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FOOD PROCESSING

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Food Processing - Route to Sustainability

Food Processing is the transformation of any raw product of agriculture, dairy, meat, poultry or fishing for an escalated commercial and consumption value along with shelf life. The Food Processing Industry (FPI) is of enormous significance as it provides vital linkages and synergies between the two pillars of the economy, i.e. agriculture and industry.

Food processing has numerous advantages which are specific to the Indian context.

- **Employment Generation:** It provides direct and indirect employment opportunities because it acts as a bridge between Agriculture and Industry.
- Doubling Farmers' Income: With value addition through food processing, there will be a commensurate rise in the price paid to the farmer, increasing his income.
- **Reduce food wastage:** NITI Aayog estimated the annual post-harvest losses of close to Rs 90,000 crore. With greater thrust on proper sorting and grading close to the farm gate, and diverting extra produce to FPI, this wastage can be reduced, leading to better price realisation for farmers, e.g. frozen Safal peas are available throughout the year.
- **Boosts Trade and Earns Foreign exchange:** It is an important source of foreign exchange. For example, Indian Basmati rice is in great demand in Middle Eastern countries.
- **Curbing Food Inflation:** Processing increases the shelf life of the food… thus keeping supplies in tune with the demand… thereby controlling food-inflation.
- **Crop-diversification:** Food processing will require different types of inputs, thus creating an incentive for the farmer to grow and diversify crops.

Way Forward for the Growth of Food Processing Industry

- Storage capacities and infrastructure should be upgraded.
- **There is need to develop the agrarian setup with practices that lead to diversification of crops.**
- **Backward linkages to farmers need to be made more robust.**
- **Effective contract farming models are needed to shield farmers from price volatility.**
- **Skill development is required at farm gate and processing levels.**
- **Public investment and connectivity should be encouraged and escalated.**
- **There is need to encourage our domestic start-ups and industry, instead of promoting international companies.**
- We need specific training institutes on technology for agri-entrepreneurs in all states.

The June edition deliberates upon all crucial aspects of the Food Processing Industry and the way forward for its growth.

Happy Reading

Mamta

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DR. M.J. KHAN

Food Processing: Promising Extra Gains To Growers

India holds immense potential in the segment of food processing. Indian agriculture is racing towards becoming a $500 billion economy in a year or two, while Indian economy itself may take five years or more to become a 5 trillion economy. The need for giving a major boost to food processing has become absolutely essential for farmers to become major beneficiary of the gains of this growth. The poor agri infrastructure and distorted markets put the onus on the Indian food processing sector to insulate the farmers from the vagaries of high seasonal price fluctuations by through value addition longer shelf life.

The potential for investments in India and assurance of high returns are guaranteed with abundance of agricultural produce, skilled man power and a vast and diversified fast growing food market. India is the largest producer of many agricultural commodities, often creating gluts and fall in prices. There are opportunities galore in the food processing segment, especially beyond the conventional food processing activities. The Covid pandemic has opened up immense space for healthy, safe and hygienic food. This space can be effectively used, and in the process a stable market can be created for traditional immunity-building foods and snacks.

The ready to eat food category is seeing an exponential growth. Packaging is a lesser explored area demanding new age solutions capitalizing on the need of easy handling, longer shelf life, better dispensing quality, no loss of nutrients etc. Business ventures concentrating on automation-based technologies and robotics will have immense scope. Food safety has emerged as an important challenge in the event of enhanced food processing demands. Inadequate knowledge about food hygiene and the standards and certification is a major handicap. Measures to address this concomitantly will aid in the development and expansion of the food processing sector.

Temperature controlled warehouses for the perishables, cold storages and appropriate logistics are emerging as prerequisites for the development of the sector. This sector requires intensive efforts from the government and the corporate since it is investment heavy. The Scheme for Formalisation of Micro Food Enterprises 2020, launched by the Government of India @INR 10,000 crores could be game changer, as it envisages upgrading the technology, skills, products and systems of micro food units and food vendors, and linking the FPOs with food processing industry to unleash its full potential.

Today India's biggest weakness in the agriculture segment is over production, and the inability to timely channelize excess production for proper storage, processing or exports. Food processing can convert this weakness into big strength. If proper technologies are developed and made accessible at farm level, not only can we address the issue of wastages but also substantially increase the income from agriculture.

RAJNI SHALEEN CHOPRA

Bihar Agricultural University shows the way

Bihar Agricultural University, Sabour, Bhagalpur has rolled out several ICT enabled innovative agriculture extension approaches to reach out to the farming community on real time basis. The university has come up with an innovative blend of ICT tools to solve the specific problem of technology dissemination. The major approaches adopted by the university include Real Time Farmers-Scientist Interface with Video-Conferencing, Kisan Gyan Rath-Taking Technology To Farmers Door Step, Community Radio Station, Digital Storytelling and its dissemination through Social media, Videos through SD cards: An approach to tackle internet issues and Dissemination of timely information through SMS.

The university has taken an initiative to cope-up malnutrition through agricultural intervention *Apni Kyari Apni Thali (AKAT)* in collaboration with ICDS (Department of Social Welfare, Bihar) and UNICEF. The programme has been implemented in four districts viz. Patna, Nalanda, Purnea and Khagaria through the existing Krishi Vigyan Kendras.

A systematic approach was followed in order to bring about perceptible improvement in the nutritional security through multipronged approach with special focus on one specific approach at each district. These included creation of awareness through nutrition education through CRS, Barh under KVK, Patna; incorporation of mushroom to daily diet at in Nalanda, and enhancing diet diversity through establishment of nutri-gardens at Aanganwadi Centres (AWCs) at Purnea and Khagaria. Five villages were selected at each districts. A strong linkage was established between respective KVK and AWC with the help of ICDS, Government of Bihar.

Nutritional garden were established at AWC to include green leafy vegetables and fruits in the diets of pregnant and lactating women, and also provided to children. Community Radio Services were employed to boost up the nutritional and health awareness programme. Awareness through Community Radio Services is one of the fascinating ways adopted by the KVK has opted to reach rural mass.

The initiatives taken by the university encouraged the cultivation and inclusion of mushroom in diets to combat the malnutrition in children. Mushroom cultivation was promoted at each selected AWCs. Mushrooms were served as a supplement in meal at selected AWCs. An extensive campaign was conducted to remove the stigmas and taboos related to food habits including mushroom consumption. Rural women were empowered with technical knowledge of nutri-garden establishment, mushroom cultivation and culinary diversification.

THE GUARDIAN OF THE ENVIRONMENT, OUR FOOD PROVIDER

MAJOR GOVERNMENT THRUST ON FOOD PROCESSING SECTOR

Shri Narendra Singh Tomar
Minister of Agriculture and Farmers Welfare, Rural Development, Panchayati Raj and Food Processing Industries, GOI

We recently celebrated World Environment Day 2021. This World Environment Day also marks the beginning of the UN Decade on Ecosystem Restoration. World Environment Day is not just a ritual for us. This special day is celebrated to highlight the importance of the environment and remind people that nature should not be taken lightly. As a country that coexists with nature, it has traditionally been a way of life for India and her many communities to look to nature as a guiding force.

This day is also a special occasion for us to brainstorm on how the country can play a leading role in the process of ecosystem restoration with programs based on the many cultures and traditions that are a part of our lives. Growing trees, green cities, reforestation, change in diet or cleaning of rivers and banks are the processes of ecosystem restoration. It is also necessary to include those things that we have forgotten or which are often destroyed. Protection of healthy ecosystem is also important.

Restoration can take place in several ways. It is not always possible to return an ecosystem to its original state. We need farmland and we also need infrastructure.

The economic benefits of ecosystem restoration interventions are many times greater than the cost of investment. Every ecosystem can be restored – forests, farms, cities, wetlands and oceans. Restoration initiatives can be launched by almost anyone, from governments and development agencies to businesses, communities and individuals.

Major Initiatives

Let us consider some of the major initiatives taken by the Government of India under the leadership of our Prime Minister Shri Narendra Modi. The Prime Minister launched the major initiative for the cleanliness of the country. He has consistently emphasized that environmental principles must be followed in the process of development.

Land degradation is a matter of serious concern. It threatens the sustainability of agriculture. Landslides and deforestation due to rain and run-off water in mountainous areas expose soil, water and wind erosion due to overgrazing in forest and plains.

India is one of the 70 countries that have joined the United Nations Convention to Combat Desertification (UNCCD), which has established land degradation neutrality by 2030 as part of the Convention's Land Degradation Neutrality Strategy. Has pledged to reach erosion neutrality goals. As a signatory to the UNCCD, India has implemented several policies and programs to combat land degradation and desertification with the goal of achieving land degradation neutrality.

Indian Institute of Food Processing Technology, Thanjavur, an autonomous institute under the administrative control of the Ministry, has developed delicious plates and ice cream cones from jackfruit, which often goes waste due to the huge production cluster in the area.

Boost to Organic Farming

The government is giving a lot of promotion to organic/natural farming. Paramparagat Krishi Vikas Yojana / Indian Natural Farming System Scheme / Zero Budget Farming is being promoted, which will definitely benefit the environment immensely. The purity of the holy river Ganga has been the priority of the central government. Agriculture along the banks of the Ganga river will be completely organic / natural so that no chemical-fertilizer etc. goes into Ganga river. This step could be a milestone.

In the remote forest dwelling areas of our country, a majority of the tribals are engaged in farming. They mostly do not use fertilizers or use it very little. Those entire vast areas are given organic certification. We are making efforts to encourage these belts, for example, the Andaman and Nicobar Islands. These areas will be used only as natural farming. The income of farmers will increase as a result of certification.

There has also been an influx of new nano fertilizers in agriculture, due to which the consumption of normal fertilizers will be reduced. This will definitely increase the fertility of the fields. One of the most important strategies being adopted by the government for sustainable agriculture amidst the challenges posed by climate change is to increase water use efficiency in agriculture. Precise water use through micro-irrigation technologies has shown great promise in reducing the water footprint at the farm level.

The budget of micro-irrigation was earlier 5 thousand crore rupees. This has been doubled by the central government. Now with a huge fund of Rs 10 thousand crore, farmers will get the benefits of micro irrigation. Less groundwater will be extracted. This will directly benefit the environment majorly. The government has also made a new policy regarding bio-stimulants, so that there is less use of chemical-fertilizers and the condition of the fields improves. Continuous work is going on under the guidance of Prime Minister Shri Narendra Modi on the plan to make ethanol from maize, which will save the environment by reducing imports as well as reducing the consumption of petrol and diesel.

Role of Food Processing Sector

Our food processing sector is instrumental in reducing post-production losses of agriculture and the allied sector through on-farm and off-farm investments in conservation and processing infrastructure, besides increasing farm incomes and generating non-farm employment. Food production and thereafter food wastage

increases the emission of greenhouse gases into the environment, which can be avoided to a great extent.

The Ministry of Food Processing Industries through its schemes has made significant contribution towards reduction in post-harvest losses by encouraging creation of farm gate infrastructure, enhancing food processing capacity and strengthening the value chain of various agro-horticulture products. PM Formlisation of Micro Food Processing Enterprises Scheme (PMFME), aimed at upgrading 2 lakh new enterprises and training 9 lakh entrepreneurs, has gone a long way in promoting sustainable processing of agriculture and allied products and protecting the environment.

The highly diverse nature of the food industry, inefficient processing techniques, handling and packaging operations create wastes. If left untreated, these can lead to serious pollution problems. During the last five years, the Ministry has supported around 800 food processing infrastructure projects ranging from huge mega food parks to small value chain linkage projects spread over an area of 50 acres. Adoption of innovative processing techniques, waste disposal system including water treatment plant and reuse of treated water, effluent treatment plant as well as solid waste disposal plant is mandatory for assistance under major schemes of Mega Food Park, Agro Processing Cluster etc. In projects that employ renewables, priority is given to support energy sources such as solar panels and efficient energy use machinery.

Research and Development

The Ministry also promotes research activities for innovative product and process development in the food processing sector. "Waste to Wealth" is one of the major focus areas of these research projects. Indian Institute of Food Processing Technology, Thanjavur, an autonomous institute under the administrative control of the Ministry, has developed delicious plates and ice cream cones from jackfruit, which often goes waste due to the huge production cluster in the area.

The Ministry of Food Processing Industries through its schemes has made significant contribution towards reduction in post-harvest losses by encouraging creation of farm gate infrastructure, enhancing food processing capacity and strengthening the value chain of various agro-horticulture products

Some of the technologies/products developed by the Institute from food waste are: (a) Mixed high fiber flour prepared from jackfruit seeds and strand powder, which is used for the preparation of cookies, biscuits and products like pasta, noodles (b) Production of onion powder from onion waste products such as onion stalks, rinds and flowers of onion for flavoring in food additives (c) pomegranate seeds and peels, grape pomace, potato peel, black gram milling waste (powder and portions of the husk) are added to flour while preparing cookies, cakes, etc., to enhance the nutritional value. The commercial food industry has focused on the use of waste streams. Food packaging material can be made using waste starch material from rice, millet, maize processing units etc. Biodegradable plates can be made using waste tree logs. Rice bran ash from paddy milling industries and sugar industries can be used for production of biodegradable food packaging materials. Eco-friendly technology can be used for extracting oil from mango seed kernels. Major research is being conducted in these fields.

