are shouldering the responsibility from Agriculture Skill Council of India (ASCI) for promotion of subsidiary occupation through skill development training to enhance the farmer's income. There are 32 job roles are given to different KVKs as per the need and expertise available and they are imparting more than 200 hrs of skill development trainings mainly focussing on practical aspects in different job role including poultry/ goats/ piggery/ dairy,beekeeping, mushroom farming, organic,promotion of garment construction, preservation of fruits and vegetables, production of quality seed, extension worker, AI Traineretc among farmers especially the rural youths. KVKs are also in process of establishing Value addition and Agro-Processing Centers (APC) through project Value addition and Technology Incubation Centre in Agriculture(VATICA) at the production catchment for primary and secondary processing, storage, handling and drying of cereals, pulses, oilseeds, fruits, vegetables and spices made available on rental/ charge basis to rural people. Extension research projects such as Attracting and Retaining Youth in Agriculture (ARYA) and Farmers FIRST are also promoting rural entrepeurship among the youth by providing the initial handholding in the form of training, skill development and setting up of their enterprises.

Conclusion

To secure the future of agriculture and to improve livelihood of half of India's population, adequate attention needs to be given to improve the welfare of farmers. Doubling farmer's income by 2022 is quite challenging, but it is needed and is attainable. Three importantstrategies focused on (i) development initiatives, (ii) technology and (iii) policy reforms in agriculture areimmensely needed to double farmer's income. Research institutes should come with technological breakthroughs for shifting production frontiers and raising efficiency in use of inputs. They should also include grassroots level innovations and traditional practices which are resilient, sustainable and income enhancing.As technologies developed by the public sector have very poor marketability, strong extension support in the form of KVKs is required for the adoption by farmers. For this there is immense need to strengthen the existing infrastructure, facilities and manpower at all the Krishi Vigyan Kendra's throughout the country to achieve the target of doubling farmers' income. If concerted and well-coordinated efforts are made by the Centre and all the States, Country can achieve the goal of doubling farmers' income by the year 2022. Achieving this goal will reduce persistent disparity between farm and non-farm income, alleviate agrarian distress, promote inclusive growth and infuse dynamism in the agriculture sector.

Chapter -11

Protected Cultivation for higher income

Rahul Dev,
ICAR-VPKAS, Hawalbagh, Almora Uttarakhand

What is protected cultivation?

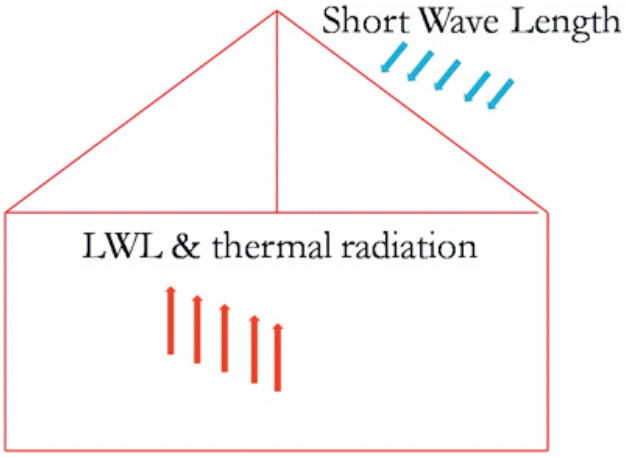
Protected cultivation is a process of growing crops in a controlled environment. This means that the temperature, humidity, light and such other factors can be regulated as per requirement of the crop in Green house.

Protected farming is a cropping technique in which the growth and development of a plant is influenced by a regulated microclimate. Several protected cultivation approaches have been widely implemented in commercial farming as agriculture has progressed. Green houses, plastic houses, artefact houses, net houses, and shade houses, among other things, are useful for defending crops to Extremes of temperature, sunshine, water, relative humidity, weeds, nutrient shortage, wind velocity, carbon dioxide concentration, and disease and insect pest incidence

Crop productivity and quality are dictated by the influence of abiotic and biotic pressures in today's changing environment are the most significant restrictions in horticulture crop productivity in North India. Vegetables, which are commonly cultivated in rural and peri-urban regions, constitute a significant and substantial element of our nutritional requirements. Hi-tech vegetable cultivation of high-value and exotic vegetables, is becoming more popular, with a focus on the high-end local and international markets.

What is Greenhouse effect:

When short wave radiation from the Sun enters the greenhouse structure. It refracts through the surface and gets transformed into long wave radiations. These long wave radiations do not escape the greenhouse in entirety, thereby trapping the heat and thus, continually increase the temperature inside. As a result of the captured solar energy inside the greenhouse, the temperature inside the greenhouse rises (greenhouse effect).However, after sunset it starts losing stored heat through conduction, convection and radiation.



Advantage of Green house cultivation

Protected cultivation of high-value crops (HVCs) have assumed an important role in getting higher crop productivity and profitability and enhancing nutritional security of the growing population.

- Plants benefit from protected culture because it creates a pleasant microclimate.
- Cultivation may be done at any time of year, even in adverse weather.

- High yield per unit area with higher quality.
- A longer manufacturing cycle
- Water consumption is optimised, with a 40-50 percent decrease.
- Suitable for high-value crops in the off-season.
- More hygienic manufacturing owing to less hazardous pesticide applications
- More effective disease and pest management.
- Assists in the early raising of the nursery.
- Propagation of premium planting material throughout year.
- Protection from the elements such as wind, rain, snow, birds, and hail.
- Encourages educated kids to work for themselves.

Type of Green house

1. Low-cost Greenhouse: Construction cost : Rs. 450–620 per sq m; suitable for cold climatic zones and low wind speed regions.
2. Medium-cost Greenhouse: Construction cost :Rs. 900–1000 per sq m; Suitable for dry and composite climatic zones.
3. High-cost Greenhouse: Construction cost :Rs.1500– 2500 per sq m; Suitable for all climatic zones.

Forced ventilated greenhouse

The greenhouse climate parameters are regulated through passive cooling by operating fan and pad systems and sensor-based controlled systems.

It is made out of an iron/aluminum framework (frame) with a dome or cone form. Temperature, humidity, and light are all automatically adjusted to meet the needs of the crop. Concrete is used for the floor and a portion of the side walls. It is quite long-lasting, however it costs around 5-6 times as much.

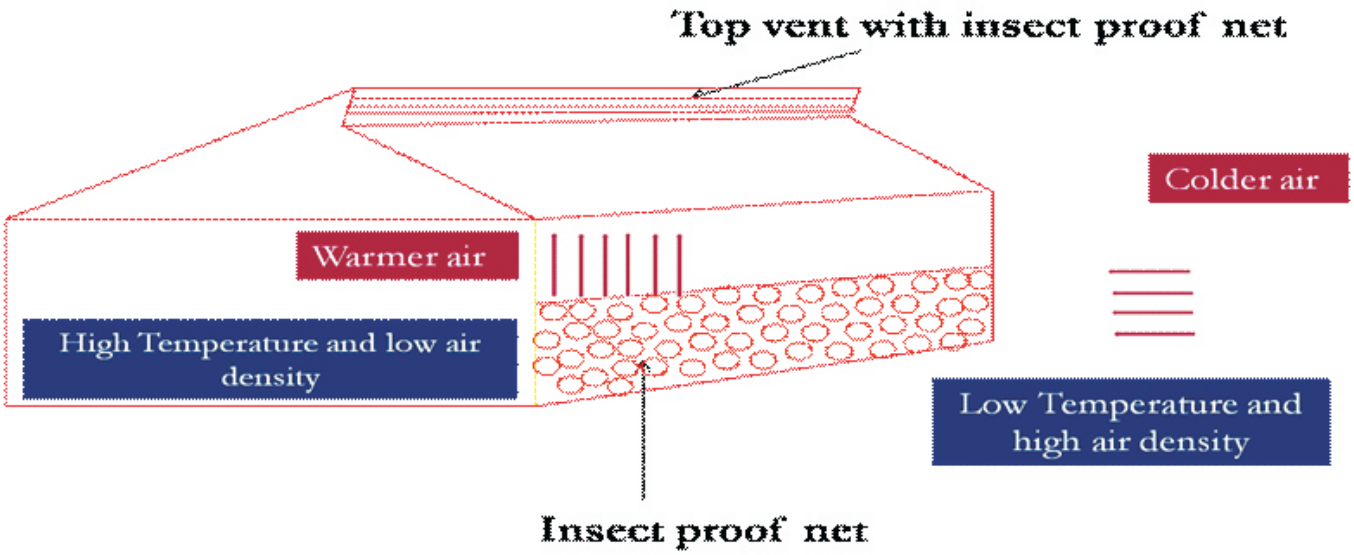
Advantage:

- Off-season cultivation of crops is possible round the year.
- Crop cultivation is possible under harsh environmental conditions.

Low cost Naturally ventilated polyhouse:

The climate inside the structure is regulated by opening and closing of side curtains (which are rolled above permanently fixed insect-proof net on windows).The quonset-shaped greenhouse, which may be created using GI tubing (class B) of 15 mm diameter, is a medium-priced greenhouse with a little higher cost. A single layer of UV-stabilized polythene with a thickness of 200 microns covers the structure. It can be

naturally ventilated by having openable windows along the sides and roof, or it can be ventilated using exhaust fans. The fanpad system may also be used to reduce the temperature of the polyhouse by humidifying it.



Advantage:

- Moderates humidity.
- Plant propagation is effective.
- Helps to improve quality and quantity of produce.
- Reduces infestation of disease / pests.
- Savings in water & fertilizer requirements as compared to open field cultivation.
- Reduces gestation period of the crop.

Insect proof net house

It is covered with UV-stabilised insect-proof net of 40–50 mesh or wire for effective control of pests and diseases.