Importance of Soil Test Cards

Intensive agriculture and increased dependence on irrigation resulted in salinity, alkalinity and water-logging in some irrigated areas of the country. In India as well as in other developing countries, water being an important component in agriculture, any loss of irrigated land should be avoided through proper irrigation practices, provision of drainage, combined use of water etc. The risk of water-logging stems from the fact that farmers may not recognize the problem until it begins to affect yields. Regular monitoring of groundwater level is essential to check water-logging.

Apart from soil erosion, there are other factors which lead to the degradation of the soil ecosystem. Intensive farming leads to soil nutrient deficiencies and imbalances, especially micronutrient deficiencies. This leads to degradation of organic matter in the soil. Wet conditions aggravate the problems posed by pests due to seepage of rainwater. The high use of nitrogen and water has caused nitrogen to be carried to the water table, thereby polluting it for future use. Keeping this in view, about 12 crore soil tests have been done and land health cards have been distributed by GOI, so that balance fertilizer use should be promoted. Deforestation is one of the biggest challenges in the world. The main reason for the decline in forest wealth is the increase in demand for fuel and other timber as a result of population growth, indiscriminate development projects and forest fires. Forest cover has not changed much in recent times. Its diversion for non-forestry purposes has been more or less compensated by afforestation. India is one of the few countries where forest cover is increasing.

India is a country with diverse agro-climatic conditions that shelter a wide variety of animals and plants. India ranks the highest in Asia and is among the top nations globally in terms of plant diversity. As agriculture becomes more and more commercialized, many plant and animal species are becoming extinct. A number of measures have been taken by GOI for sustainable management of forests, including agriculture and fisheries, with a view to providing food and nutritional security to all without destroying the natural resource base, while ensuring intergenerational environmental equity. It is a matter of pride for us that our Annadatas also take on the role of the protectors of the environment.


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INITIATIVES BY MINISTRY OF FOOD PROCESSING INDUSTRIES

STRENGTHENING INDIA'S FOOD PROCESSING SECTOR

Food is the fundamental basis of life. It is the source of energy, nutrition and while eating a balanced amount of food keeps us fit and healthy, a well developed food processing sector is crucial for a healthy nation. Higher processing can improve value addition, reduce wastage, ensure better return to the farmers and address critical issues such as food security, food inflation etc. Amidst this global pandemic, there has been an even greater need to have a robust immune system to fight diseases. Thus, the importance of food in unordinary times like these cannot be emphasized enough. While many sectors across the country and worldwide are seeing a downturn, food processing is relatively shielded by the effects of the pandemic and continues to flourish. The Ministry of Food Processing Industries (MoFPI) is cognizant of the myriad of opportunities available in the sector and is driving its growth with full capacity by launching new initiatives, supporting entrepreneurship, strengthening research, and academia are a few of the many steps taken by the apex body.

Some of the major initiatives taken by MoFPI in recent times are discussed in detail below:

Production Linked Incentive Scheme for Food Processing Industry (PLISFPI)

Pursuant to the Hon'ble Prime Minister's mission of 'Aatmanirbhar Bharat', the Government of India approved a new central sector scheme, namely 'Production Linked Incentive Scheme for Food Processing Industry'. The scheme will be slated for implementation during 2021-22 to 2026-27 with an overall outlay of Rs. 10,900 crore. This initiative will support

the creation of global food manufacturing champions commensurate with India's natural resource endowment and support Indian brands of food products in the international markets. The scheme proposes to incentivize the food processing companies to modernize their infrastructure and enhance their competitiveness by manufacturing specific categories of food products having high potential for growth in output and value addition.

The scheme includes four food segments, Ready to Cook/ Ready to Eat (RTC/ RTE) foods, including Millet products, Processed Fruits and Vegetables, Marine Products, and Mozzarella Cheese. Innovative/ Organic products of SMEs in these segments, including Free Range - Eggs, Poultry Meat, Egg Products, are also covered. Additionally, the scheme is open for private food processing companies, co-operatives, and small and medium scale enterprises.

Pradhan Mantri Formalization of Micro Food Processing Enterprises (PMFME)

In June 2020, MoFPI introduced a pan-India scheme called 'Pradhan Mantri Formalisation of Micro Food Processing Enterprises' (PMFME), in partnership with the state/ UT governments under "Aatmanirbhar Bharat Abhiyan". The scheme aims to enhance the level of competitiveness of the present micro-enterprises in the unorganized segment of the food industry and thus, aiding the process of formalization of the sector and support Farmer Producer Organizations (FPOs), Self Help Groups (SHGs) and Producers Cooperatives along their entire value chain.

Production Linked Incentive Scheme for Food Processing Industry will facilitate expansion of processing facility to generate processed food output of Rs. 33,494 crore, create employment opportunities for nearly 2.5 lakh persons by 2026-27, ensure justified prices for farm produce, and increase farmers' income

The scheme is slated for implementation from 2020-21 to 2024-25 with a total outlay of Rs. 10,000 crore and is expected to benefit 2,00,000 micro-enterprises by this credit linked subsidy. Major objectives are to increase in access to finance by micro food processing units and revenues of target enterprises, enhance compliance with food quality and safety standards by providing access to common infrastructure like common processing facility, laboratories etc. It will also focus on on-site skill training and handhold-

Ease of Doing Business and Investment Facilitation

To provide a hassle-free experience to the industry players and the desirous entrepreneurs, the ministry initiated an idea of launching a portal at the inauguration of World Food India-2017. A dedicated investor portal - 'Nivesh Bandhu' was launched by the Hon'ble Prime Minister. The portal proved beneficial for budding entrepreneurs to get quick relevant information related to food processing sector on one platform, such as central and state government policies, incentives provided for the food processing sector, mapping resource availability, processing infrastructure etc. Recently in February 2021, the Nivesh Bandhu portal was further revamped to enhance user friendliness and to provide a more seamless experience to its users.

The ministry had also set up a dedicated Investor Facilitation Desk with Invest India, the national investment promotion agency of India, for ease on doing business and providing handholding support in the food processing sector. The desk has been continuously working closely with various major industry players, new entrepreneurs and SMEs to facilitate them throughout their investment lifecycle. The desk is engaged with both domestic and foreign investors for gathering inputs for policy reforms, issue/ query resolution, investment facilitation etc.

In 2020, MoFPI constituted a Project Development Cell (PDC) with the prime objective of accelerating investments, and to bring projects to the Empowered Group of Secretaries (EGoS) that require special incentives, policy interventions, expeditious clearances, systemic reforms or a new project developed by the PDCs.

ing for DPR and technical upgradation.

Extension of Operation Greens

The scheme was announced in the union budget speech of 2018-19 with the objectives to stabilize the supply of Tomato, Onion and Potato (TOP) crops, ensure availability of these perishable crops round the year across country without major price fluctuations and enhance the realized value of TOP farmers. MoFPI is committed to achieve these objectives through targeted interventions and by strengthening TOP production clusters and their FPOs, and linking/connecting them with the market, reduction in post-harvest losses by creation of farm gate infrastructure, development of suitable agro-logistics, creation of appropriate storage capacity linking consumption centres.

During the COVID lockdown in 2020, the scheme was extended from TOP to TOTAL (to all fruits and vegetables) to provide 50 per cent subsidy for transportation of eligible crops from surplus production cluster to the consumption centre for six months and / or hiring of appropriate storage facilities for eligible crops (for maximum period of 3 months).

Recently, the scope of 'Operation Greens' scheme was enlarged to 22 perishable products confirming government's focus towards boosting the value addition in agriculture and allied sector.

Strengthening of Institutions and Academia

The MoFPI has two premier institutes National Institute of Food Technology, Entrepreneurship and Management (NIFTEM) and Indian Institute of Food Processing Technology (IIFPT) under its aegis, to cater to the needs of various stakeholders such as entrepreneurs, industries, exporters, policy makers, government and existing institutions. In February 2019, the Union Cabinet chaired by the Hon'ble Prime Minister approved the introduction of National Institutes of Food Technology, Entrepreneurship and Management Bill, 2019 to to confer the status of 'Institutions of National Importance' to NIFTEM and IIFPT. This would enable both institutes to provide world class teaching and research experience by adopting innovative practices.

Promoting Research and Development

The ministry understands that keeping abreast of the latest developments in R&D is critical for the food processing ecosystem in the country. For this reason, the ministry is providing continuous support to encourage research and development in the field of food processing. A total of 126 R&D projects for process development, efficient technologies, improved packaging, value addition etc. are being supported, 15 patents were filed / received, 20 technologies were commercialized and 187 research findings were published from the projects assisted by MoFPI.

Promotion of Women Entrepreneurs

There is a substantial women participation of 12.55 per cent and 24.69 per cent in both registered food processing units and unincorporated non-agricultural enterprises respectively. Empowering women has always been one of the prime objective of this government. With the same intent, MoFPI in partnership with Ministry of Women and Child Development organized the 'Organic Food Festival' in February 2020 in New Delhi.

The significance of the event was to provide a platform to women entrepreneurs for capacity building and economic empowerment. The event saw participation of over 180 women entrepreneurs and self-help groups coming from over 25 states and UTs with very interesting products on display from across the country. Training programs were also organized on the topics of post-harvest management, product innovation, packaging and capacity building for women entrepreneurs and SHGs.

The write-up is based on the inputs received from the Ministry of Food Processing Industries (MoFPI)

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DOUBLING FARMERS INCOME

INNOVATIONS IN FOOD PROCESSING

Food processing and value addition at all levels of the food supply chain is regarded very important to enhance the farmer's income. To sustain the increased production of fruits and vegetables, milk, food grains, spices etc, processing has to increase and more value addition is required. There should be direct linkages between farmers and industries. The farmers need to approach a business model to get remunerative price for the products. Individual farmer may find it difficult to address the scale of economy. The farmer needs to understand the consumer's requirements to grow what is demanded by the market.

Consumer preferences are changing from cereals-based food into composite foods. There is a slow shift from usefulness in processing to usefulness to consumers. Processed foods are gaining importance and product innovation has become a key for getting a good demand. The concepts of organic farming, primary processing, value addition, ready to eat foods etc., are being preferred. Fortification of flours, milk, eggs, fruits etc., are new innovations coming to the market.

Farmers must focus on primary processing, cold chain logistics and establishment of cold storages. It is essential to educate the farmers on technological advancements and scientific developments in agriculture and food processing

Value addition in Products

Fortifying the bakery products with micro nutrition and by active compounds is finding a rich market. The processing levels of milk, meat and fish are satisfactory. The processing of pulses, fruits and vegetables needs boost. It cannot be done alone by a single body. The scientists, industries and GOI must work together for the upliftment of farmers.

The Indian farmer is generally not aware of technological advancements and scientific developments in the field of agriculture. He is not well informed of the programs and policies of government which are meant to bring relief and comfort in his life. To empower farmers to understand the existing scenario and to act accordingly, there is a need to create farming clusters, FPOs and FPCs to ensure value addition and improving the post-harvest quality of food.

Three important areas where farmers should focus are primary processing, cold chain logistics and establishment of cold storages. This shall help to maintain the quality of food and make it available during lean season when it is not available so that the farmers can improve their profit margin. It is also important in the present-day context that farmers should establish networks through which their products could be effectively marketed and get better profit.

In order to increase awareness about the importance of innovative technologies in production, processing and value addition, it is essential to educate the farmers on technological advancements and scientific developments in the field of agriculture and food processing. Awareness about

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WITH
Komal Chauhan, National Institute of Food Technology Entrepreneurship and Management

government policies and schemes need to be increased. GOI is providing support to the farmers to establish primary processing units on the farm for minimal processing of crops.

Encourage Innovative Technologies

Technocrats should take up focused R&D to address issues related to farmers and industries to bridge the gap between farmers and industries. Adding value to traditional foods by developing standard recipes for better quality, safety and sustainability, development of composite foods and fortified food including bio fortification are ways to achieve this. Traditional foods are generally packed in bulk. Appropriate packaging materials should be used and the products should be branded for traceability and better keeping quality.

On the export front, India has been a raw material exporter. Food processing at appropriate threshold must be considered a farm-level economic activity like scientific farm management. Planners are exploring the possibilities for food and agro processing for farm and/or self-help groups for income and employment generation in rural India.

Important scientific developments are taking place for improving the quality and safety of food in view of consumer demand and global standards. Many technologies have evolved in the organized sector in the country. Public and private R&D institutions have significantly contributed to the introduction of innovative technologies. We now have IOT (Internet of things) concepts for addressing modernization, automation in processing, establishment of cold chain logistics, block chain technologies, use of energy efficient storage facilities, large scale storage of commodities etc. Innovative technologies include cold plasma technology, pulsed electrified field, Ohmic heating, bio-fortification, irradiation, hydrolyses bio-based/protein rich food, high pressure processing, homogenization, ultrasound, three dimensional printing, organics, minimal processing, ready to eat and ready to cook technology, extrusion technology, traditional food in packed forms, improved packaging, use of fortified flour, milk, sugar and fortified bakery products with micro nutrient, grains and bio-active compounds.

Some issues that need attention are intelligent cold chain systems; adaptive control of storage conditions with biological sensors; rapid detection of food adulterants, fungal and bacterial toxins and other contaminants; using bio-sensors/ nano-bio-sensors/molecular markers

There is good consumer acceptability for these products. Processing technologies must maintain the nutritional value of diet for addressing health and wellness concerns. There is a need for on-farm processing. We must also ensure utilization of by-products and wastes from food processing industries through better use of technology and establishment of value chains. Innovations like bringing in robotics and automatization in the food and agricultural sector will help.

Some issues that need our attention are intelligent cold chain systems; adaptive control of storage conditions with biological sensors; rapid detection of food adulterants, fungal and bacterial toxins and other contaminants; using bio-sensors/ nano-bio-sensors/molecular markers; application of robotics, artificial neural networking, nutri-genomics, non-destructive and/or online testing techniques and supercritical fluid extraction for production of high-value products. We also need to focus on the development of bio-polymers for packaging and bio-composites for structures based on nano-technological development, bio sensors to predict and manage the shelf life of processed foods.

Shri Sharad Gupta

18th September 1960- 6th May 2021

Mr Sharad Gupta and Dairy India Yearbook (DIY) that he published are synonyms. Mr Gupta breathed, lived and existed for and by DIY. He was a par excellence and passionate, proficient professional, knowledge seeker, information miner, data hunter, statistics stalker, all rolled-in-one for the DIY. These also made him a walking encyclopedia of dairy. He combined all these traits with his skills of editing, fearless expurgation of superfluous and unwarranted junk, with his acute attention to detail for evidence. He applied his art of wordsmithery, composition, collation, compilation of what he had collected, assembled, and accumulated as the core content for the DIY. He keenly embellished, enhanced and smartened the content and manuscript with graphics and pictorials to fascinate and appeal to the reader. To bind the volume in covers, he was an elitist at cherrypicking paper and print.

Most believed that he was one-man editor and publisher of DIY. The truth is that he had created an invisible universe of educated, erudite, well-informed, professionally experienced, knowledge gatherers, academics, scientists, researchers, scholars, investigators, entrepreneurs, industrialists, and corporates. These men of letters, intellectuals and intelligent people with brainpower contributed their knowledge and comprehension as articles that he packaged. He essayed those articles and commentaries with modesty, convincing, conviction, persuasion, influence, and motivation. All of them have individually and collectively partnered with him in generating and engineering the modern Veda of the dairy world – Dairy India Yearbook.

Mr Gupta was born in Delhi on 18th September, 1960. He went to St Columbus School in Delhi and earned his Post Graduate Diploma in Book Publishing from the University of Delhi, after studying journalism at the Dateline School of Journalism. He had inherited most of his skills and traits in legacy from his father, the originator, founder and publisher. Mr Gupta valued, admired, revered, respected, worshipped and has continued to honour him in successfully accomplishing his father's dream. In his demise, the dairy world has lost a valued asset, architect and designer of the one stop portal and gateway to information and statistics of Indian Dairying.

● Dr. R S Khanna

FOOD PROCESSING AND DOUBLING FARMER'S INCOME

The Hon'ble Prime Minister has spelt out an ambitious mission to double farmer income by 2022 by which time India would have completed her 75 years of Independence. Achievement of this outcome is critical for 70 per cent of Indian lives and livelihoods dependent on agriculture. This superordinate goal has also been provided a policy level direction and thrust through the Agriculture Export Policy 2018.

It will be worthwhile to reflect on the trajectory that Indian Agriculture has taken in the post-independence era. The focus over half a century or so has been primarily on increasing agriculture output to hedge against risks of food shortages which India faced in the mid-60s. The strategy in the green revolution era has largely been a combination of supply side innovation to enhance farm productivity and output, price support for farmers and subsidies on farm inputs. The outcomes achieved have been encouraging. India's food production multiplied by 3.7 times and population multiplied by 2.55 times during the same period. This has not only made India self-sufficient in agriculture but also a net food exporting country.

While India did well on the farm production side, it did not effectively catalyse enhancement of farmer prosperity and well-being during this period. As per Niti Aayog's policy paper on Doubling Farmer's Income, as per the NSSO data on consumption expenditure for the year 2011-12, more than one fifth of the rural households with self-employment as agriculture had incomes below poverty line. Farm income has also remained significantly low at around 35-40 per cent of income earned by those in non-farm sector. This left the country in agrarian distress, with adverse effects on agriculture Evidently, India today needs a tectonic shift in its strategy for agriculture. It is in this context that the Prime Minister's vision of doubling farm incomes is highly relevant.

> When enterprise innovation meets untapped potential, value is unleashed for all stakeholders in the chain. ITC has been a stellar example of business model innovation in the agri and food processing chain

Food processing – The vital node

Food processing, a vital node connecting agriculture with manufacturing will prove to be one of the key pivots to augment farmer incomes. Food processing is a value creation bridge that links global and domestic demand with the Indian agri value chain. A demand-led agri value chain deep-

ITC Limited

ABOUT THE AUTHOR

Mr Hemant Malik is currently the Divisional Chief Executive of ITC's Foods Business. He is also a member of the Corporate Management Committee of ITC Limited. ITC Foods is the third largest packaged food company in India and also the fastest growing, with strong play in staples, snacks, biscuits, noodles, spices, juices, diary, chocolates etc

ly coupled with consumer needs triggers a virtuous cycle of value addition to farm produce, enhanced realisations for the farmer, generates efficiencies across the entire agri value chain, reduces wastage, creates large scale employment and lies at the root of creation of world class Indian brands that stand for trust, credibility and quality. Food processing Industry also provides the much needed cushion and stability to farmers who are vulnerable against vagaries of weather, reel under the debts and asymmetries of trade caused by traditional middlemen, by providing the farmer an alternative market access option for his produce.

The untapped and latent potential in the agri and food processing chain can be illustrated by the some of the facts that follow. India is home to 11.2 per cent of the arable land in the world. India ranks first in the world in sectors such as Spices, Milk, Ghee, Pulses, Ginger, Banana, Guava, Papaya, Mango. We are second in the world in segment such as Rice, Wheat, Fish and Aquaculture and many other fruits and vegetables. However, less than 10% of the agriculture output in India is processed which is much lower compared to countries such as US (65 pc) and China (30 pc). In spite of India's rich potential, it ranks 11th in terms of the agriculture exports with a meagre share of 2.5 per cent of global agriculture exports. The share of high-value and value-added products in food product exports from India is less than 15 per cent as compared to US at 25 per cent and China at 49 per cent. The value of wastages in the Indian agri value chain today stands at a staggering number of over Rs 90000 crore.

When enterprise innovation meets untapped potential, value is unleashed for all stakeholders in the chain. ITC has been a stellar example of business model innovation in the agri and food processing chain. Farmer incomes have been significantly enhanced through demand led agri value chains. Exemplars in this area include B Natural Juices made from 100 per cent Indian fruit from farmers in India across states such as Tamil Nadu, UP and Kerala, leveraging crops of significance in that geography.

Similarly, a whole new market has been created over the last two decades in the area of branded and packaged Atta by establishing deep farm linkages in MP, UP, Rajasthan and Bihar, sourcing the finest quality of wheat such as Sharbati for its Aashirvaad Brand. ITC has created world class Indian brands in the packaged foods space with consumer spends of over 15000 core that reach one out of every two Indian households. ITC has enhanced farm incomes manifold and is also retaining the value added product within the Indian economy. Today, ITC's e choupal is the world's largest "Rural Digital Infrastructure" spread across 35000 villages and empowering 4 million farmers. ITC`s agri-business lends distinctive competitive advantage to its branded packaged food businesses with superior agri-sourcing that focuses on identity preservation, traceability and certification, as well as lower transaction costs. ITC expects to support nearly 3,000 FPOs with more than a million farmers across 24 crop value chain clusters in 21 states, shaping competitive agri value-chains and enhancing farmers` incomes.

Suitable Government Policies

Government policies and regulatory shifts have been sharply directed to provide a fillip to unlock the natural synergies between agriculture and food processing. The liberalisation of regulations at the farm end and the Productivity Linked Scheme with an allocation of Rs 10,900 crore will indeed enable the organised food processing sector to plough back economic surpluses at a significant scale. This will bring in much needed investments at the farm end in terms of technology and infrastructure for enhancing farm incomes. PLI scheme will prove to be a game changer in augmenting farm incomes as it is outcome focussed, offsets factor costs, helps garner scale and makes India as one of the most attractive destinations for investment in the globe. It also promotes exports and makes India an integral part of global supply chains.

There are several agri value chains which gain relevance from a health and nutrition point of view. They have the potential to transform the destiny of the farmer while also achieving positive outcomes on the health and nutrition front. The resurgence of the pandemic has accentuated the need for building agri value chains on the theme of health and immunity. Such agri value chains with potential include super foods such as millets, ragi, medicinal and aromatic plants such as Moringa, Tulsi, Ashwagandha etc and organic food value chains.

To sum up, the Indian food processing sector is uniquely positioned to influence positive outcomes for the farming community owing to the abundance of agriculture crops where India has a competitive advantage, favourable demographic profile of the Indian consumer with rising disposable incomes, significant headroom for growth from the current levels of food processing, growing export demand, proactive Government policies and the enterprise strength inherent in world class Indian companies.

PROCESSING FRUITS & VEGETABLES

LET'S MAKE OUR FARMERS THRIVE

Farm and Pharma. During the corona pandemic, these two sectors were the lifelines of mankind, providing health, hygiene and nutrition.

Farmers, despite being exposed to all life risks, continued to maintain the supply lines of perishable agri-produce like fruits, vegetables and milk 24X7. Consumption of fruits and vegetables, herbs, spices and condiments have proved to be the *Rambaan*, the panacea for fighting corona.

The goodness of fruits and vegetables like anola, lime and drumsticks for health, immunity and nutrition for the body, mind and soul has been well appreciated and internalised in our society. When cash flow of farmers was at stress during corona, fruits and vegetables proved to be a saviour by bringing in much needed liquidity into the system apart from timely support from the government. The fruits and vegetables sector contributes largely to the Gross Domestic Happiness for the nation by ensuring economic growth, physical health, and spiritual wealth.

ABOUT THE AUTHOR

Mr Pradipta Kumar Sahoo is Chief Strategy Officer & Head (International Business), Mother Dairy Fruit and Vegetable Pvt Ltd

Dichotomy

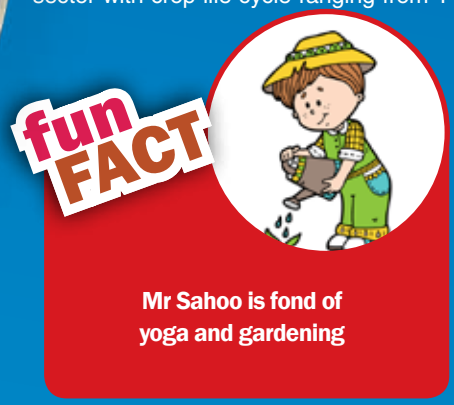
People are aware of the proverb, *An apple a day keeps the doctor away*. The irony is that after almost 74 years of our independence the fruits and vegetables sector remains more perplexing and complex than rocket science to comprehend. We as country have made advancements in all most all sectors post-independence. But we are yet to crack the tough nut of fruits and vegetables. The sector has been languishing with systemic issues. The result: frequent supply shocks with short supply and glut situation bringing boon and bane to varied stake holders at different time, thereby bringing stress in the minds of policy makers and politicians.

Given this backdrop, there is strong need to understand and appreciate the dynamics and imperatives of this industry.

Uniqueness: The Fruits and Vegetables (F&V) sector brings both tears and happiness.

Uniqueness of the F&V space is as follows:

- **Supply Side:** It contributes highest output annually (more than 300 Million Tons) comprising largest number of commodities (around 200) in the agriculture sector with crop life cycle ranging from 1 month to 100 years in varied agroclimatic zones round the year.
- **Employment Generation:** It engages the largest number of farmers, majority of them being small and marginal ones in the backend. In the downstream, activities are manpower intensive and terms of trade not favourable to farmers.
- **Category complexity:** F&V is highly perishable, cyclic, ambiguous and complex, with loosely defined quality standards and specifications.
- **Price Situation:** It is highly volatile and has higher weightage in overall basket and food basket CPI and WPI basket.
- **Demand side (Industry):** Mostly unorganised sector (98 % of the produce), lowest capital formation in both private and public, no demand-based crop planning, demand is erratic and price sensitive, poor infrastructure and delayed market reforms and no minimum support price and insurance support.