The minimum size of insect-proof net house is 100 sq m.

Advantages

- Off-season cultivation
- Production of quality seedlings is possible.

- Restrict the growth of pests and diseases.

Shade House

Shadenet house are mainly used to provide development of healthy grafts/ seedlings & hardening for various horticultural crops irrespective of climatic conditions.

Advantage:

- Plant propagation is effective.
- They control high intensity solar radiation.
- They protect plants from frost.
- They also protect plants from large insects.

Summary:

During the rainy season in Northern India, low and medium-cost greenhouses offer plenty of opportunities to produce high-value crops and flowers (July-October).Tomato, cherry tomato, colourful capsicum, cucumbers, and pole type French beans are difficult to grow in open circumstances at this time, and little supply of these commodities fetches a premium price on the market, enhancing profitability.Exotic (non-native) and off-season crops, export-grade cut flowers, and excellent seedlings are all grown professionally in greenhouses. When high-value agricultural products are cultivated under greenhouse conditions, their economic returns can be significantly boosted.

Chapter -12

Mining The Social Entrepreneurship Strategies For Holistic Development

Prof. KausikPradhan and Indrajit Barman
Department of Agricultural Extension
Uttar BangaKrishiViswavidyalaya, Pundibari, Coochbehar, WB

INTRODUCTION

Social entrepreneurship is a kind of entrepreneurship initiative that aims at taking up a social problem for bringing about a transformation in the society. It is the process of recognizing and resourcefully pursuing opportunities to create social value. Social entrepreneurship is all about recognizing the social problems and achieving a social change by employing entrepreneurial principles, processes and operations. It is a development oriented approach to completely define a particular social problem and then organizing, creating and managing a social venture to attain the desired development or change

The person who takes up the challenge is called a social entrepreneur and he / she uses principle of entrepreneurship with the intent of creating social capital and not being essentially profit centered. Social entrepreneurs are innovative, resourceful, and results oriented. They draw upon the best thinking in both the business and nonprofit worlds to develop strategies that maximize their social impact. Social entrepreneurs can be those individuals who are associated with non-profit and non-government organizations that raise funds through community events and activities.. Social entrepreneurs sometimes are referred to as "public entrepreneurs," "civic entrepreneurs," or "social innovators". They are change agents; they create large-scale change using pattern-breaking ideas, they address the root causes of social problems, and they possess the ambition to create systemic change by introducing a new idea and persuading others to adopt it. These types of transformative changes can be national or global. The founder and manager of Grameen Bank, Muhammad Yunus is a contemporary social entrepreneur. The venture, Grameen Bank or micro finance has been continuously growing and benefiting a large section of the society. The extraordinary people put their brilliant ideas and bring a change in society against all odds. Rang De is another brilliant example of a non-profit social enterprise. Established in the year 2008 by Ramakrishna and Smita Ram, it is an online platform from where rural and urban poor people in India can access micro-credits with an interest rate of as low as 2 percent per annum.The George Foundation is one more nationally recognized social enterprise.. By employing the principles of social entrepreneurship, these organizations are addressing the social problems and bringing a positive change in the society.

The aim of social entrepreneurship is to promote the cause of social and environmental goals that have an impact in either in the present or the times to come. Such entrepreneurs are generally a part of or associated in some way with some nonprofit organisations (NGO's). Although profit making is also as aspect of this concept but it may not be the sole purpose of the organisation. Social entrepreneurship mainly focuses on creating social capital without measuring the performance in profit or return in monetary terms. The entrepreneurs in this field are associated with non-profit sectors and organizations. But this does not eliminate the need of making profit. After all entrepreneurs need capital to carry on with the process and bring a positive change in the society. Along with social problems, social entrepreneurship also focuses on environmental problems.

Table 1.Contrasting definitions and core characteristics of the terms "social entrepreneur" and "social entrepreneurship"

Source	Definition	Core Characteristics
Bornstein (1998) tinyurl.com/6ucfnc6	A social entrepreneur is a path breaker with a powerful new idea who combines visionary and real-world problem-solving creativity, has a strong ethical fiber, and is totally possessed by his or her vision for change.	• Mission leader • Persistent
Thompson et al. (2000) tinyurl.com/7mkp7ah	Social entrepreneurs are people who realize where there is an opportunity to satisfy some unmet need that the state welfare system will not or cannot meet, and who gather together the necessary resources (generally people, often volunteers, money, and premises) and use these to "make a difference".	• Emotionally charged • Social value creator
Dees (1998) tinyurl.com/86g2a6	Social entrepreneurs play the role of change agents in the social sector by: • Adopting a mission to create and sustain social value • Recognizing and relentlessly pursuing new opportunities to serve that mission; • Engaging in a process of continuous innovation, adaptation, and learning; • Acting boldly without being limited by resources currently in hand; • Exhibiting a heightened sense of accountability to the constituencies served for the outcomes created.	• Change agent • Highly accountable • Dedicated • Socially alert
Brinckerhoff (2009) tinyurl.com/7w8dfs5	A social entrepreneur is someone who takes reasonable risk on behalf of the people their organization serves.	• Opinion leader
Leadbeater (1997) tinyurl.com/7exwebб	Social entrepreneurs are entrepreneurial, innovative, and "transformatory" individuals who are also: leaders, storytellers, people managers, visionary opportunists and alliance builders. They recognize a social problem and organize, create, and manage a venture to make social change.	• Manager • Leader
Zahra et al. (2008) tinyurl.com/87upzh3	Social entrepreneurship encompasses the activities and processes undertaken to discover, define, and exploit opportunities in order to enhance social wealth by creating new ventures or managing existing organizations in an innovative manner.	• Innovator • Initiative taker • Opportunity alert
Ashoka (2012) tinyurl.com/5jjv6u	Social entrepreneurs are individuals with innovative solutions to society's most pressing social problems [...] They are both visionaries and ultimate realists, concerned with the practical implementation of their vision above all else.	• Visionary • Committed

(Source:Abu-Saifan, S. 2012)

SOCIAL ENTREPRENEURSHIP HISTORY

Social entrepreneurship is relatively a new term. It has witnessed a boom in the past few years with more and more people getting attracted to it. The field of social entrepreneurship is growing rapidly and attracting increased attention from many sectorsIt came in to notice just a few decades ago. But its usage can be found throughout the history. In fact, there were several entrepreneurs who established social enterprises to eliminate social problems or bring positive change in the society. VinobaBhave, the founder of India's Land Gift Movement (Bhoodan Movement), Robert Owen, the founder of cooperative movement and Florence Nightingale, founder of first nursing school and developer of modern nursing practices might be included in this category. They had established such foundations and organizations in 19th century that is

much before the concept of Social Entrepreneurship used in management or being popular among social development practitioners.

There were entrepreneurs during nineteenth and twentieth centuries who made efforts to eradicate social evils. Apart from this, there are many societies and organizations that work for child rights, women empowerment, save environment, save trees, treatment of waste products, etc. Apart from addressing the social issues, social entrepreneurship also includes recognition and addressing the environmental problems and financial issues for rural and urban poor.These days, the concept of social entrepreneurship has been widely used and that too in different forms. The establishment of Grameen Bank by Muhammad Yunus, Ashoka: The Innovators for the Public by Bill Drayton, Youth United by JyotindraNath, Rand De by Ramakrishna and Smita Ram, SKS Microfinance by VikramAkula and Roozi.com by Nick Reder, Brent Freeman and Norma La Rosa has popularized the term.Now a days it is being observed that many multinational companies are adopting the concept of social entrepreneurship and trying to address the issues in our society by opening schools in far flung areas, educating women for family planning, making it possible for farmers and poor individuals to access low interest credits, establishing plants for waste treatment, planting trees and going green.

PIONEERS IN SOCIAL ENTREPRENEURSHIP

- Susan B Anthony: was the Co-Founder of the first women's temperance movement and a prominent American civil rights leader for women's rights in the 19th century.
- VinobhaBhave: is a prominent figure in Indian modern history and was the founder and leader of the Land gift movement that helped reallocate land to untouchables.
- Maria Montessori: a pioneer in education. Developed the Montessori approach to early education in children.
- Florence nightingale: she laid the foundation for the first school of nurses and worked to improve the hospital conditions.
- Margaret Sanger: She was the founder and Leader of the planned parent hoodfederation of America, championed the family planning system around the world.

FAMOUS SOCIAL ENTERPRISES IN THE WORLD

With an aim to generate income if not wealth, the social enterprises come up with innovative as well as people-friendly solutions to bring a positive change in the society. What makes them different from the corporate world is their basic aim; they work for the people who live below poverty line and offer flexible working environment to people. Although the concept of social entrepreneurship has been around since 1960s and is promoted by many individuals but the establishment of The Grameen Bank in Bangladesh was the first instance where the concept was thoroughly used. Under the leadership of Muhammad Yunus, it tried to address the issue of people living below poverty line and gradually has evolved as a strong identity.

The Skoll Foundation - North America

Founded by Jeff Skoll, the first president of ebay, the Skoll Foundation supports the social enterprises and highlights their work by establishing their partnerships with Sundance Institute and NewsHour with Jim Lehrer. NIKA Water Company is another social enterprise in America. The company sells bottled water in the country and brings clean water to the developing world with its profits. It uses its

100 percent profit in the activity.

Grameen Bank - Bangladesh

Social enterprise is not a new concept but it started becoming popular only in 1960s. There may be different rules and regulations for social enterprises around the world but their basic concept remains the same. Their ultimate aim is to serve the people of the society who are at the bottom of the pyramid. In Bangladesh, Muhammad Yunus incorporated the Grameen Bank, a microfinance organization that makes small loans to people living in rural areas without requiring collateral. The bank does not believe in charity but in offering help to people as an initiative to break through the poverty cycle.