Mr Sahoo is fond of yoga and gardening

Current Industry Landscape

Given the above background, any initiative to double farm income must focus on the areas of value addition and market linkages. The processing level in India is still abysmally lower as compared to its global peers.

The industry is grappling with issue of low-capacity utilization (around 40%). The industry faces the problem of sluggish domestic demand on the back of consumer's food habits as they spend little on processed F&V. On the export front, the players face stiff competition from countries like China, Turkey and Brazil, which compete for a slice of share of the EU (European Union) markets.

The Fruits & Vegetables processing industry comprises of Pulp, Frozen, Potato Chips and Dehydrates segments.

Pulp: The estimated size of the Pulp segment is about 4.1 lakh MT valued at Rs 2000 Cr. It is growing at a CAGR of 5 per cent over last 5 years. Eighty per cent of the processing volume comprises of mango. The

rest 20 per cent is shared among tomato, papaya, guava, amla etc. Chittoor in AP is the major mango processing hub, which houses about 55 small and large processors. Chittoor processes around 2000-2500MT of mango per day during the season. The second hub is around Nasik. Around 30 per cent of pulp produced in India gets exported as a food ingredient.

Frozen IQF: The Frozen segment comprises three major products. These are green peas, sweet corn and potato-based french-fries and snacks.

- Rudrapur and Kashipur of Uttarakhand belt is the hub of the Peas processing. Of the total 64 plants, 38 are located in this region. The estimated size of the Industry is about 1.5Lakh MT of frozen peas, with a value of about 1200 Cr. The processing season is once a year during Jan- Mar.

- Pune with about 25 processors is the hub of Sweet Corn. It has a volume of about 50 thousand MT and a market size of about 300 Cr. The major sales channel in this case is retail. It witnessed a growth of about 20-25 per cent, primarily driven by home consumptions.

- French-fries have a volume in the range of 50-60 thousand MT per annum with an estimated market size of about 500-600Cr and a potato requirement of around 2Lakh MT. Mehsana near Ahmedabad in Gujrat is the emerging hub for french-fries. The industry processes throughout the year out of the stored potato sourced from contract farming.

Potato Chips: The Potato Chips, which is an ambient packaged snack is estimated to be the volume of 3.75-4 Lakh MT. As per Euro monitor, the size of the Indian chip market is about Rs 7,000-7,500 crore. The quantum of potato equivalent for processing is in the range of 13- 15 Lakh MT against the total potato production of about 50 Million MT.

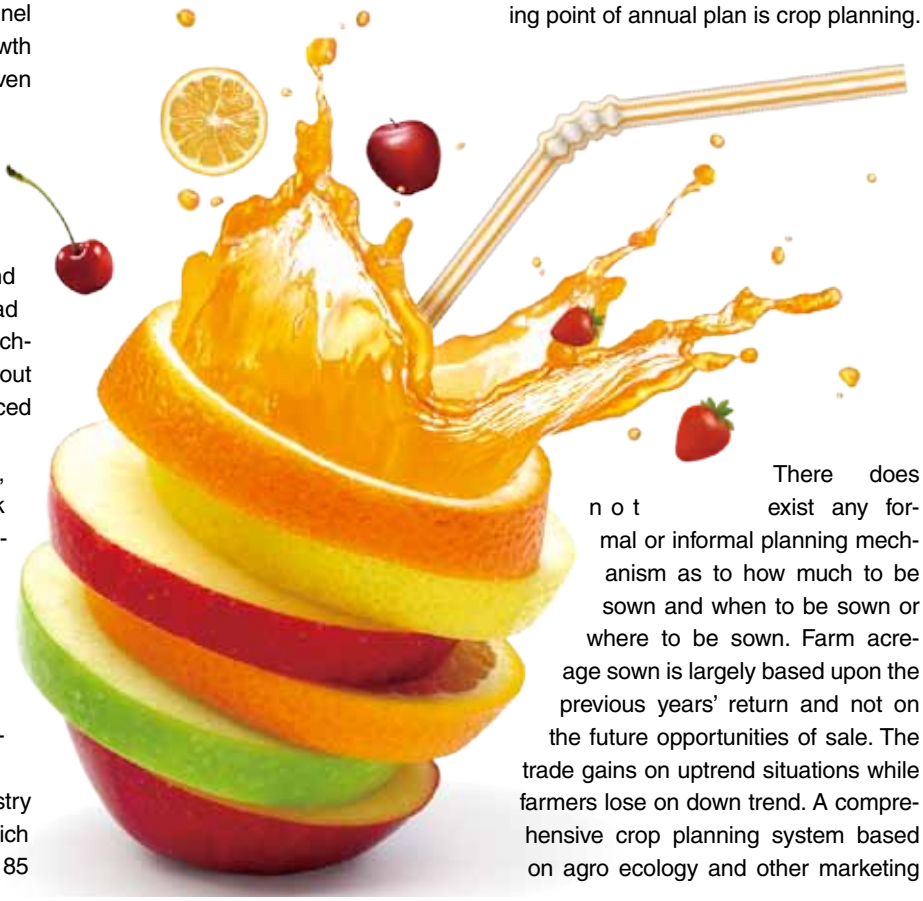
Dehydrates: Dehydrates industry comprises of about 175 SMEs which processes onion and garlic. Almost 85 per cent of these are in Gujarat. Rest 15 per cent plants are shared with MP, Maharashtra & Rajasthan. Mahua, a small town near Bhavnagar is the hub of dehydrates. The industry processes about 75000 MT of dehydrated onion. The equivalent raw onion required to process this is just 7.5Lakh MT against a total production of about 21.8 Million MT. Seventy per cent of this is white onion, which is preferred for exports to West Asia, Europe, and the South-East Asian nations. Domestic demand of dehydrated products is about 25-30 per cent.

Food and vegetable cultivation should be treated as an Industry. A comprehensive crop planning system based on agro ecology and other marketing and logistics comparative advantages and processing needs will go a long way to manage deficit vs glut, thus stabilizing prices and creating value for farmers

Way forward

The need of the hour is to promote processing and ensure market linkages aggressively. In fact, processing must be an integral part of the production ecosystem. Production can be graded at farmgate itself to generate at least three broad grades in terms of physical characteristics. A grade can go for table use. B and C grade can go for processing purpose. In fact, such a grading mechanism will ensure better realization for A grades. Apart from that, processable varieties can be grown exclusively to cater to specific processing needs.

Food and vegetable cultivation should be treated as an Industry. The key starting point of annual plan is crop planning.



There does not exist any formal or informal planning mechanism as to how much to be sown and when to be sown or where to be sown. Farm acreage sown is largely based upon the previous years' return and not on the future opportunities of sale. The trade gains on uptrend situations while farmers lose on down trend. A comprehensive crop planning system based on agro ecology and other marketing

and logistics comparative advantages and processing needs will go a long way to manage deficit vs glut, thus stabilizing prices and creating value for farmers. The advanced forecasting tools can throw up most likely models to adopt so far as production acreage is concerned.

To promote such processing clusters, comprehensive value chain support from GOI has been in place. Schemes for promoting FPOs/FPCs and CBBOs are good schemes to do crop planning and transform agriculture to agri-business, provided it is manned by people with the right intention to add value. The recent production-linked incentives for the industry promise gains for F&V processing and marketing of value-added products. MSP and crop insurance if introduced in this sector will help farmers to grow crops which are of high importance so far as processing is concerned. Recent reforms in contract farming and other farm laws will be handy for the industry which wants to promote innovation and differentiation in the market. Creating buffer for storable products like onion by MARKFED and Price Stabilisation Fund have smoothened the demand-supply gap. There needs to be a consistent and sustainable approach for exports which has to be neutral to domestic pulls and pressure. Digitisation through e-NAM and village haats covering fruits & vegetables for processing will help in price discovery and will give price arbitrage opportunity to processors.

Game Changer: A realtime initiative by Safal in Ranchi

Laxman Mahato, age 34, an economics graduate took up sweetcorn cultivation in 2016. His share of landholding is 2acres at Khunti in Jharkhand. Traditionally, he grew maize (desi variety) in kharif. He switched to sweetcorn and managed 2MT/acre yield. But monetization became a nightmare due to poor market linkage. He could not sell more than 200 pieces per day in retail at Ranchi. So, he moved goods to Bhubaneswar, 450km away. It added cost of Rs 3.50/kg freight & 7 per cent commission. Either of these channels were not remunerative for the farmer.

In 2018, Mother Dairy set up a fruit and vegetable processing plant in Ranchi, Jharkhand. Safal Farmers' development team contacted Mr Mahato and handheld him with better seeds, package of practices, assured price and buy back of produce.

Mr. Mahato focused on yield & area expansion. The yield increased to 6-8MT/acre and he expanded area from 3 to 30 acre on lease. Income improved from twenty-five thousand to eighteen lakhs per annum. The incremental cash flow of village was Rs 48 lakhs with 80 acres (estimate). The cluster with 300 acres had a cash flow of around Rs 1.8 Crore. It became a true circular economy. It may be noted that Pune in the west is a traditional growing hub for sweet corn. Ranchi is fast emerging as second hub in the east to cater to north and eastern markets.

This intervention falls under "Farmers management of price assurance & farm service Act". But it is not as simple to implement as it appears. The economic value this initiative unleashed in a predominantly tribal area is humongous and transformative in nature.

(Disclaimer: The views expressed are personal and not of any of the present or past organization the author is associated)

Trends in PACKAGED FOOD INDUSTRY

The food packaging industry is India's fifth largest sector with a current worth of nearly USD 40 billion (3.2 Lac cr). The Indian packaged food market is expected to be double and grow up to USD 70 billion (5.6 Lac cr) in the next five to ten years. Food processing industry is a major employment provider, contributing to 11.4 per cent of organised manufacturing employment.

The Indian packaged food industry plays a critical role in our economy. A rise in disposable incomes, demographic dividend, rise in nuclear families, participation of more women in the workforce, rise in organized trade and digital commerce – all have contributed towards the growth of packaged food in India. Covid has also impacted consumer behaviour and packaged food in a big way. I am sharing some of the key shifts and areas of growth for the next few years in packaged foods.

Packed & Branded Staples

Touch, feel and smell have always been important factors in the way shoppers shopped for staples. Even in modern trade, loose staples made up for 30-50 pc of sales in categories like pulses, rice, wheat and sugar. Covid has altered the behaviour of consumers. Contact-free shopping, store following safety standards, untouched by hands – these became important considerations. Share of packed staples in total staples jumped in strong double digits. Rice, dry fruits, whole spices, powdered spices have seen a very big shift towards brands. Premium brands like Karmiq, Sangis Kitchen and Golden Harvest have seen more than a double-digit jump in shares. New foods have gained in popularity like seeds, dry fruit mixes, trail mixes, millets, dehydrated fruits, cold-pressed oils etc Organic staples have seen unprecedented growth of more than 20 pc over last year. We will see a steady rise in packed, branded and differentiated play in staples.

Cooking at Home

Eating out and home-delivery – both have seen a drop from 40-60 pc in various months of the pandemic. Consumer staples like packaged rice, refined edible

ABOUT THE AUTHOR

Mr Kamaldeep Singh has two decades of experience in FMCG, Food & Retail Business. He is currently President, Food & FMCG at Future Group. Future Group is the leader in Food and FMCG Retail with more than 1000 stores with leading formats like Big Bazaar, Hyper City, Easyday and Heritage

oil, ghee, tea, atta, sooji, maida have seen strong growth rates. Instant foods like noodles, pasta, vermicelli, oats, poha replaced meals and created new snacking occasions at home. Dessert mixes and baking picked up. Convenience drove demand for categories like ready to cook chapatis, batter etc. This segment has seen many new launches like gravy mixes, cuisine-based masalas, instant upma, instant poha in instant foods segment. The food processing industry also saw several new product launches – 3,500, to be precise, as per a Nielsen report – over the past 12 months.

Health, Wellness, and Immunity

All-natural, high in fibre, high in proteins, natural flavours, vitamin & mineral fortified foods are popular now. High fibre foods such as millets-ragi, bajra, jowar have seen a rise in demand across towns, classes and regions. There has been a steady growth in demand for healthy flours like soya bean flour, millet-based flours and pulse-based flours. There is increasing demand for preservative-free bread in many metros and mini metros. The pandemic has seen a big surge in immunity boosting products.

Mr Kamaldeep Singh is an avid reader and likes to cook in his leisure hours

This segment has been full of action with many new launches promising immunity. Infused tea, infused honey, immunity kit, immunity booster drops, kadha, giloy, amla juices and many more products. These categories will continue to do well even post-pandemic.

Engagement and Content

Physical and digital are no longer separate worlds. Augmented reality, QR codes, smartphone scanning has been around for some time. Digital packaging will use these features to offer a new process of engagement with consumers. Traceability through the supply chain, education, entertainment, gamification – these will be real possibilities. Packaged foods will go through a digital transformation through innovation in packaging, content management, engagement and traceability throughout the value chain.

Rise of Micro Niches & Brands

Distribution has been a complicated affair in India. With millions of outlets, reaching consumers is a daunting task. Large players had a substantial edge over smaller ones due to reach and distribution muscle. Organised trade expanded distribution for regional and local brands through centralised supply chains. Digitisation is helping brands to reach directly to consumers. Mass personalisation at scale and one on one interface with consumers is a real possibility. Through social media smaller and niche brands can create their own channels of distribution and communication. We will see many smaller brands serving niches profitably. This will drive innovation, diversity and localisation of food.

Rise of Fresh Categories

There has been a rapid expansion in cold chain infrastructure in the country. The dairy sector has built cold chain infrastructure to Tier 3 towns. Organised trade is also creating cold chain infrastructure with expansion to towns below 1 lac population. Packaged liquid milk is available across states and expanded into many cities in the last few years. It will emerge as the biggest category in packaged food space. The Indian dairy industry is growing at a CAGR of 12-13 pc over FY18-23. In India, 65 pc of the milk is consumed in fluid form and the rest 35 pc is used for making products like ghee, ice cream, paneer, curd, sweets and so on. Paneer and khoa is growing at a CAGR of 17-18 percent (FY18-23). It has emerged as one of the massive categories under milk products. The curd market is growing at a CAGR 10-11 pc and ice cream at 22-24 pc (FY18-23). Cheese and ice cream are expected to grow at the highest rate close to 24 pc in (FY18-23). Traditional Indian sweets – this is a big category waiting to expand. Cold chain infra will lead to the emergence of many new categories.

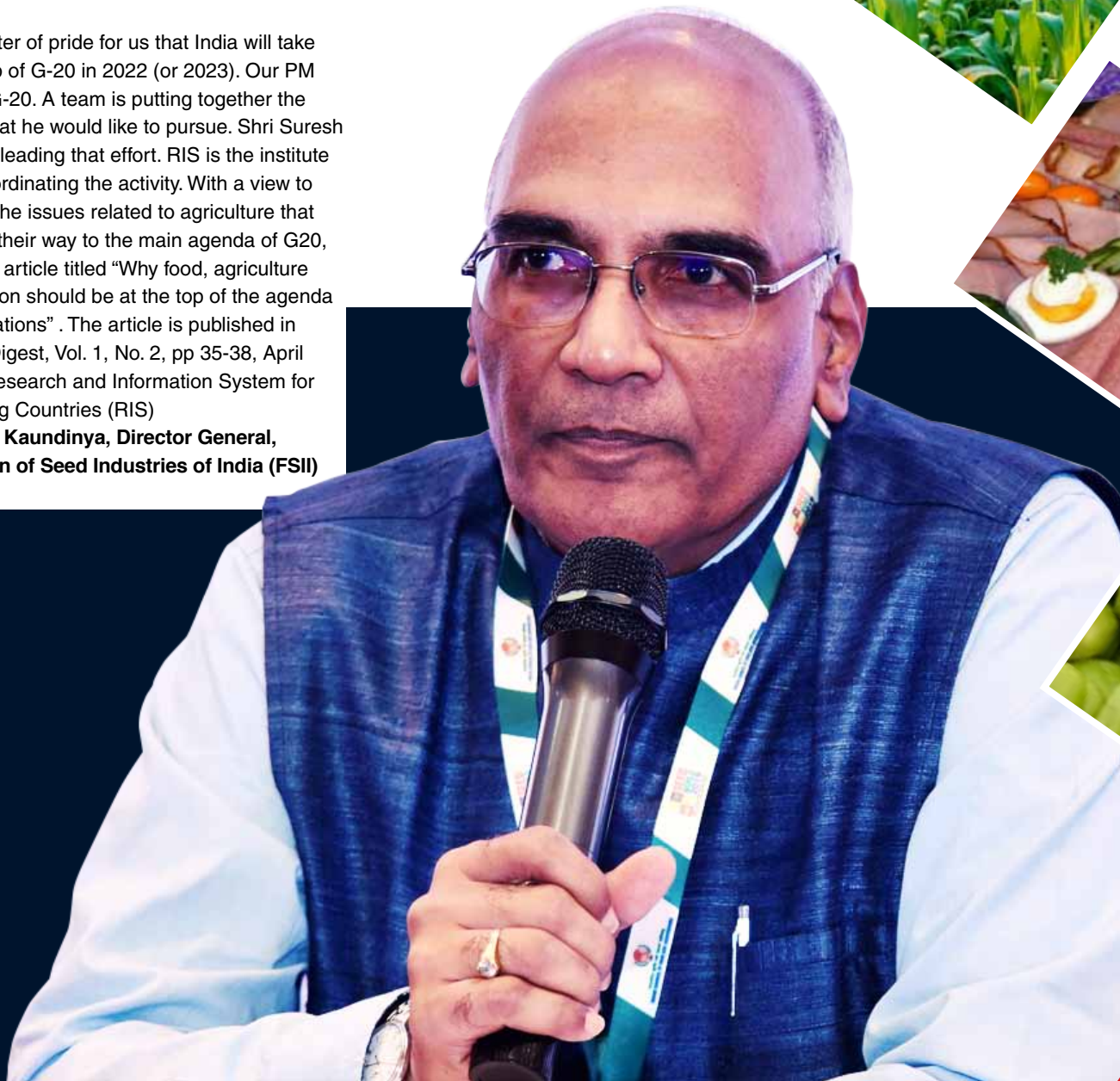
Paneer and khoa are growing at a CAGR of 17-18 percent (FY18-23). The curd market is growing at a CAGR of 10-11 percent and ice cream at 22-24 percent (FY18-23). Cheese and ice cream are expected to grow at close to 24 percent (FY18-23). Traditional Indian sweets is a big category waiting to expand. Cold chain infra will lead to the emergence of many new categories

AGENDA FOR G20 NATIONS

WHY FOOD, AGRICULTURE AND NUTRITION MUST RANK AT THE TOP

It is a matter of pride for us that India will take leadership of G-20 in 2022 (or 2023). Our PM will lead G-20. A team is putting together the agenda that he would like to pursue. Shri Suresh Prabhu is leading that effort. RIS is the institute that is coordinating the activity. With a view to bring out the issues related to agriculture that must find their way to the main agenda of G20, I wrote an article titled “Why food, agriculture and nutrition should be at the top of the agenda for G20 nations” . The article is published in the G20 Digest, Vol. 1, No. 2, pp 35-38, April

- Mr. Ram Kaundinya, Director General, Federation of Seed Industries of India (FSII)



As India takes up leadership of G20 in 2022 it would be most appropriate to bring food, nutrition and agriculture to the centre stage for this elite group. While the world would perhaps be recovering from the ravages of COVID-19 by 2022, it would be very important to bring the attention of the world back to the most essential things of life like food and health and create enabling conditions for their promotion.

Some of the Sustainable Development Goals are intrinsically linked to food, nutrition and agriculture. Zero Hunger (2), Good Health & Well-being (3), Responsible consumption and production (12), Climate action (13) and Life on land (15) are in this list. In the Post-COVID situation these goals assume more importance as the emphasis would shift from GDP driven economic goals to the Well Being driven social goals. Agriculture, Nutrition and Food form the bed rock of the well-being of people across continents.

Governments of G20 countries have a responsibility to make the SDGs achievable by 2030. Food, nutrition and agriculture will play a crucial role in that endeavour. Such an important topic deserves to be at the centre of the agenda of G20.

As COVID-19 exposes the fragility of the supply chain of food and agricultural produce around the world, the nations are exploring means of being more self-reliant, especially with food. Small holder farmers who dominate agriculture in many of the G20 countries, many of them being women, need to be protected and nurtured for the sustainability of the local food production system. Hence, it is an important topic for the G20 nations to debate and find answers to.

Agriculture has made great progress in many countries in the last 50 years, starting with Green Revolution followed by hybrid technology and biotechnology. Yield increases helped the world to feed the ever growing population. However, tragically hunger still exists in the world. More than 5 million children died last year due to lack of food, clean water and health care. About 160 million children of below 5 years age are found to be malnourished in the world. These numbers can go up if immediate action is not taken.

Equity is a victim of our growth so far. Lack of purchasing power has deprived certain sections of the world community from accessing food. On the other hand there is abundance of food in most of the advanced

> Can agriculture survive if farmers die? Leaders have to find answers that can improve the financial wherewithal of the farmers and increase their risk-bearing capacity

countries. Inequality based on gender, geography, income and other parameters needs to be addressed. Lack of equity in access to food is a major issue, especially in disaster situations like pandemics when it gets exposed more due to the failure of food supply chain and the natural advantage the rich have in accessing food in such situations. This needs the attention of world leaders.

Small holder farmers and their welfare need to be at the top of the priority list for governments around the world. Unprofitable agriculture, in many parts of the world, has left the farmers poor and vulnerable to several risks. In most of the developing countries more than 80 per cent of the farmers are small and resource-poor, and many of them are women. They lack access to high quality inputs, finance, technical advice and access to markets. They are unable to practice sustainable and good agricultural practices. Distress among farmers leading to increased suicide rate is a big challenge for the world.

Can agriculture survive if farmers die? If youth does not have interest in agriculture, how will the future of agriculture look? Leaders have to look at this serious problem that cuts across most of the world and G20 countries. They have to find answers that can improve the financial wherewithal of the farmers and increase their risk-bearing capacity.

Depletion of natural resources has become a very serious issue in most of the countries. Soil, water and biodiversity have depleted due to continuous and intensive agriculture followed in the last 50 years. Our food production systems in each country have to be measured against a natural resource use efficiency index. Diffusion of technology across the nations to help them in improving their natural resource use efficiency index has to be given priority as a humanitarian effort to conserve environment.

Digital technologies can help in creating market linkages, transferring knowledge to farmers and supporting financial systems. Precision agriculture and micro irrigation can make a huge difference to the way we manage the use of natural resources in agriculture.

The Threat of Climate Change

The leaders have to take policy decisions to promote this collaborative approach. Climate Change is the biggest threat to global agriculture whose impact is increasing year after year. Droughts, floods are increasing in intensity. Potential yields could drop and food availability could be severely restricted by 2050 due to climate change unless we start responding now. Sustainable agricultural practices and cultivation of climate resilient crops may help us in fighting this, but how to make it a part of our life and how to handle possible immediate yield losses? Is it possible to have a collaborative policy across nations which helps the total global population?

This needs the attention of the world leaders to find a collaborative effort.

ot having predictable commercial models for sharing of technological innovations among countries has not helped. Biotechnology can help in fighting biotic and abiotic stress in agriculture. Digital technologies can help in creating market linkages, transferring knowledge to farmers and supporting financial systems. Precision agriculture and micro irrigation can make a huge difference to the way we manage the use of natural resources in agriculture. It is important for the world leaders to take this agenda forward and

find regulatory and commercial structures that will make technological tools available for the benefit of food and agriculture field uniformly across the world.

Seeds and Planting Material

Seeds and planting material need special mention among all agricultural inputs not just because this is the most important input carrying genetic potential that can benefit humanity but also because they become controversial in different parts of the world. It is vitally important that farmers use high quality seed every time they plant a crop. Unfortunately public institutions have run out of steam in funding crop development research, and private industry takes interest in seeds where their commercial interests lie. This leaves large OP variety crops without adequate research funding leading to low genetic gain. Some of them are staple food crops like wheat, rice, millets, root crops and nutritious crops like vegetables, oilseeds and lentils, and forage crops for the livestock.

World leaders have to find a way of funding research in improving such crops and to make them resilient to climate change. Modern tools like genomics, gene editing in addition to traditional plant breeding have to be dovetailed to support these crops. Cropping systems in different countries have to be optimized by making seed the carrier of all the good things needed in our food. Seed systems have to be professionalized and augmented in the poorer nations who are struggling to reach the levels of stable food production and security that others have reached. This needs a major discussion among the world leaders so that institutional infrastructure is put in place towards this end.

There are several other subjects like biodiversity, international movement of germplasm and intellectual property management in agriculture which need special attention of the world leaders. These subjects have to be sorted out in such a way to facilitate smooth and seamless use of these resources for the common good while simultaneously protecting the

biodiversity and proprietorship of biological resources of the communities.

Financial systems, consisting of credit and insurance products and services have to be made available to farmers so that their risks are covered and their financial wherewithal is built over a period of time. Using modern digital technologies the financial institutions should be able to offer these services in a seamless manner to the farmers as they offer to their urban counterparts. Digital land records, collateral management, digital market linkages for the produce and similar infrastructure are essential for the success of this effort.

Diversification of Agriculture

Farmers' incomes have to be strengthened through diversification. Livestock, dairy, fisheries, birds and other sources of non-farm income for the farmers are to be built on a strong platform with funding, insurance, technical advice, linkage to markets and digital support systems. This will reduce vulnerability of farmers' lives due to crop failure for reasons like abiotic and biotic stresses. A robust structure of farmer cooperatives and farmer producer organizations is to be built covering farm and non-farm activities of farmers in a comprehensive way.