Echoing Green - USA

Based in New York, Echoing Green is a non-profit organization that operates in social sector investing. For last twenty years, it has been working in this field encouraging and helping young entrepreneurs to launch new organizations.

Rang De - India

Rang De is a not profit online organization in India that lends small loans to individuals planning to start a new or grow their existing business. It is a successful attempt to bring together the two parts of India one of which is successfully progressing while one is left out due to shortage of resources. Founded in the year 2006 by Ramakrishna NK and Smita Ram, Rang De, today is a major online platform in the country.

Schwab Foundation for Social Entrepreneurship

Founded by Professor Klaus Schwab and his wife, the main purpose of Schwab Foundation for Social Entrepreneurship is to promote social innovation. The foundation does not give grants but addresses social problems and provides platforms at the country, global and regional levels.

Omidyar Network

Established in 2004, the Omidyar Network is a philanthrocapitalist investment firm that fosters economic advancement. With a network of for-profit companies, the network encourages participation in the areas of government transparency, microfinance, social media and property rights. Headquartered in Redwood City, California, it was established by Pierre Omidyar and his wife Pam.

ADVANTAGES OF SOCIAL ENTERPRISES

Social enterprises tend to operate with a purpose of creating value for the society and also generate income. Social enterprises are supposed to be innovative, unique, people and environment friendly and cost effective. They are the enterprises that are advantageous to the society, people and the environment.Theseare beneficial to the poor, generally by providing them with a means of livelihood.

1. Social entrepreneurs find it easier to raise capital. There are huge incentives and schemes from the government for the same. since the investment industry here is ethical, it is easier to raise capital at below market rates.

2. Marketing and promotion for social enterprise is easy. Since a social problem is being tackled with a solution, it is easier to attract attention of the people and media. The degree of publicity often depends on the degree of uniqueness of the solution.

3. It is easier to garner support from likeminded individuals since there is a social side to the enterprise. It is also easier to get people onboard at lower salaries than compared to other industry.

4. Services in whichever section they may be offered are customized better to suit the needs of the individual or the problem. This is also designed in harmony with all other systems like the environment, society or the people.

5. Cost effectiveness is another advantage of a social enterprise. The solutions offered by these organisations in the form of either products or services are reasonable than compared to the same service provided by a profit making organisation. No wonder basc amenities like healthcare, education etc have become very affordable to people world over with the help of these institutions. Micro finance, for example, today caters not to the poor but to the poorest!

CHARACTERISTICS OF SOCIAL ENTREPRENEUR

Social entrepreneurs firstly need to possess strong passion that drives their desire to see their ideas and initiatives come to fruition, while also adopting a healthy impatience that ties in with their uncomfortableness with sitting back to wait for change to happen.They also need to come up with practical but innovative ideas to social issues and often use market forces and principles. It allows them to break away from constraints imposed by the traditions and customs within the field of certain disciplines to take risks that others are afraid of taking

1. Curiosity

Social entrepreneurs must nurture a sense of curiosity about people and the problems they face. The best social entrepreneurs seek to truly understand the needs and desires of the people they serve. Great social ventures often start through immersive market research, an empathy-centric process through which social entrepreneurs gain knowledge in the field.

2. Inspiration

In order to design effective solutions, social entrepreneurs must be inspired by the people and problems they encounter. Inspiration motivates action and helps social entrepreneurs tackle challenges that others shy away from addressing.

3. Resourcefulness

In the world of social entrepreneurship, key resources, such as human and financial capital, can often be scarce. Successful social entrepreneurs know how to leverage the resources at their disposal and develop innovative methods to overcome obstacles.

4. Pragmatism

Changing the world takes time, effort, and experimentation. While visions for massive social change may provide their inspiration, experienced social entrepreneurs know that they need to take small steps in pursuit of their goals. Great social ventures are not born overnight!

5. Adaptability

Social entrepreneurs must remain open to solutions. This includes knowing when to pivot and change their strategies if their initial methods do not succeed. Adaptability and flexibility are integral in the

development of early-stage social enterprises.

6. Openness to Collaboration

While embarking on a quest to change the world may feel lonely, it is important to remember that social entrepreneurship is a team sport, and other people are willing to help. Social entrepreneurs need to stay open and attentive to potential partnership and collaboration opportunities. In many cases, collaborative initiatives and joint-ventures can achieve social/business goals much more effectively than solo endeavours

7. Persistence

Social entrepreneurs take on some of the most daunting challenges our society has to offer. This often creates a recipe for early-stage failures. However, the successful social entrepreneurs are the ones who persist past initial setbacks and persevere to deliver effective solutions. Experienced social entrepreneurs know how to learn from failures, adjust their methods, and make continual strategic improvements. Don't give up if at first you don't succeed!

Table 2.Unique and common characteristics of profit-oriented entrepreneurs and social entrepreneurs

Unique characteristics of the profit-oriented entrepreneur	Characteristics common to both types	Unique characteristics of the social entrepreneur
• High achiever	• Innovator	• Mission leader
• Risk bearer	• Dedicated	• Emotionally charged
• Organizer	• Initiative taker	• Change agent
• Strategic thinker	• Leader	• Opinion leader
• Value creator	• Opportunity alert	• Social value creator
• Holistic	• Persistent	• Socially alert
• Arbitrageur	• Committed	• Manager
		• Visionary
		• Highly accountable

(Source:Abu-Saifan, S. 2012)

CHARACTERISTICS OF SUCCESSFUL SOCIAL ENTREPRENEUR

1.SuccessfulSocial entrepreneurs arenot bound by norms or traditions

2. Successful Social entrepreneurs arenot confined by barriers that stand in the way of their goal

3.SuccessfulSocial entrepreneurs are able todevelop new models and pioneer new approaches to enable them toovercome obstacles

4.SuccessfulSocial entrepreneurs are able totake innovative approaches to solve social issues

5.SuccessfulSocial entrepreneurs are able totransform communities through strategic partnership

6.SuccessfulSocial entrepreneurs arePath breaker/finder with a powerful idea (Visionary + Real world problemsolvingcreativity + Ethics)

7.SuccessfulSocial entrepreneurs are pragramatist and they have strong professional skill

8.SuccessfulSocial entrepreneurs believe hard work and see opportunities

9.SuccessfulSocial entrepreneurs are radical thinker, strong in networking and communication skill, ambitious, mission driven, strategic, resourceful and result oriented

STAGES OF SOCIAL ENTREPRENEURSHIP DEVELOPMENT

Stage 1: Defining Systemic Problem is stating a problem derived from the overall social system, e.g., the root cause of inequality, human insecurity, or a crisis of global sustainability.

Stage 2: Individualizing Enterprise is an activity solely by the founder (or, cofounders) of a social enterprise

Stage 3: Organizing Enterprise is an activity by a team of the social enterprise utilizing ToC(Theory of Change)

Stage 4: Socializing Enterprise is an activity by multistakeholders in society who strive to solve the systemic problem collectively.

Stage 5: Achieving Systemic Change is realizing a fundamental change at the level of the social system, which prevents or alleviates the systemic problem per se.

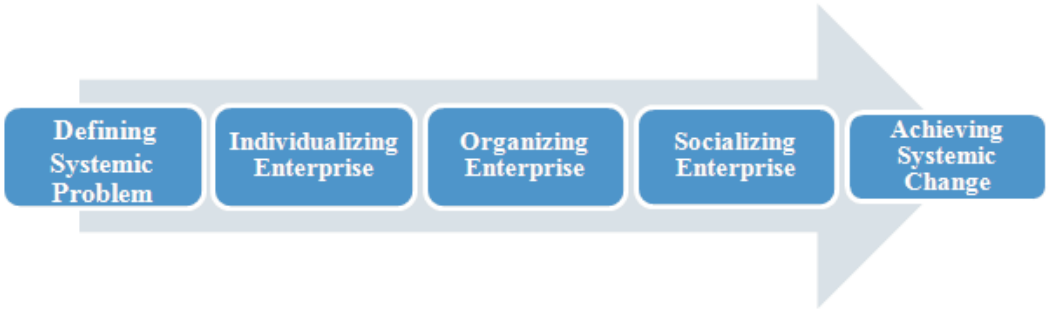


Fig 1.: Five Stages of Social Entrepreneurship Development

Social Entrepreneurship Development Model under ICAR Experiment

1. Local base and partnerships established

- Partnership with local government and other local actors (line departments)
- Establish Farmers' Producers Company (FPC)with local youth/farmers

2. Capacity developed

- Skills and capacity development of FPC and partners,
- Ensure FPC sustainability

3. Social Capital developed

- Conduct social initiatives through FPC

4. Social entrepreneurship promoted in local communities

- Youth/Farmers outreach and social entrepreneurship promotion to thebroader farming community

5. Social enterprises formulated and established

- Brainstorming on local social entrepreneurial opportunities
- Training imparted and Business plan formulated on selected viable socialenterprise
- Funding on business plan through locally available resources

6. Social enterprises are running successfully

- Technical assistance for running social enterprise successfully

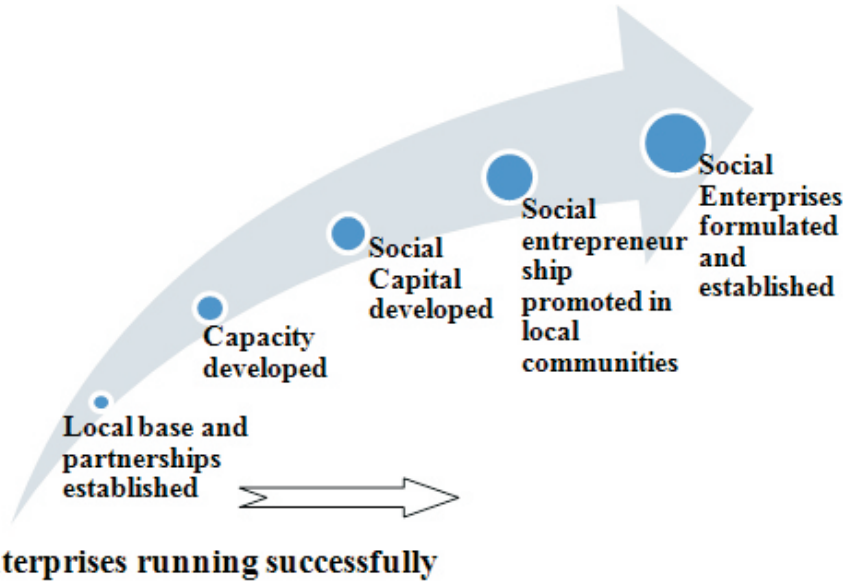


Fig2. :Social Entrepreneurship Development Model under ICAR Experiment

MAIN OPERATIONAL AREAS OF SOCIAL ENTREPRENEURS

- Poverty alleviation through empowerment, for example the microfinance movement
- Health care, ranging from small-scale support for the mentally ill 'in the community' to larger scale ventures tackling the HIV/AIDS pandemic
- Education and training, such as widening participation and the democratization of knowledge transfer.
- Environmental preservation and sustainable development, such as 'green' energy projects.