India has a huge role to play in bringing all these aspects of food, nutrition and agriculture to the centre stage during its tenure of leadership of G20. India is a major contributor to the pool of agricultural land, number of small holder farmers, crop diversity, agro-climatic conditions and food systems of the world. India can benefit from bringing all the above aspects into a seamless stream of knowledge and experience sharing across countries. At the same time India can also contribute towards making this work for many other developing countries. India should take lead in getting some of the policy level decisions on the above aspects hammered out among G20 countries during its tenure.

The G20 leaders have to show unflinching commitment to achieving the Sustainable Development Goals by 2030, especially those impacting food, nutrition and agriculture - which kept the world going during COVID-19 pandemic. They have to build a more equitable world in the post-COVID situation.

PROCESSED FOOD

COMPATIBILITY OF INDIAN LOGISTICS INFRASTRUCTURE

Processed food is growing at a fast pace in India. The demand for ready-to-eat meals, healthy and immunity boosting food choices, safe and processed snacks have also become drivers to growth. Home delivery of packaged and processed food has shifted from mere convenience to a necessity. The challenges of the pandemic have created immense opportunities to drive both investments and infrastructure.

India is one of the largest producers of most of the foodgrains, sugar and edible oils, but the focus of the food processing industry largely has been on beverages and dairy products. This is further corroborated by the fact that less than 10% of India's grans / oilseed output is being processed. This opens up large possibilities and opportunities to scale both in terms of the processed food industry and the logistics that surround it.

With urbanisation and increasing access to the market through interventions of e-market players, consumer preferences have seen a shift from unpackaged to branded and packaged goods. This has set up the platform for exponential growth for India's food processing industry. By 2024, the food processing industry is expected

ABOUT THE AUTHORS

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Ms Ann Thomas heads communication for Arya. She has worked closely with the management at design houses, institutions, start ups and media houses to design various internal processes, and with government organisations like BBMP and Namma Metro to look at art and activism in public spaces

to attract USD 33 bn investments and generate employment for around 9 million people. By 2030, our annual consumption is expected to make India the fifth largest consumer.

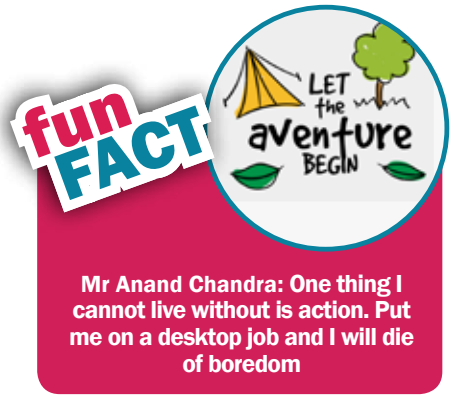
To bolster this growth, efforts need to be directed to strengthen the distribution channels, enhance the logistics infrastructure, ramp up the technology and digitisation of value chains. Alongside implementation of emerging technology such as artificial intelligence, machine learning, blockchain and IoT can create enormous breakthroughs. Emerging technologies can be a game-changer in building a strong logistics foundation which can enhance the traceability and ensure proper mapping of supply with demand.

Value addition for Impact

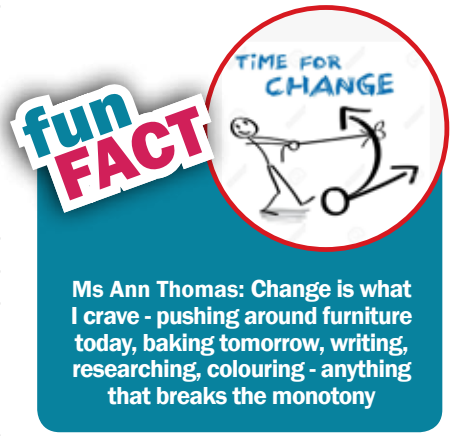
Farmers have been forced to sell their produce in distress immediately after harvest, when prices are often at their lowest. Surplus gets wasted or dumped to save transportation costs which are higher than the commodity value or due to lack of access to consumer markets. According to the United Nations Development Programme, up to 40 per cent of the perishable food produced in India is wasted. Food Processing is essential to reduce wastage. With the right balance of storage infrastructure and food processing a large part of these perishable commodities can be stored, packaged, marketed and preserved for later consumption and better returns.

Approximately 60 percent of India's rural households still depend primarily on agriculture for employment. To increase their incomes and generate further employment, value addition to their produce through primarily level and secondary level food processing comes through as an easy solution.

As India's largest agri-warehousing player, with 85 percent of our operations in primary and secondary agricultural markets, we at Arya have found great success in working with Farmer Producer Organisations in meeting the growing needs of the food industry.



Mr Anand Chandra: One thing I cannot live without is action. Put me on a desktop job and I will die of boredom



Ms Ann Thomas: Change is what I crave - pushing around furniture today, baking tomorrow, writing, researching, colouring - anything that breaks the monotony

The Role of FPOs

As FPOs farmers aggregate the farmers' produce, a primary level of quality assessment in the form of sorting and grading perishable commodities like Tomato, Potato etc at the farmgates can save costs and improve returns. Once the products have been graded, these can easily be categorised for immediate sale, storage and processing. With FPOs aggregating the produce on behalf of the members farmers, large volumes enable access to far off markets at rationalised transportation costs.

Value addition through simple processes of drying, pickling, pulping, etc can ensure greater returns for produce and save huge wastage of food produce. Improved logistics and distribution channels allow access to new markets and direct consumers. The farmers can easily connect to consumers anywhere across the world with homegrown produce, if equipped with food customization and promotion of ethnic food chains.

Logistics for Processed Food

Being a key enabler of multiple other industries operating in the country, the advancement of the logistics sector is critical to ensure an overall growth of the Indian economy. According to Fortune India, India's logistics sector, currently valued at USD 160 billion, is expected to grow at a CAGR of 10 percent to USD 215 billion by 2022.

Implementation of advanced technology and refined processes to boost knowledge, improvements and new strategies is key to attain profitability. With planning, implementation and control of goods through digitisation of commodity, movements have become faster and efficient.

Only 10-15 percent of the Indian logistics market is owned by organised players. With the pressing need to reduce logistics costs, India's highly fragmented logistics market would benefit to get more organised or aggregated. There is still the need for an integrated well-knit network of logistics enablers-rail, road, air and waterways.

The recent stimulus package of Rs 1.5-lakh-crore announced by GOI to strengthen logistics is a positive step in this direction. The introduction of mega food parks with Plug and Play Infrastructure for agri-commodities can effectively add value to the value chains. Mega food parks are envisaged to bring together farmers, processors and retailers in a well-defined agri/horticultural zone with state of the art infrastructure including collection centers, primary processing centers, central processing centers and cold chains.

Strengthening our cold chain infrastructure with refrigerated transport to bridge gaps in the value chain and improved market linkages are key to the growth of the agri-processing industry. Another criteria to improve logistics of processed food is to push for research and developments in the packaging sector for transportation of these packaged foods. Better packaging will bolster the growth of the industry and increase the income of the producer by increasing the shelf life, reducing damage in transit and increasing access to distant markets. Relevant packaging to preserve the produce while keeping quality intact during longer hours of transport can further facilitate the movement of produce. With the opening up of markets due to intervention of e-market players, the need for proper and sustainable packaging material is critical.

Building a robust logistics infrastructure and streamlining the agricultural supply chain is key to a stronger economy. It will minimise wastage, benefit allied sectors, generate employment and above all provide better prices to farmers improving their life and living conditions.

LIVESTOCK PRODUCTS
WE HAVE ENOUGH, BUT IS IT GOOD ENOUGH?

"Ensure sustainable consumption and production patterns", states the Sustainable Development Goal (SDG) 12 of the Global Agenda 2030. Target 12.3 of this goal aims to "by 2030, halve the per capita global food waste at the retail and consumer level, and reduce food losses along production and supply chains including post-harvest losses". According to the estimate of The United Nations' Food and Agriculture Organisation (FAO), "each year, approximately one third of all food produced for human consumption in the world is lost or wasted".

FAO urges nations to cut current food loss levels in half by 2030 to improve global food security and public health. To achieve this aim, the use of innovative new approaches and technology is the FAO's recommended strategy. It is in this context and perspective that we should appreciate the importance of value addition as a key solution to solving the problem of food loss in both developed and developing countries, while at the same time benefiting stakeholders throughout the supply chain.

Value addition is variously defined by the academia as transformation of raw agricultural

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product into a new and economically more beneficial product through the means of packaging, processing etc. from its raw into a new form. This definition may be correct, but it is not complete. While some commodities necessarily require value addition before their consumption as food (like converting wheat into flour), some others such as vegetables, fruit, poultry etc. are best preferred raw by the consumers. In the latter, value addition, if any, is minimal.

Freshness is key

In the Indian context where the consumer puts a high degree of premium on purchase of fresh and raw agriculture products, the most valuable value addition would be freshness. And in the case of livestock products, be it dairy or meat or fish, it is freshness, and freshness alone, that continues to be the most dominant determinant of the value of the product. No wonder the Sashimi grade Tuna, which the Japanese consume fresh and raw, is the most expensive fish, at times fetching an unbelievable price of above US$ 1000 for one kilogram.

Value addition in the case of this product would simply be freezing it at -60 degree celsius quickly after it is caught and till it reaches the retail end. In fact, it is the degree of temperature at which the fish is handled that increases or reduces its value. So you have Tuna being sold approximately at 75,000 or more per kg but at the other end of the spectrum the same Tuna may be getting a price of no more than 250 or less per kg. The difference between the two is little more than the temperature it is stored and handled at. Do you know that a Tuna caught today, when handled, stored and processed well, would carry a label such as "Best before June, 2023". Yes, the fish, most perishable of food commodities, would remain as fresh as the same day catch even after two years.

Value Addition For Livestock Products

Only about 20 to 25 pc milk is handled by the organised sector, including the cooperatives. Value addition in the form of an increased shelf life or more milk products is woefully lacking. In fact, our halwais appear to have a much greater understanding of the milk market. They manage to make three to four times the money by a minimal conversion of milk. Reduce the moisture and add sugar is the basic process in most of our traditional mithais which continue to command immense popularity and mass appeal all across the country. The same popularity cannot assigned to chocolates or pies.

We have done really well on lassi, paneer, dahi, chhaas etc. but we need to graduate beyond even the popular shrikhand and mishti doi. Therefore, a sea of opportunity exists for the organised dairy sector to branch off into industrial production of a vast range of traditional Indian sweets. This further opens the window for large scale khoa production for providing the consumer with hygienic milk-based sweets. The unique strength of traditional Indian sweets is their acceptability to all kinds of palates. So why not attempt to break the global hegemony of chocolate, the most widely consumed milk product.

A sea of opportunity exists for the organised dairy sector to branch off into industrial production of a vast range of traditional Indian sweets. This further opens the window for large scale khoa production. Why not attempt to break the global hegemony of chocolate, the most widely consumed milk product?

The Poultry Industry

At 103.93 billion eggs in 2018-19, India is the world's third biggest producer after China (566 billion) and the US (109 billion). From 1.82 billion eggs in 1950-51, 10.06 billion in 1980-81 and 36.63

billion in 2000-01, this represents a huge jump. The encouraging part about the poultry sector in India, spectacular growth apart, is that it has transformed what was a supplementary backyard activity to a highly-organised farming business. Today, over 80 pc of both egg and poultry meat production in the country is in the organised sector. This industry is far more organised than even dairying, where not even a quarter of the milk produced is handled by cooperatives and private corporate players.

At an average rate of Rs 5, the 100 billion-plus egg production would be worth over Rs 50,000 crore annually. Roughly 4 million tonnes of poultry meat at Rs 75/kg will add another Rs 30,000 crore.

However, the poultry industry's development has been highly skewed. More than half of India's egg production is accounted for by just three southern states: Tamil Nadu, Andhra Pradesh and Telangana. Secondly, despite the industry's relatively organised character, our productivity levels are still low. An average laying hen in the US produces about 290 eggs per year. The number in India is about 108 from desi and 209 from improved birds. Yet, poultry's advantage over other livestock sectors in India is that it is an already organised industry. Almost every farmer,

In India the constraint has been the absence of easy supply of frozen and processed meat rather than lack of demand. With a meager 6 percent poultry being chilled, frozen and processed, and less than 1 percent converted into value added products, the challenge is huge for us

mostly small, has been integrated along the value chain. Also, few industries offer scope for rural entrepreneurship with relatively low investment and short gestation/payment as poultry.

While domestic consumption should at least double, there is a need to also focus on exports. India contributes more than 5 pc to global egg production, but its share in exports is less than 1 pc. As against a close Number 3 behind the US in production, we rank a lowly 32nd or so in exports, behind even the likes of Turkey and Lithuania.