- Community regeneration, such as housing associations.
- Welfare projects, such as employment for the unemployed or homeless and drug and alcohol abuse projects.
- Advocacy and campaigning, such as Fair Trade and human rights promotion.

COMMON BUSINESS MODEL FRAMEWORKS OF SOCIAL ENTERPRISES

1. Cross-Compensation – One group of customers pays for the service. Profits from this group are used to subsidize the service for another, underserved group.

2. Fee for Service – Beneficiaries pay directly for the goods or services provided by the social enterprise.
3. Employment and skills training – The core purpose is to provide living wages, skills development, and job training to the beneficiaries: the employees.

4. Market Intermediary – The social enterprise acts as an intermediary, or distributor, to an expanded market. The beneficiaries are the suppliers of the product and/or service that is being distributed to an international market.

5. Market Connector – The social enterprise facilitates trade relationships between beneficiaries and new markets.

6. Independent Support – The social enterprise delivers a product or service to an external market that is separate from the beneficiary and social impact generated. Funds are used to support social programs to the beneficiary.

7. Cooperative – A for-profit or nonprofit business that is owned by its members who also use its services, providing virtually any type of goods or services.

SOCIAL ENTREPRENEURSHIP BUSINESS MODELS

According to Trico Foundation," Social Entrepreneurship uses business models – selling products or services – to solve social problems." Acumen defines social enterprise as: "Any enterprise that prioritizes transformative social impact while striving for financial sustainability."A social enterprise approach is only a means to an end: the profit-making strategies are not in place for profit maximization but are in place as an essential component to bring about social or environmental change in a meaningful and long term way.Social businesses focus on double – or triple – bottom line business practices that lead to social, environmental and economic profitability.With goals to achieve both social impact and financial sustainability, social enterprises look to a unique set of business models to achieve their goals.

Table3.:Social Entrepreneurship Business Models

Theme	Business model	Example
Social Supermarket	Fee for Service.	Community Shop
Used Textbooks for Social Change	Cross-compensation and Independent Support	Textbooks for Change
Sustainable Water	Fee for Service.	Water Health International
Micro Lending	Market Connector.	Kiva
Baking/Cooking for a Social Cause	Employment and Skills Training.	Edgar and Joe's
Efficient Wood Stoves for Developing World	Cross-Compensation.	Bio Lite
Innovative Information Product	Cross-Compensation.	Information Blanket
Micro Power Generation	Fee for Service	Husk Power
Socially Conscious Consumer Electronics	Fee for Service and Market Intermediary.	Fair Phone.
Education Books on a Social Topic	Fee for Service and independent support	Chef'sCollaborative Network
Ultra-Modern Technology to Attract Economic Development	Fee for Service. Cooperative	O-Net
Beauty Products to Support a Social Mission	Independent Support	Bottle 4 Bottle
A marketplace for social good	Market Intermediary	Do Good Buy Us and Ten Thousand Villages
Exercise equipment for social outreach	Fee for Service and Cross-Compensation	Rubber Banditz
Educational travel company	Fee for Service	Think Impact and Evolution
Food for Philanthropy	Independent support.	Newman's Own and Late.
Water for everyone!	Cross-compensation	Soma Water
Micro-Giving for easy philanthropy	Cross-compensation or independent support	B1G1.
Social products and employment for the underserved	Employment and Skills Training, Fee for Service	Livelyhoods

MAJOR CHALLENGES FACING SOCIAL ENTREPRENEURS

The social entrepreneur seeks to implement innovative and creative ideas to solve large-scale social problems in a sustainable way. A social enterprise faces the same issues that any traditional business faces in its growth and operations. But social entrepreneurs also face unique challenges in delivering the social value, social returns or social impact of the enterprise in addition to commercial value.

Funding

Social enterprises can be run as for-profit or non-profit and sit somewhere in the middle of the traditional corporation and a purely charitable organization. Some organizations are able to generate sufficient income through the sale of socially beneficial goods or services, but many are not. Other funding opportunities include corporate investment, donations and government funding. Approaching investors may not be easy, however, if the organization is perceived as more non-profit than profit-oriented and not likely to make a reasonable return for investors. On the other hand, many donors are distrustful of a social enterprise being run as a for-profit company where too much focus may be placed on wealth generation and too little on social value.

Communicating Value Objectively

The social enterprise delivers more than commercial value, and it is the additional social value that often ignites the passion of the social entrepreneur. This in combination with the fact that social value is not easily measured can make it difficult to communicate the bottom line to investors, donors or the community at large. It is important to stay objective to remain convincing, and to make the right decisions in moving the enterprise toward its goals.

Strategy and Long-Term Focus

It is important to any business to identify a long-term strategy, define appropriate goals and drive growth in a sustainable manner. Difficulties for social enterprises again stem from the fact that the purpose of the organization is to create social benefits. It is often the case that multiple social benefits can mean multiple goals, all of which must be evaluated in terms of cost of provision to ensure true value creation. A strong strategy will identify a unique value proposition compared to other organizations and indicate clearly what the organization will not do. Activities of the social enterprise should work together and reinforce each other.

Remaining True to the Mission

Establishing a good strategy for the social enterprise will help to mitigate the possibility of mission creep. It is often easier to fight fires and not focus on the long-term goals of the organization, but this could result in an undesirable shift in the social value provided. A successful organization will continuously review strategy and work to improve it, but changes in the mission can cause confusion and dilute the organization's impact.

INCUBATION CENTRES FOR SOCIAL ENTREPRENEURS IN INDIA

ALC India Incubates and mobilises funds for ruralentrepreneurs. Transforming India

Initiative (TII) fellowship programme

Jaaga Sustain Incubates entrepreneurs who usetechnology to solve environmentalchallenges

Deshpande foundation(Karnataka)Incubates entrepreneurs launch scalablemodels (through grants and mentorship) insocial sectors

JSiE (Jindal, Haryana) Provides entrepreneurship training

Action for India (Bangaluru) Incubates social entrepreneurs working inagriculture, education, energy, healthcare,financial inclusion and livelihood sectors

CIIE (IIM Ahmedabad) Incubate the innovators through theirpartnerships with investors, developmentagencies, mentors and corporates, 56ventures already, iAccelerator

Incubator (RTBI) IIT MadrasOffers mentorship, infrastructure,preliminary funding and access tonetworks, for startups be they in earlystage or towards completion

Dell Foundation IndiaProvides mission-driven impactinvestments. It works in tandem with

Startup India, Skill India, and Digital Indiato ensure sustainable scaling or enterprisesthat it supports.

UnLtd India (Maharastra)Focuses on building entrepreneurialmindsets rather than enterprises, as theyare made for life

Villgro

Incubates and invests in social enterprisesthrough prototyping and early growth

phase. They provides a 100 day incubationplan with human resource, technical, and

financial advisories and go-to-marketstrategies.

DasraFocuses on strategy building fund raising,impact assessment and talent management

FUNDING SOURCES FOR SOCIAL ENTREPRENEURSHIP IN INDIA

Acumen Fund : It supports sustainable enterprises providing the poor withcritical goods and services at an affordable price. Primary focus on healthcare,housing, water, energy and agriculture

VenturEast: It builds profitable businesses that cater to under-served markets.Focuses on meeting India's domestic needs (primarily rural and semi-urbanmarkets)

Oasis Fund: It supports enterprises that develop innovative solutions thatprovide the poor with better access to critical goods and services. Investsmostly equity, with some debt.

Song: It supports entrepreneurs in high-growth sectors like education andtraining, agriculture and food, healthcare, financial services, basic utilities(waste, water, rural telecom, affordable housing, etc)

Aavishkaar India Micro Venture Capital: It creates sustainable change byincreasing economic activity at the bottom of the pyramid and boosting theentrepreneurial spirit.

Gray Matters Capital: It invests in the information, communication andtechnology space to bridge the urban-rural digital gap

Elevar Equity II: It creates market-based solutions for poverty eradication.Focuses on sectors like healthcare, education and information.