In 2018-19, our total export of bird eggs and powder (mainly dried yolk) amounted to a paltry Rs 618 crore. The fact that there are only a handful of egg processing plants – all, not surprisingly, in the South. This is testimony to the long distance even this most organised of agro industries has to travel. Wet markets are likely to start withering away, unless they reinvent themselves in terms of food safety and hygiene. In fact, in India the constraint has been the absence of easy supply of frozen and processed meat rather than lack of demand. With a meagre 6 pc poultry being chilled, frozen and processed, and less than 1 pc converted into value added products, the challenge is huge for us. And here lie the future opportunities: safe, hygienic, fresh products. True value addition, as in fish, would mean freshness and hygiene.

"Sometimes, frozen can be more nutritious than fresh", said Krish Ashok in an informative and interesting article in the Mint Lounge of May 8. He goes on to advise an approach based on science and nuance while selecting ingredients for food as fresh is "not necessarily the ideal state to eat everything". So we would be well advised to distinguish between raw and fresh when we make a choice of our livestock product next time. Ask the question: Is fresh really fresh? And is Value Added truly value added? A true value addition would be value for every player in the production and supply chain – the consumer, the processor, the retailer, and above all the farmer.

FOOD PROCESSING

WAY TO A STRONG AGRI ECONOMY

Despite being a leader in the production of several agricultural commodities, India's agriculture sector is primarily characterized by high wastage post-harvest (up to 16 pc in perishable products such as fruits and vegetables), lack of mechanization, low yield and lower levels of value addition compared to their global counterparts. This has prevented farmers from realizing the true potential of their crops, resulting in significantly lower incomes.

The Ministry of Food Processing Industries is mandated to reduce post-harvest losses and enhance food processing levels in India. The food processing sector links agriculture, manufacturing sector and final consumers. The sector is critical to increasing the farmer's income in India through value addition and reducing wastage, resulting in enhanced income for farmers in India.

As the fifth largest sector in India, food processing contributes about 9.5 pc to GVA and 13 pc to employment in the manufacturing segment. A recently released report by KPMG in India titled Indian Food Processing Industry: Growth Opportunities Post the Covid-19 Pandemic estimates that the sector is currently valued at USD 263 billion (2019) with a 5-year CAGR of 11 pc. The sector offers significant potential for increase of farmers' income in India. There are two lenses to gauge this opportunity. First, there is significant demand potential (domestic/ export) and second, various interventions by government and industry to increase processing capacities in India are expected to lead to higher value addition.

The above mentioned report also estimates that the food

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processing industry in India is expected to reach USD 535 billion by 2025 (CAGR 15 pc). Currently, food processing levels in India are only 10 pc, which is significantly lower than its global peers (levels up to 55 pc in European countries). The inherent tastes of our multi-cultural society, propensity to consume fresh food and the traditional distrust of outside food and its quality have hampered growth in the food processing sector. However, increasing urbanization, rise in disposable income, availability of a greater variety of processed food, increasing demand from Tier 2/3 cities, and the emergence of E-commerce has brought a change in food consumption patterns of the country and propelled the Food Processing industry towards a growth trajectory leading to higher processing levels. The Covid-19 pandemic has led to increased acceptance of processed food. In addition, there is significant potential in the export market as well.

The increased demand for processed food is a potential opportunity for farmers in terms of increased production, greater demand for raw material for value-added products, diversification from grain-based crops to horticulture, production of high-value processable varieties - all of which can add to farmers' income. There is a dire need for increasing and enhancing processing facilities at farm-gate level (currently very primitive), for farmers to rise higher in Food Processing value chain.

There have been multiple case studies that emphasize a change in cropping patterns and an increase in the prosperity of farmers when they are enabled to produce crops for profit rather than sustenance. In western Uttar Pradesh, farmers prefer to grow Sugarcane, in Madhya Pradesh they prefer Soyabean and the success of exports of pickled Cucumber & Gherkins has changed cropping patterns in more than 20 districts in Karnataka, which later spread to neighbouring States.

On the supply front, the lack of cold chain infrastructure, modern logistics and storage infrastructure are the primary reasons behind high levels of post-harvest wastage of Agriculture produce in India.

There have been multiple efforts from the Central Government as well as State Governments to reduce post-harvest wastage through the development of storage and supply chain infrastructure, development of processing infrastructure and subsidising of investments in the Food Processing Sector. Major schemes by Government of India include schemes such as Pradhan Mantri Kisan Sampada Yojana (PMKSY) which provides subsidy for the development of high-quality infrastructure such as Mega Food Park with world-class facilities and modern storage facilities, Cold Chain, testing laboratories etc. The scheme also envisages setting up of near farm infrastructure such as Agri Processing Clusters which are aimed at creating primary processing facilities.

Recently announced Agriculture Infra Fund worth INR 1 trillion - provides support to a large number of beneficiaries including Farmer Producers Organizations (FPOs), Self Help Group (SHG), Farmers, Joint Liability Groups (JLG), Multipurpose Cooperative Societies, Agri-entrepreneurs, startups etc. by way of interest subsidy.

However, efforts need to be made to ensure that the scheme benefits reach the intended beneficiaries - small & marginal farmers (82% of overall farmers) who have no bargaining strength and do not aggregate their produce.

On a policy front, several State Governments have identified Food Processing as a thrust /important/ focus sector for attracting investments in the State. This is expected to increase processing capacities and lead to higher raw material/ primary processed product sourcing opportunities from farmers.

Going forward, the Government needs to ensure fairness by producers so that farmers get a better realization of the money earned across the value chain. A policy intervention or regulation in this regard is the need of the hour.

In conclusion, the rise of the Food Processing sector provides several opportunities for increasing farmers' income. Several interventions have been planned by the Government but more are needed to ensure that their end objectives are met.

To sum up, the KPMG in India report mentioned above also highlights some of these interventions such as increasing adoption of technology, encouraging product innovation, high quality infrastructure in cold chains, quality testing & certification and focus on integrated inter-ministerial approach.

SUPPORTING AGRICULTURE THROUGH VALUE ADDITION

ROLE OF INDIAN SUGAR SECTOR

Sugar is the second largest agro based industry supporting over 50 million farmers along with direct and indirect employment to around 12 percent of rural population in major sugar producing states. The turnover of the industry is in the range of Rs. 100,000 crores, out of which Rs. 80,000 crores accrues to the sugarcane growers. Today majority of the sugar complexes are not only producing sugar but are also contributing to the energy security of the nation by supplying green power and green fuel. The industry is also saving precious foreign exchange to the tune of around Rs. 7,000 crores.

Sugar industry is located in rural heartland of the country and has played a very important role in the development and prosperity of rural India. Apart from sourcing sugarcane and generating employment, this industry spearheads numerous sugarcane development initiatives, CSR initiatives and sustainability practices which have a direct impact on the livelihoods of the rural population. During the Covid pandemic, the sugar industry has risen to the occasion and contributed in all possible ways. Most notably, the industry has been in the forefront in the production and distribution of sanitizers, and currently in the process of setting up of oxygen plants.

It is one of the few sectors where practically no intermediaries are there and the industry has seamless interface/round the year engagement with the growers and the local community. As a result of the consistent efforts of the sugar industry, there has been significant improvement in sugarcane productivity. This has led to increase in the farmers' income, which is essential from the growth of the industry.

ABOUT THE AUTHOR

Mr Roshan Lal Tamak heads the Sugar and Ethanol businesses at DCM Shriram Ltd as its Executive Director & CEO. He has more than three decades of distinguished professional experience of the sugar sector in leading companies like Balrampur, Dhampur, Mawana and Olam. Mr Tamak has successfully championed sustainability initiatives in agriculture and factories. He is a key member of various industry platforms like ISMA, CII, Bonsucro-London, International Society of Sugar Technologists (ISSCT), Mauritius, Research Advisory Committee of ICAR-IISR, etc. He has been bestowed with many global and national awards

NOTEWORTHY CONTRIBUTIONS OF SUGAR SECTOR

Contributions and achievements of the sugar sector are quite significant by utilization of all its products and by-products with integration and diversification.

Sugar

The national sugar production has been consistent and in the range of 30-31 MT per annum. Out of this, 25-26 MT is consumed domestically, making India the largest consumer of sugar in the world. The country is also the second highest producer of sugar after Brazil and is now a strategic exporter as well. India has exported 6 MT of sugar in 2019-20 and shall export approximately 6 MT in 2020-21 as well. These exports helped the industry in reducing the surplus inventory.

Ethanol

Now the industry is actively working to divert the excess sugarcane produced by way of B-heavy molasses and sugarcane juice, and produce ethanol under the aegis of Ethanol Blending Program of GOI. Currently national production is around

3.5 billion litres of ethanol, annually. Molasses, the by-product of sugar manufacturing, is the main feedstock for ethanol. India has achieved the blending level of approximately 7.5 percent. The government is intending to achieve 20 percent by 2025. The benefits emanated under this flagship program are noteworthy:

- Diversion of excess sugar to ethanol shall aid sugar mills in making timely payments to growers. At present, around 2 MT of excess sugar is diverted to ethanol annually. This is going to increase further as millers are adding capacities with the financial assistance being provided by GOI.
- Well distributed production centres for Ethanol will help in reducing transportation costs
- Reduction of crude import shall enable the country to become Atma Nirbhar
- INR 40,000 Cr investment in the capacity building projects will lead to increased employment in distilleries
- Environmental benefits from clean and green fuels
- **Bagasse based Co-generation**

The annual production of 3000 MW of clean and green power by the industry produced as cogeneration from another by-product bagasse is supporting national energy security.

Press-mud

The industry supports farmers by offering high quality manure in the form of press-mud at affordable rates. This helps in increasing the organic carbon content of the soil and enhances soil health. Newer initiatives by the industry such as the setting up of compressed biogas (CBG) plants under the aegis of SATAT (Sustainable Alternative Towards Affordable Transportation) scheme shall also help in adding clean and green fuel which will help in reducing pollution levels.

These are some examples of value addition and a circular economy.

ROLE OF FOOD PROCESSING INDUSTRY IN SUPPORTING AGRICULTURE

Agricultural produce is perishable in nature. Most Indian farmers have small land holdings and therefore no means to store and process their produce. Approximately 40 percent of total food produced in India is wasted, as per a report published by the Food and Agricultural Organization, UN. The food processing sector can play a vital role in reducing the wastage of perishable agricultural produce, enhancing the shelf life of food products and ensuring value addition to agricultural produce. This will also help in diversification and commercialization of agriculture, generation of employment, enhancing income of farmers and creating surplus for the export of agro and processed foods. This sector has been gaining traction benefiting farmers in some pockets of the country. There are miles to go to extend the benefit to our entire farming community.

ROLE OF SUGAR INDUSTRY IN SUPPORTING FOOD PROCESSING AND AGRICULTURE

The sugar sector is uniquely placed, and can play a pivotal role in providing impetus to the food processing sector of the country. It has the following inherent advantages:

- Sugar complexes are located exactly at the origin for agri-produce i.e. rural India. Over the years they have established their agri-value chain and supply chain linkages. For any new comer it takes a lot of time to establish the supply chain linkage and credibility amongst growers. The sugar industry operating since decades has this advantage. All sugar factories have a well-oiled extension network which can be used for educating growers for production of other crops as well.
- Sugar factories have the basic infrastructure readily available for food processing such as power, manpower, machinery and production capabilities. The industry produces excess green power which can be used for setting up cold chain infrastructure and warehousing facilities adjacent to the existing mills.
- On the market side, the fundamental market linkages for selling the processed food are available, and selling other products will be an adjacency only.

Sugar sector is the largest sector in organized food processing of the country. It has established itself as a major contributor of bio energy in terms of clean and green power and fuel. Sugarcane-based feedstock is the mainstay of the flagship Ethanol Blending Program, which is a progressive and fast-tracked initiative of GOI. Additionally, progress has commenced in more areas like producing Bio CNG under the SATAT program of the government.

The sugar industry is well poised and can support Indian agriculture by turning sugar complexes into bio-energy hubs and agri-processing hubs in the times to come.

Mr Tamak likes to read books on management skills and leadership trends. He is a passionate listener of Punjabi folk songs

BRAND NAFED
KISAN SE KITCHEN TAK
SERVING THE FARMERS AND CONSUMERS

The National Agricultural Co-operative Marketing Federation of India Ltd. (Nafed) is an apex organization of marketing cooperatives for agricultural produce in India. It was established on the auspicious day of Gandhi Jayanti on 2nd October 1958 and is registered under the Multi State Co-operative Societies Act.

NAFED

More than 60 Years in Service

Nafed was founded with the objective to promote the trade of agricultural produce and forest resources across the nation. Agricultural farmers are the main members of Nafed, who have a say in the working of Nafed in the form of members of the General Body.

Nafed has a three tier-structure with Nafed at the top of the tier, primary cooperative marketing / processing societies at the bottom and state level marketing/ tribal/commodity federations in the middle. Some national /apex level marketing / consumer cooperative federations are

also members of Nafed.