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Chapter -13

Marketing Strategies and Support Services in Mushroom Production

Santosh Kumar
Department of Plant Pathology, Bihar Agricultural University, Sabour, Bhagalpur-813210 (Bihar)

Mushroom cultivation is considered as an alternate source of income generation in which rural youth can play a vital role without sacrificing their household responsibilities. This practice will not only maximize their farm-income and generate self-employment but will also restrict the migration of rural youth to urban areas and can be proved as a very successful tool for rural development as it can be well adopted by poor, small and marginal farmers, farmwomen, landless labourers, unemployed youth and even retired or in-service personnel in rural areas to an extent (Das, 2014; Biswas, 2015). This is the high profit venture and dose not require much capital or access to land, as mushrooms can be grown on substrate prepared from any clean agricultural waste material.Commercial cultivation of mushroom might prove 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. In India, the mushroom industry is faced by improper marketing system and support services.Therefore, there is need to popularizationand promotion of mushroom industry through the well-developed marketing strategies and support from Government and Non-Government agencies.

Introduction

Globally, mushroom production increased more than 25-fold during the last 35 years (from about 1 billion kilogrammes in 1978 to 27 billion kilogrammes in 2012) (Royse, 2014). China is the largest producer and consumer of mushrooms in the world followed by USA and Netherland. India has witnessed a conspicuous growth in mushroom production due to favourableagro-climate conditions and rich fungal biodiversity. At present, India's total mushroom production is approximately 0.13 MT (million tonnes) however, it is less than 1% of global mushroom production (Wakchaure, 2011). Out of the total mushroom produced, the share of white button mushroom is highest with 73% followed by oyster mushroom (16%), paddy straw mushroom (7%), and milky mushroom (3%). In comparison to vegetables the per capita consumption of mushrooms in India is meagre with less than 100 grams per year per person. In the year 2016-2017, Indian mushroom industry generated revenue of □ 7282.26 lacs by exporting 1054 quintals of white button mushroom in canned and frozen form.Himanchal Pradesh, Punjab, Uttrakhand, Haryana, Uttar Pradesh, and Tamil Nadu were the leading producers of mushroom in the country (Prakasam, 2012). The present production status revealed that, Maharashtra and Odisha are emerging as the leading states in mushroom production.

Mushroom cultivation

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). There are diversegroup of edible mushrooms, out of which usually four types viz., button (Agaricus sp.), oyster (Pleurotus sp.), paddy straw (Volvariellavolvacea) and milky mushroom (Calocybe indica)are commercially cultivated in most of the states of India. Button mushroom (Agaricus bisporus) is the most popular and widespread and still dominating the Indian and International market. It grown for bothnational

and international market. This mushroom requires hi-tech infra structure for quality production. Oyster mushroom is one of the Easiest cultivatable mushroom which are commercially produced in both India and overseas.This mushroom cultivated on wide range of agricultural wastes and suitable for both temperate and sub-tropical areas. 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.Post-harvest processing particularly dehydration/sun drying and value edition is easy of this mushroom. Paddy straw mushroomis another quick growingmushroom in South East and East Asian countries. In India, Odisha is the most leading state for cultivation of this mushroom and accessible in every nook and corner of the state. This mushroom is known for excellent test and flavour and has very short cropping cycle. Milky mushroomis also calledIndian mushroom and is most suitable for tropical condition. Currently this mushroom is being commercially grown in South Indian status such asTamil Nadu, A.P. and Karnataka. wheat straw, Paddy, lentil, 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.

Marketing strategies

Marketing and consumption of the mushroom and derived product is one of the important factors which govern the development of mushroom industry. In India, mushroom marketing is often limited and not yet well organized. It is the simple system of producers selling directly to retailer or even to consumer, which has its own limitations. Direct marketing of mushrooms at local farmers' markets, to restaurants, to hotels or in supermarkets is possible in many locations. Local grocery stores are another potential buyer of fresh mushrooms. The domestic marketing channels lack adequate price support faced with erratic demand and supplies. Now a day digital marketing may also play important role in promotion and awareness of mushroom industry through the active social media. E-Kisan market (KisanMandi.com)and Agricultural Marketing Information Network (AGMARKNET)is one of the most popular digital marketing platforms. Some common methods for conducting initial marketing research includes;

- Buyers observation
- Surveys of stores
- Customer demand
- Individual interviews with growers
- Marketing analysis
- Competition assesses.

This will help you determine what market already exists and identify any niches you could fill. To find out more about your competitors, use their products. Talk to them. You may be surprised how much information they will share.

Strategies for successful mushroom marketing

1. Effective storage and transport facility

2. Diminish the cost of production and bring down the sale price to boost the demand.

3. Expand the market area and strengthen the demand

4. Good prepacks for eye appeal.

5. Guide retailers about handling, storage, food value and recipes.

6. Approach supermarkets, chain vegetable stores, mother dairy retail counters for retail sale.

7. States should fix minimum support price.

8. Public sector marketing, processing and export organizations should come forward.

9. Assured supply throughout the year at a reasonable constant price is key to good marketing.

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.

Support services and promotion strategies

Various Governmental and Non-Governmental agencies are involved in the production of fresh mushroom and their 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 controlled conditions. Indian government has interacted with the State Governments, Agricultural Universities and ICAR institutions to export and exploit the emerging potential of mushroom.The National Centre for Mushroom Research, Solan, Himachal Pradesh is leading institutionin terms of research and extension activities of mushroom. This instituteserves as a training and capacity building centers on mushrooms in addition to mushroom mela, exhibitions and on farm trials. ICAR-AICRP on mushroom running in various Agricultural Universities has played important role in the training of entrepreneurs leading to establishment of a good Mushroom farms. The Indo-Dutch Mushroom Project, Palampur under the aegis of state Directorate of Horticulture, are supplying compost to mushroom growers in many districts of India. National Agricultural Cooperative Marketing Federation of India (NAFED) is also involved in promoting and developing market strategies in mushroom besides processing and storage of mushroom produce and distribution of machinery use in mushroom business.National Bank for Agriculture and Rural Development (NABARD) an apex body for regulation of regional rural and apex cooperative banks in Indiaprovides refinance support for credit linked capital subsidy schemes. It helps in flow of credit for promotion of thrust activities in mushroom agri-business. 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 advertise, literatures, posters and demonstration may be highly helpful to aware the people and mushroom the consumers.

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Chapter -14

Entrepreneurship Opportunities through Livestock based Agribusiness Models at Farmer's Field

Y. S. Jadoun*, Pragya Bhadauria[1], Jaswinder Singh[2] and Arunbeer Singh[3]
*[,2,3] Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana (Punjab)
[1]ICAR-ATARI, Zone-1, PAU Campus, Ludhiana (Punjab)
*Corresponding Author Email ID: ysvet1203@gmail.com

Abstract

Entrepreneurship is a key aspect for the survival of small-scale farming in an ever-changing and progressively complex global economy. Farmer-entrepreneurs see their farms as a business. They see their farms as a means of earning profits. They are enthusiastic about their farm business and are willing to take calculated risks to make their farms money-making and their businesses to cultivate. Farmer-entrepreneurs run in a complex and dynamic environment. They are part of a larger collection of persons including other farmers, suppliers, traders, transporters, processors and many others. Each of these has a role to play in producing products and moving them through to the market – through the livestock value chain. However, in the present times, there are many innovative and progressive farmers operating the successful livestock-based business modules which provides the good economic return and profit to the farm families and these business modules needs to be replicated at regional, state and national level. Beyond this, successful farmer-entrepreneurs become more technically competent, innovative and plan ahead so they can direct their farm businesses through the stages of enterprise development – from establishment and survival to rapid growth and maturity.

Key words: Agribusiness Models, Entrepreneurship, Livestock

Overview

India is an agriculture-based country and the livestock are more equally distributed than the land and therefore it continues as subsidiary occupation of most of the rural inhabitants. In India, the share of livestock output to agriculture has been increasing and now it accounts for 27% of agricultural output and 5.4% of total national GDP. About 90% of livestock is owned by small farmers and landless rural households that are extensively dependent on income from the sale of milk, meat and live animals to meet their daily household expenses. It also provides draught power and organic fertilizer for crop production; serves as store of wealth and means of transportation (Garcia, et al., 2006). Even in the mixed farming systems, 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).

Since most of the animal production is handled by poor farmers with limited resources that are not likely to benefit directly from advanced technologies beyond the level of the extension services. In India, there is increasing pressure on farmers to commercialise their farming operations due to declining land size, which means that farmers need more intensive production systems to support their family needs; urbanisation and rapid population growth and general modernisation. This means that farming families need to generate larger incomes to support their family needs and expectations in terms of medical support, education, transport, communication and to cover the rising costs of their cultural traditions. In order to

support the small and marginal farming sector, there is immense need to upgrade farming to a commercial activity. To stay relevant and meet the needs of the rural farming community, rural entrepreneurship is the potential tool which can be used as a promising intervention that could promote and speed up the development process. Apart from the potential benefit of offering employment, rural entrepreneurship is seen as a way of improving the quality of life for individuals, families and communities and sustaining a healthy economy and environment. Therefore, agripreneurship is becoming a key factor in the survival of smallholder farms that have to keep up with the demands of a changing scenario.

Why Livestock as Business Enterprise?

In India, majority of livestock farmers are merely at subsistence stage more due to compulsion than their personal choice to practice animal rearing. Similarly, a significant proportion of youth do not take over the family farming, but often unemployed or work informally in unpaid, low skilled, insecure and hazardous jobs, leading to massive migration to cities. They prefer to migrate to nearby cities for alternate livelihoods meeting their aspirations, rather than putting laborious efforts in a low profile and less remunerative farming. Livestock farming is no longer seems to be appealing enterprise among these youth as their aspirations are not compatible with the opportunities available to them in this farming. Despite the decline in interest in livestock farming, many have to work on their farms as a last source of subsistence and livelihood. As farmer's production is mainly oriented towards household consumption needs and the MSP (Minimum Support price) when compare to an entrepreurs. They manage their farming activities as livelihood source but do not generally run the enterprise as a business person. They generally possess technical and managerial skills but lack entrepreneurial drive to take calculated risks to overcome agribusiness challenges related to accessing remunerative markets, timely finance, low bargaining power, regulations, appropriate technologies and information access.

However, in the present crisis, there are some innovative and progressive farmers that select livestock farming as economic enterprise when it offers real business opportunities. An entrepreneur farmer is someone who produces for the market and always looks for opportunities to improve and expand his business by taking calculated risks. Only a small percentage of farmers try new breeds, adopt alternate technologies and package of practices to make livestock farming profitable business. Here comes the role of livestock entrepreneurship which has been recently evolved phenomenon for an individual who organizes or operates a business to qualities that define a successful business person. There are certain broader areas of rural economy that provides number of self-employment and income generating opportunities in which rural people can be gainfully employed as livestock entrepreurs. Along with this, livestock rearing at the household level is largely a women-led activity and therefore, rural women can also be a potential clientele for the same. By looking at the present scenario of youth and women in rural area, micro enterprise or small-scale entrepreneurship may be a tool for self employment. Entrepreneurship development through livestock farming can serve as better option without disturbing their social and cultural ecosystems. Micro-enterprise development related to livestock management activities like dairy farming, small scale commercial livestock faming of sheep, goat, rabbit or pig, poultry farm, livestock feed production, food processing, waste management, fodder production. Organic livestock farming can be an important area which will provide them a better opportunity. It is also an effective instrument for women to add to the family income while taking care of their own home and livestock task. It is not only to increase national productivity or to generate new employment, but it helps the farmer to enhance their personal capabilities and social status in the society as a whole.

Only the attention has to be paid in improving their participation in acquiring the knowledge, capacities and skills for promoting self-employment though their available resources. Educating farmers in the areas of agribusiness management, marketing and entrepreneurship would help them see livestock farming more as a profitable enterprise than a last resort. It posed an interesting challenge to educate and communicate key agribusiness principles to farmers in a simple and easy to understand language. Therefore, it is important to develop relevant business, marketing and entrepreneurship training content and methodologies that could empower farmers to manage their enterprise successfully. It can be achieved through inculcating the technical know-how of the commercial livestock farming through Krishi Vigyan Kendra and connecting them to incubate their idea to sources of financial credit for agri-enterpreneurship.

Micro-Enterprise Development

Livestock entrepreneurship relates to producing and marketing of various livestock products as well as inputs. Most smallholder farmers produce food for their families, but at the same time, almost all smallholders sell a portion of their produce into various markets. Although, the major barrier for small farmers that they could never take up farming to an enterprise level individually due to lack of capital and other resources involved. Therefore, small entrepreneurs may work alone and keep the profit of their ventures for themselves, or they may choose to become part of a farmer group where they invest in their production system as an individual but sell collectively. Over time, farmers are increasingly entering into regular business relationships with other value chain partners. They tend to shift from working as individuals towards some form of cooperative or contractual marketing approach and, if successful, they go on to create medium to large-sized businesses. Within this context, farmers are seen as agripreneurs and farmer groups or cooperatives are seen as enterprises. Farmer groups are primarily organisations of farmers, typically informal in nature with a membership of 15–50 farmers. Cooperatives are larger, second-order and more formal associations that look after the interests and causes of farmers. Farmer organisations, which are often community-based, can be grouped into two types: resource-orientated organisations and market-orientated organisations.

However, sustainability of these farmers' institutions requires entrepreneurial and management skills for managing staffs and board members, accounting, managing profit and losses, procurement, inventory management, building partnerships with retailers, traders, private players and government agencies, business and marketing strategies, and awareness on rules and regulations that small farmers lack currently. Even though farmers may be innovative and entrepreneurial, they often lack the know-how to engage with markets on a consistent basis and they need the advice and support of extension services to shift from opportunistic sales to regular and consistently profitable sales. Also, government's efforts of promoting groups didn't focus much on the needs for building such capacities of farmers to manage group successfully and sustainably. Therefore, these farmers' institutions find it difficult to breakeven and continue to depend on field NGOs even after several years of support.

In order to meet the challenges of becoming livestock entrepreneurs, farmers particularly smallholder farmers and farmer groups need to expand their understanding of markets and economic opportunities. In this way, the present extension services have to shift from focusing on poverty reduction to include value capture and wealth creation through these enterprises. Strategies also need to take on a more market focused and systems approach to work in ways that strengthen the roles and opportunities of other actors in a value chain, such as farm workers, input suppliers, warehouse managers, transport companies and financial services, so that they can all work towards a common business goal. Government also needs to

change it's policy and role to empower farmers to decide prices of agri-produce and replace old inputs based subsidy approach that benefit mainly input suppliers with an output based price incentives directly to farmers. Recent attempts to organize farmers into FPCs (Farmer Producer Companies) have been facilitated by combined efforts of government agencies and field NGOs primarily to help farmers become agripreneur to diversify into various agribusiness enterprises related to trading agri tools and equipments, value added products, certification and marketing, agri-inputs and trade, and. The Producer Company Act allows small and marginal farmers to join hands with other local resourceful farmers to form FPCs to take up agribusiness enterprises, and become entrepreneurs. In this way, they should be able to achieve success in running their farms, groups and cooperatives as sustainable and profitable businesses.

Successful Livestock based Agribusiness Models

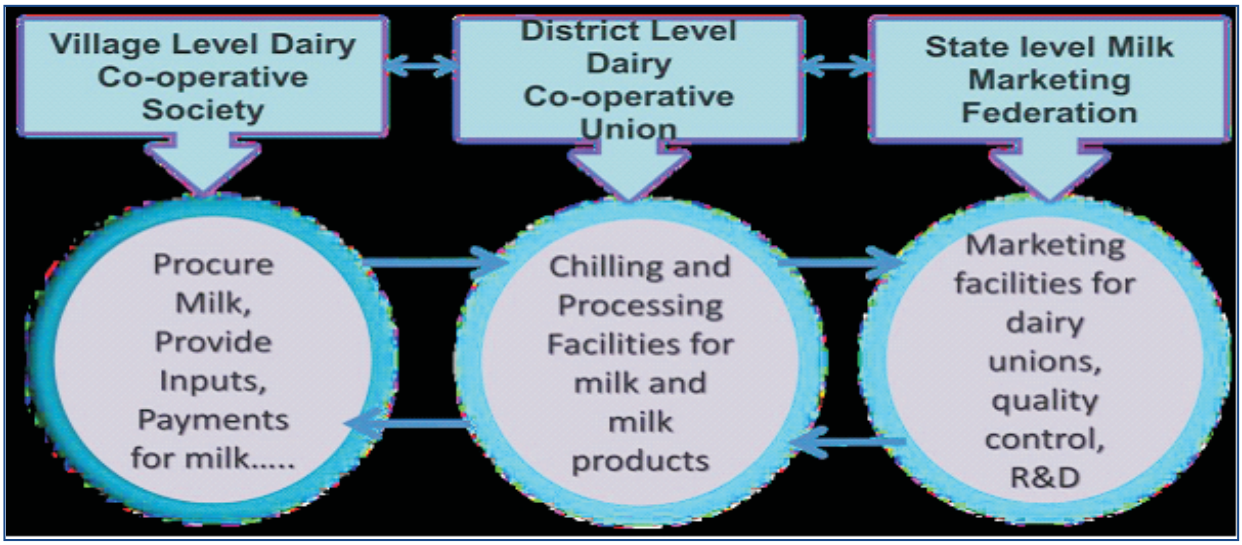
Entrepreneur associated with the livestock farming/business, production of livestock related raw materials and production, livestock related processing/value addition, marketing, input supply is considered as livestock entrepreneur. In other terms, a person who is linked directly or indirectly to the animal husbandry or livestock sector is referred as livestock entrepreneur.

1. Cooperative Milk Marketing Models in Dairy farming

Dairy farming is a large unorganized sector in India and a major source for livelihood of millions of rural masses. Commercial and small-scale dairy farming in India is no doubt playing an important role in the total milk production and economy of our country. Almost all regions of India are suitable for setting up dairy farming business. Since the dairy industry has become more consumer oriented due to health consciousness and increase in purchasing power leads to development of innovative practices of organized retailing, supply chain management, balanced product portfolio, product development. It leads to increase in demand for milk and milk products to ensure remunerative prices to milk producers and increased income generation. In India, 80% of the milk is marketed through the highly fragmented unorganized sector, which includes local milk vendors, wholesalers, retailers, and producers themselves. On the other hand, the organized dairy industry, which accounts for about 20 percent of total milk production, comprises two sectors: government and co-operatives. Within the organized sector, small dairy farmers can opt for co-operative sector. As milk production generally takes place in rural areas, whereas the profitable market exists in urban areas. Lack of transport facility, organized system of processing and marketing as well as farmer's margin in this occupation is very small. In view of these and several other constraints, dairy cooperative are considered to be most effective strategy for helping the rural poor without altering the village social structure by providing guaranteed market for milk at fixed price. Dairy co-operatives have succeeded simply because the farmers own and manage them. These are based on the AMUL model of maximization of farmer profit and productivity through cooperative effort. The core feature of these co-operatives is farmer control at all three stages i.e. procurement, processing and marketing of milk. At present eighty-two thousand Dairy Co-operative Societies (DCSs) across the countries have a strong membership of nearly 10 million landless, marginal, and smallholder milk-producer families (Rajendran and Mohanty, 2004). Various major brands brands are involved in cooperative milk marketing such as AMUL (Anand), Sudha (Bihar), Verka (Punjab) Dudhsagar (Gujrat), Aavin (Tamil Nadu), Sanchi (MP), OMFEED (Orissa), Nandini (Karnataka), Milma (Kerala) etc.

However, progressive farmers may also be guided for small scale dairy farming and commercial dairy business depending upon the capital investment. Farmer can start their own dairy farms by rearing small number of animals and with proper business plan, scientific management and care can ensure

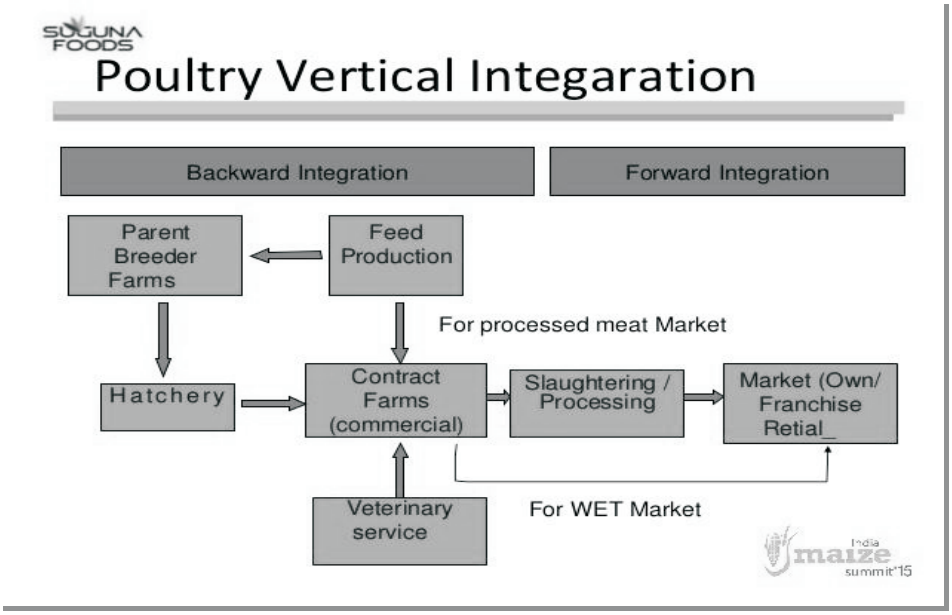
maximum production and profit from dairy farming business. If they have to expand their dairy enterprise on a commercial basis successfully, they have to adopt new and modern dairy farming tools, time and energy saving tools and techniques and other processing technologies. sp.), oyster (Pleurotus sp.), paddy straw (Volvariellavolvacea) and milky mushroom (Calocybe indica)are commercially cultivated in most of the states of India. Button mushroom (Agaricus bisporus) is the most popular and widespread and still dominating the Indian and International market. It grown for bothnational



2. Group Approach and Contract Farming in Poultry Sector

Poultry sector is the one of the fastest growing sectors with a growth rate of 8-10% per year. It is the only sector which is organized up-to 70% into commercial poultry farming. The rest of the 30% unorganized sector compromise of backyard poultry production mainly undertaken by the rural population for household food and nutritional security rather than for commercial purpose. This is mainly because of their distance from the market and a small marketable surplus. However, there are lots of successful models of women producers who have organized poultry production activities as Self-Help Group (SHGs) for income generating activity. SHGs seem to be a potential organization for rural women to harness income, job opportunities, improve quality life and standard of living in rural communities. Various centrally and state government sponsored schemes are also promoting BPL families mainly the women farmers under National Livestock Mission (NLM), Rural Backyard Poultry Development (RBPD) which covers beneficiaries from BPL families to enable them to gain supplementary income and nutritional support.

In commercial poultry production, contract farming is well practiced farming system where the farmers are given all the inputs such as chicks, feed, medicines and technical inputs, etc. Farmers have to rear the chicks and the integrator will take care of the marketing activities. Most success models can be seen in commercial layer and broiler farming offered by private companies like Venky's, Indian Broiler, Suguna Srinivas etc. In commercial poultry production smallholder producers can be linked to modern supply chains to reduce risks and uncertainty among both producers and buyers, manage quality and timing of supply. Later on independent poultry farms can be initiated as small medium and large scale basis according to the investment capacity.



3. Commercial Pig Farming

Among the various livestock species, pig has the highest feed conversion efficiency and dressing percentage (60 to 80%) after broiler, as they produce more live-weight. Pigs are the most prolific breeders with high fecundity and shorter generation interval. Pig farming provides quick returns since the marketable weight (80-100Kg) of fatteners can be achieved at the age of 7-9 months. There is a huge and ever-increasing market for pigs in India as there is significant lag between the demand and supply of pigs in the country. The pork is sold to abattoirs, local butcher shops, retailers, hotels, supermarkets, restaurants, wholesalers and individual consumers. The export market for pork is also very huge. The largest importers of pork are Japan, Russia, Hong Kong, China, South Korea and Mexico. Besides, piggery being an employment opportunity for farmers, it has also a commercial value as source of store fat/lard for which there is an increasing demand from poultry feed, soap, paints and other chemical industries. There is good demand from domestic as well as export market for pig products such as pork, bacon, ham, sausages, lard, bristles or hair etc. Pig's manure is widely used as fertilizer for agriculture farms and fish ponds. So, one can say every part of the pig's body is usable in various commercial industries that can be used by a farmer.

In general, pig farmers are small-holders downtrodden society practicing traditional methods of pig farming. Presently, commercial pig farming is no more restricted to lower class people. It becomes piggy banks for smart investors and entrepreneurs to take advantage of the huge demand for pork and many progressive entrepreneurs are already enjoying the lucrative benefits of this enterprise. They are also rearing small number of pigs in integration with fisheries and making a huge profit by judiciously utilizing their resources. Pig traders from Kerala, Assam and Nagaland themselves buying pigs from Punjab and transporting them in trucks. Now the farmers also started hiring coaches in direct train to Dimapur, Nagaland for selling the live pigs to North-East. Producers in this area are linked to markets in the conventional form of "Producer-Commission Agent-Seller-Consumer" channel. As few of the progressive farmers of Punjab has flourish their business to export the pork to other countries also. Farmers are also engaged in value addition of pork in form of pork, bacon, ham, sausages, salamis, pickles and other by-products which they are selling to different parts of country including Chandigarh, Delhi, Hyderabad etc.

The increase in pig farming in the state can also be ascertained form the fact, that pig farmers have also formed Farmer Interest Groups and Progressive Pig Farmers' Association (PPFA) in Punjab to economically harness this sector in near future. In Punjab only there are more than 200 pig farms and farmers from Malwa area of Punjab are getting handsome return from pig-cum-fish integrated farming. Some of the successful pig farms are Kotli Pig Breeding Farm (Ludhiana) Dhaliwal Pig Farm (Sangrur), B.T. Pig Farm (Barnala), Golden Hog Pig Farm etc.

4. Commercial Goat Farming

Goats are important part of rural economy, particularly in the arid, semi arid and mountainous regions of the country and are the backbone of economy of small and landless farmers in India. It is an insurance against crop failure and provides alternate source of livelihood to farmers all the year round. Goats play an important role in income generation, capital storage, employment generation and improving household nutrition. Goats are among the main meat-producing animals in India, whose meat (chevon) is one of the choicest meats and has huge domestic demand. Goat is mainly reared for milk, meat, sale of breeding stock as an income source. Their hide is used for the manufacture of leather products and hairs are used for the manufacture of rugs and ropes. Fibres like Pashmina shawls, Mohair and Kashmiri carpets are in great demand and are sold at very high prices. The manure is 2.5 times richer in nitrogen and phosphoric acid than cow manure. Now days, goat milk is in great demand because of its medicinal property as ayurvedic medicine for persons ailing with asthma, cough, diabetes, gout and other digestive problems etc. High demand for meat and its products with potential of good economic returns have been obtained from meat processing as its growth rate has reached up-to 12.68 %. This versatility of goats allows the producer to plan and operate a more stable economic production unit. An increased level of adoption of technologies and availability of good quality breeding stock would be essential to make the commercial goat farming more successful. Simultaneously, emerging favourable market conditions and easy accessibility to improved goat technologies are also making this enterprise a profitable venture.

5. Feed Manufacturer and Supplier

The growing demand for animal products worldwide largely depends on the continuous supply of good quality nutritious feeds to livestock farmers to grow various species of livestock. Animal feed production and supply will play a significant part in near future. As farmer spend about 70% of its input cost on feed alone, so livestock feed manufacturing is a profitable business. As India has largest livestock population and the growth of India's feed industry is 8% and it primarily consists of cattle feed and poultry feed segments. Farmers can start their own feed mill units for various livestock and poultry species with proper planning and know-how about the right mixing formula. Although, animal feed manufacturing is a capital-intensive business. To start up, one should require machinery such as bagging equipment, conveyors, mixers, dryers, scales, extruder, pelleting equipment and grinders. The raw materials for making feed will also require a good amount of capital. To save costs, most feed manufacturers like to take advantage of price fluctuations of feed ingredients by buying in bulk when prices are low; or by contracting for supplies months ahead. Additionally, identifying cheap raw material and seasonally modification in feed composition to remain price competitive while delivering good quality food is also necessary for better profitability. However, there are various factors restraining growth of the market which includes high import duties on feed ingredients, vague regulatory regime, volatility in raw material prices and frequent disease outbreak.

6. Fodder Production and Supplier

The main constraint which hampers the growth of livestock production is the inadequacy of nutritious fodder. The availability of green fodder throughout the year has been a very important issue for the dairy farmers as this is very common that green fodder is surplus in some months and dairy farmers face shortage in other months. There is shrinkage of open land for cattle grazing and only 4% of total cultivable land under fodder production. As there is more than 60% fodder deficit in India, farmers especially women through group approach, purchase fertile land or some community land to produce green quality fodder and supply them to the nearby livestock farmers. They can also establish community fodder banks or fodder seed banks in the potential areas.

Progressive farmers can also take up the upcoming venture of silage making from green fodder through advanced technology machines of silage balers. The silage bales from green fodder could be easily wrapped and packed in bags, tubes and easily transported to small, landless farmers, urban dairies and green fodder deficient states. This would also provide new business and self-employment opportunities to the farmers of the as they could flourish this business by selling packed silage to the landless and needy dairy farmers across the country. In Punjab the government has launched a scheme to provide 40% subsidy to the farmers on the Silage Baler-cum-Wrapper machines through the Punjab Dairy Development Board to make dairy farming more advanced and profitable. In near future, advanced techniques like hydroponics, drip irrigation; vertical farming can also serve as promising agribusiness for fodder cultivation which takes up less space and upto seven times increase in yield as well. This is required especially in areas where there is extreme shortages of water and draught affect located in the arid areas where seasonal effects take place and finding fodder is hard and it doesn't grow on its own. Progressive farmers of Khalsa Silage from Gurdaspur and Harinder from Muktsar Sahib are role model in Silage bale making.

7. Livestock Products Processor

Value addition is another important concept in the livestock sector. Value of the products get increased many folds during processing and thereby provide excellent returns. Traditionally, processing comes into picture when there is surplus production and/or there is demand for value added products. Processing of raw milk into products such as flavoured milk, butter, ghee, cheese, yogurt, condensed milk, skimmed milk powder, ice cream etc have huge profit potential. Generally, cow milk can be used to produce dairy products, but as per the upcoming demands goats, sheep and camels are also been extensively used now a days. Sometimes donkeys are used to produce an alternative to cows' milk for babies. India is one of the fastest growing markets for cheese with a total consumption of about 7,000 tons a year. Similarly, there is huge market for ice cream and milk powder as a segment of dairy food market. Farmer can start their milk parlour, where they can sell processed milk and milk products etc.

Similarly, the demand for meat and meat products continues strong in India and will be the key driver for livestock sector. Emerging consumption of convenience and value added meat products will not only diversify the food production system, but also will provide huge employment opportunities to large number of micro, small and medium scale entrepreneurs Processing of meat is primarily done to add value to the meat for better marketing and distribution. However, hardly 1% of the total meat produced in India is used for processing against to more than 70% in developed countries. The meat produced for the domestic market is sold as hot meat (pre-rigor meat without any chilling). However, sale of fresh meat may yield 4-5% margin, however, processing into value added meat products such as dried meat, smoked meat, canned meat, emulsion and reconstructed meat products of poultry, chevon, mutton, pork, fish etc. could be sold will

result in 15-20% profit margin for meat processors (Naveena et al., 2011). Marketing of these value-added products could be done in their own brand name and they can start chain of parlours/hotels later. Packaging of dairy and meat products is also another very promising area. However, it further needs ISO, HACCP certification. Huge investment is needed in animal sector, especially meat sector, in order to supply the country with reliable, safe and high quality meat and meat products.

8. Organic Livestock Production

Livestock farming is becoming attractive and glamorous among educated youths especially in the production of organic products such as pure cow milk and organic milk, organic eggs in peri-urban areas. Rearing of desi cattle provides economic benefits to farmers and health benefits to consumers. The desi cow milk or A2 milk are supposed to have medicinal benefits thus fetches higher rates to the rural economics. Similarly, desi cow ghee/A2 ghee, organic or designer eggs are also in great demand due to health consciousness. There is an also untapped opportunities for skin care product industry taking into account that organic products are natural, chemically inert and non-toxic when used on the skin. Milk based, dung based and urine-based skin care products are available. This is due to milk proteins and rich amino acids in the formula they will not irritate the sensitive skin. Some of the Start-ups like; Cowpathy, make soap, toothpaste, floor cleaners, hair oil, incense, shaving cream and face wash.

9. Animal Waste Management

Dairy farming with biogas plant and distillation plant is very lucrative for new entrepreurs. Animal waste especially dairy animals waste can be utilized as biogas units for producing gas, manure and other products made out of cow dung. Gobar pots are an excellent sustainable option for plastic pots and are a best out of waste project and the Gobar logs could replace the place of wood. These pots are ideal gifts and Cow dung logs could be used in havans, crematoriums and bonfires. Dhoop and Agarbattis made of cow dung and some havan samagri could purify the home atmosphere. Similarly, cow urine/goumutra of native cows is used as manure for organic farming. Distilled cow urine when consumed also has medicinal values to increase the immunity and serves as detoxifier. The cow urine is used to cure skin diseases, kidney and liver ailments to obesity and heart ailments. Installing cow urine distillation plants for helping collect the urine and distill that in turn could be used to make fertilizers and pest repellants. Thus, the farmers save on buying pesticides and manure for urban gardens instead of chemical fertilizers. Other products like Panchagavya, Amruth Jal and pest repellants like Jeevamrutha etc could be also harnessed.

10. Male Buffalo Calf Rearing

Livestock farmers do not consider raising of male animals to be remunerative; as a result, the country suffers a huge economic loss per year. The farmer sees the male buffalo calf as a liability and cull the same for obvious reasons. However, it could be an income-generating source by utilizing them for meat production and recovery of hide, thereby improving economic condition of poor farmers and providing quality meat for export market and domestic consumption. The demand for buffalo meat is high in most of the Asian and European countries because of its high protein, low fat and cholesterol content and fewer calories compared to other red meats. According to Agricultural and Processed Food Products Export Development Authority (APEDA) 13.5 Lakh tons of buffalo meat exports from India. It is one of the largest buffalo meat exporters in the world especially Vietnam, Malaysia and Egyptian country.

In this regard, a MoU has also been signed between Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana and Rural India Solutions (RIS), Pune for promotion of

rearing male buffalo calves under the SWADHAN scheme in various districts of Punjab. Under the schemes male buffalo calves are reared at farmer's field's upto the age of 22 months for economic meat production, recovery of hides to enlarge raw material base for leather industry and to generate employment opportunities in rural area with a free preventive health care and feed supply to them. Later on, the firm buy back these buffalo calves at market rates set at the time of signing the contract with farmers. Similarly, GOI scheme "Salvaging of Male Buffalo Calves" is also running in the country to promote buffalo calf rearing among the farmers.

11. Semen Production

The productivity of dairy animals in India is considerably low that can be increased significantly from genetic import and selection of elite animals. Entrepreneurs interested in dairy farming often face the problem of shortage of high yielding animals. There is a good scope for establishing breeding farms especially of male germplasm for supply of high grade semen straw to new comers in dairy business. Farmers can rear best of bulls; cross breeds them, checks out the semen for both productivity and resistance to diseases, and then sells the semen to other farmers and start up. But this venture requires a huge capital investment for establishment of state of art facilities to collect semen, grade and storage. Best example is of Yuvraj a Murrah Buffalo bull owned by a progressive farmer Karamveer Singh of Kurukshetra, Haryana state produces around 45,000 doses every year. The bull semen is one probably most expensive in India, costing up to 350 rupees a dose. A single ejaculation, triggered with the help of teaser animal or electro-ejaculation method generate 5-6 ml semen. Collected semen diluted scientifically and 500 to 600 doses prepared. As single dose cost Rs.@300/-, thus from a single dose of one ejaculation can be earned Rs. 150,000 to 180,000. Similarly, there is increasing scope for semen of indigenous cattle like Gir, Sahiwal, Bachaur, from different parts of the country.

12. Hatchery Business

In the poultry farming industry, the term hatchery covers the sector which is engaged in production and supply of one-day-old chicks by artificial incubation. Day old chicks are produced keeping in view the customer's requirements. A small-scale chicken hatchery is a lucrative business to start. However, the business demands sufficient knowledge and skill. Starting a hatchery requires higher investment but it offers good return.

Organizations and Schemes for Promotion of Agribusiness

For imparting training and skill for tapping, developing and harnessing the entrepreneurial qualities of rural people, various government agencies are offering different programmes and schemes.

1. National Institute for Entrepreneurship and Small Business Development (NIESBUD) under Ministry of Industry (now Ministry of Small Scale Industries), Govt. of India, as an apex body for coordinating and overseeing the activities of various institutions/ agencies engaged in Entrepreneurship Development Particularly in the area of small industry and small business.
2. Ministry of Small Scale Industries: Ministry of Small Scale Industries is the nodal Ministry for formulation of policy, promotion, development and protection of small scale industries in India.
3. Small Industries Development Bank of India (SIDBI): Small Industries Development Bank of India (SIDBI) is the principal financial institution for promotion, financing , development of industry in the small scale sector and coordinating the functions of other institutions engaged in similar

activities.

4. Web-portal, epashuhaat.gov.in of DAHDF, MoA&FW has launched a in 2016. It provides real time access to relevant information on germplasm and live animals. It helps connect breeders, state agencies and farmer stakeholders. It is the first step in unifying and harmonising the livestock market.

5. Agri-Business Centers: For the growth of an ecosystem that links farmers with markets, entrepreneurship and agribusiness ventures need to be promoted. To provide a nurturing ecosystem for the growth of entrepreneurship, business incubators are now gaining recognition as a vital link between agriculture and industry and the improvement of economic, social and environmental conditions especially of rural communities. Agri-Business Incubators are innovation hubs funded by Indian Council of Agricultural Research (ICAR) which offers technical and business mentorship, network of industry experts as well as access to government grants and funding platforms. It supports to agri- startups in scaling up their business and commercialise their product.

6. RKVY-RAFTAAR: It is a uniquely designed incubation program specifically for early-stage agri-startups, with an aim to promote innovation and entrepreneurship in the field of agribusiness and allied sectors. In this process, incubation facilities and expertise available with the participating academic, technical, management and R&D institutions in the country shall be utilized on an individual or collective basis to harness synergies.

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