The activities of Nafed add to the betterment of agriculture and post-harvest of the produce. Nafed procures stocks directly from the farmers in regulated mandies via open auction through the cooperative infrastructure. In this way, Nafed provides farmers with a ready market, fair price, and prevents their exploitation at the hands of private traders. Nafed provides support to the farmers by way of implementing various schemes of Central Government/State Governments such as PSS, PSF, and MIS. Nafed also procures various agricultural commodities directly from farmers at mandi level through its cooperative network.

Nafed has also been nominated for supply of pulses to the Army, Central Para Military Forces, and to states under different welfare schemes such as PDS, MDM and ICDS out of the national buffer. Nafed has recently entered into an MoU with the Ministry of Food Processing Industries to further the objectives of the Prime Minster Formalisation of Micro food processing Enterprises (PMFME) scheme. As part of the collaboration, Nafed will develop a new brand NAFED FOOD to market the products produced under the PMFME programme.

NAFED BAZAARS: Serving the Consumers

To serve the broader social objective of making essential items of daily needs available to the consumers at affordable rates, Nafed operates several stores, under the brand Nafed Bazaar, through its Consumer Marketing Division.

Nafed Bazaar stores provide grocery and consumer items at affordable prices to consumers. The chain will soon be expanded to a network of over 200 stores across India.

Nafed Product Range

One of the most popular consumer products is Nafed Brand Tea available in two variants namely Nafed CTC and Nafed PREMIUM. NAFED brand tea bags are available in ten flavors - Assam CTC, Green Tea, Green Tea (Tulsi), Green Tea (Lemon), Earl Grey, English Breakfast Tea, Masala Tea, Slimming Tea, Jasmine, Green Tea and Rose Tea. Nafed Tea is one of the tastiest flavored teas of India.

NAFED Pulses are one of the most sought out product from our Portfolio. NAFED has launched more than 16 varieties of pulses under its brand name NAFED Pulses.

NAFED also deals in different varieties for Dry fruits under brand name NAFED Dryfruits.

Few of the recent additions in the NAFED branded Products are NAFED Masala (Whole and Powder: More than 25 varieties), NAFED Besan, NAFED Rice (10 Varieties).

NAFED is also in the process of launching fortified Rice Bran Oil, Nilgiri's Teas, Atta, Suji, Maida, Dalia and other grocery products.

CO-Branding with others

NAFED continues to support organic cultivators across the country by providing the requisite market linkages for ensuring a better price recovery. The product range under its ambit has now increased to 90. These new products launched under brand name of Organic Soul include pulses, spices, grains, flours, honey, edible oils, flex seeds, chia seeds, tea etc.

Institutional Sales

Nafed supplies grocery items and various other FMCG products to a large number of government institutions. Nafed will soon start supplying stationery and office supplies as well.

With exclusive tie-ups with major brands and a robust warehousing and supply chain network, Nafed is well placed to provide the best prices and speedy service to our institutional buyers. Nafed also undertakes supply of specific items as per the requirement of our institutional clients. We also supply special corporate gift packs featuring 100 percent organic items as well as exclusive regional produce like fruit, grains and spices.

OPPORTUNITIES OF PROCESSED POULTRY AND DAIRY PRODUCTS IN INDIA

India is the second largest producer of eggs and fourth largest producer of chicken. Valued at more than Rs 1 trillion, the poultry industry supports more than 25 million farmers and employs over five million. Unlike Brazil and the US, where nearly 80% of meat sold is packaged and processed, the poultry industry in India depends on wet markets. Consumers prefer to buy fresh meat. With Covid, consumers have started realizing that fresh doesn't always translate into clean.

This transition in mindset is the trigger for exponential growth expected in processed and value-added poultry market which is presently only 5-10 pc, depending on the geography. There is clear opportunity to double or even triple the size of processed poultry meat in India. According to an estimate, the poultry processing industry in India is expected to expand at CAGR of more than 12 pc between 2018 and 2023, to reach a value of Rs 107.6 bn in 2023.

A major pain area for Indian poultry producers is that consumption cycle is not constant. It is also unpredictable. Producers often bear reduced margins or even losses to sustain farming volumes.

ABOUT THE AUTHOR

Dr (Capt) Tanweer Alam is Marketing Director, Kemin Industries South Asia. Observing consumer behavior and fore-sighting consumption trends fascinates him

A well-developed processed meat market will benefit both producers and consumers. Processing increases the shelf life of meat and meat products. It enables producers to absorb demand shocks through improved inventory control. The ability to store the product also protects producers from unexpected price crashes.

As per KPMG data, going by consumer preference, the need for hygienically packed meat untouched by hand will increase. Indian customers will start asking for traceability, non-usage of antibiotics/chemicals as add on features. This shall encourage some existing players to forward integrate into a processed branded market domain in sync with future consumer trends.

The Challenges

The challenges ahead will be reaching out to consumers on how nutritive quality remains undisturbed with processing and also upgrading the processing and

supply chain infrastructure, including a robust cold chain set up. Packaging needs attention. In one survey, nine in 10 consumers said they rank packaging to prevent contamination high for food purchase. Two in three said they wished that meat had more protective packaging.

Opportunities in Dairy Market

India stands tallest across the world with more than 195 MMT annual milk production. While 48 pc of milk produced is consumed by dairy farmers themselves, 52 pc goes to the market. Out of this, about 20 pc is processed by the cooperative sector, about 30 pc by branded private companies and the balance by the unorganized sector. The key to note is the proliferation of private dairy enterprises. They account for more than 60 pc dairy processing capacity. In the cooperative sector, processing capacity is skewed. Gujarat alone accounts for 46 pc of it. Other states are expanding exponentially now.

India has set its eyes on doubling milk processing capacities from the current 53.5 million tons to 108 million tons by 2025. This will help in increasing the present 23 pc share of value-added processed milk to more than 40 pc. Trend of increase in processing capacities in the private sector and also the cooperative sector is encouraging. There are excellent prospects for value added and processed milk and milk products.

Processing and value addition in dairy industry has twin advantages. Consumers get to drink and eat milk as per their taste and choices. Better realization of value of milk can significantly impact the earning of more than 70 million dairy farmers. Almost 50 pc of total milk in India comes from buffaloes. It is much creamier and suitable for value added products like mozzarella, curd etc. This offers us a unique advantage.

It is noteworthy that the success of a value adder and processor depends on finding the sweet spot of growth, margin and investment. In general, the EBIT of milk and SMP is in single digit. The same for value added products can be more than 20 pc. It requires understanding of market's unique characteristics, supply and demand dynamics and urge to innovate continuously to meet the consumers' choice of product mix, and achieve success. Covid has made this understanding even more relevant. While packaged liquid milk continues to remain a key driver in the Indian Industry, value-added products are promising growth of 15-20 pc YOY.

fun FACT

Dr Alam is fond of long distance solo running and playing squash. Sometimes during leisure hours, he likes to pen his thoughts on his blog page

Consumer trends as driver of growth

COVID has disrupted consumer behavior. Many more disruptions are still to come. One of the disruptions is HORECA (syllabic abbreviation of Hotel/Restaurant/Café) loss. But milk retailers have gained as family consumption has registered a major increase. A McKinsey research report suggested that during Covid, about 65 percent consumers tried a new or alternate brand. Nearly 10 percent do not intend to switch back.

Both dairy and poultry market are seeing an accelerated shift from loose or unbranded to the packed segment. Consumers are increasingly conscious of hygiene and safety. Many regional brands are getting amazing customer appreciation. Functional food is not a fad. It is here to stay. Consumers have fundamentally changed their attitudes to health and wellness. Immunity is a big USP. Consumers prefer to cook dishes at home and have started realizing the cost saving. The also have a much more discerning eye on value for money. Anyone who had been splurging money of packaging and the look and feel of the product may have to think twice. It may not work as the only mantra to please consumers.

Consumers now insist on hygienic, value-added and trustworthy products at their doorstep with compassionate communication and humanized digital experience. Hope the industry is ready to serve the new genre of consumers!

AGRICULTURE TRADE FROM INDIA

SWOT ANALYSIS TOWARDS POLICY MAKING

India is one of the world's five largest producers of livestock and poultry meat, with one of the fastest growth rates. India ranked within the world's five largest producers of over 80 per cent of agricultural produce items, including many cash crops such as coffee and cotton. India is the world's largest producer of many fresh fruits and vegetables, milk, major spices, select fresh meats, select fibrous crops such as jute, several staples such as wheat, rice, millets and castor oil seed. India is the second largest producer of wheat and rice, the world's major food staples. India is also the world's second or third largest producer of several dry fruits, agriculture-based textile raw materials, roots and tuber crops, pulses, farmed fish, eggs, coconut, sugarcane and numerous vegetables.

Strong production base, but not able to leverage international market

Higher marketable surpluses should be optimally converting into enhanced presence of these products in the global market as exports; but has so far been only a little more than a mirage. A few examples illustrate this unrealised potential. India is the largest producer of milk and milk products but its share in total world exports is a meagre 0.2 per cent; for cereals it is 1.4 per cent; coffee, tea and spices 4.4 per cent; and fisheries only 2.6 per cent. This paradox is further substantiated by comparative rank analysis between production and exports.

Stiff Global Competition

The comparisons throw upon alarming situation, especially in case of fruits and vegetables where India is the largest producer of many fruits including banana, mango, papaya; third largest for apples; mangoes with total number of varieties across various agro climatic zones of India crossing approx 1000 still leading to 25th position when it comes to exports. Comparative analysis of India's production versus exports vis-à-vis other global players highlights the need for an immediate policy focus towards bridging this gap.

The hiatus is attributed to the fact, that there exists stiff competition for all these sectors. Brazil gives India tough competition in case of sugar, coffee, tobacco and mango. USA competes for groundnut, rice, tobacco, grape, apples, wheat, poultry meat and fish exports; while China has recently emerged as major competitor for groundnut, apple and fish. Even smaller economies like Vietnam and Turkey are occupying much larger share in the global markets as compared to India.

A prime challenge is that India's export markets do not match with prime importing countries for respective products. The dissonance between India's global ranking between production and exports may be attributed to both supply side as well as demand side issues. The sufficiency condition for achieving a robust export status warrants that all demand side issues be addressed.

Supply and demand side issues

Instances of very high final landing price as compared to other competing suppliers can be witnessed in case of mangoes in the USA, which is one of the biggest importers of mangoes and tea. Similar situation prevails in case of tea in US; rice in UK, refined sugar in Australia and similarly in most other cases. Hence India is losing out on export opportunity available in the developed country markets where demands for agri-imports are on rise.

Tariff escalation: a challenge for value added food exports: Currently only 8-10 per cent of the perishables are processed in the country. Processed food industry is expanding globally and certain niche sectors in India can gain advantage.

Rising non-tariff barrier for agro-exports in existing markets: India's farm exports also have to face a series of non-tariff barriers in top consuming markets, for example, a ban on import of mangoes by EU.

Making Indian Agro Globally Competitive

This calls for adopting a eight-pronged strategy covering,

- Product segmentation
- Quality enhancement
- Market diversification
- Market penetration
- Value addition
- Agriculture infrastructure upgradation
- Skill development
- Branding/Promotion

Further, a conducive export policy and regulations framework is critical in ensuring competitiveness of India's agro-export trade globally.

Market intelligence: One of the prime reasons of poor presence of Indian exports in the shelves of global retail chains is its inability to appreciate the variation in consumer tastes and preferences across various importing countries.

Establishing cluster level FPOs and wide network of farmers' registration: To comply with the norms of importing nations, it is a requisite that the produce is procured from registered farmers only. If the farmers' registration is not in place, exports may be adversely affected.

Focussed training and skill development of FPOs: Unregulated input (chemicals) usage at the farm level, inadequate harvest and post-harvest management practices affect quality and shelf life of the produce. Region and commodity specific package of practices need to be developed and disseminated to reach the last mile. Farmers' awareness is critical to regulate the chemical usage on the farm. This needs a coordinated approach through active participation of State Agriculture Departments, Commodity Boards, Research Institutions and APEDA.

Production versus Exports: India's status versus World

Agri Products	India's Share In World Exports	Rank in World	
		Production	Exports
Coffee, Mate & Spices	4.4	5	5
Tea	4.1	2	5
Sugars	1.9	2	10
Fish	2.6	2	12
Oil seed	1.5	1	12
Cereals	1.4	3	14
Tobacco	1.7	3	15
Edible vegetables	1.5	2	17
Edible fruit	1	1	25

Establishing Traceability systems

European Union directive Article 3(15) of regulation 178/2002 makes it mandatory for exporting units to establish the traceability systems in their supply chains. This means the "ability to trace and follow feed, food producing animal or substance intended to be, or expected to be incorporated into a food or feed through all stages of production, processing or distribution.

Establishing SPS/TBT dissemination system

Frequent changes have been witnessed in the SPS/TBT regulations in the export markets. In the absence of access to the actual and timely information on Sanitary and Phyto Sanitary (SPS) requirements in foreign markets, Indian farmers face significant delays and confusion.

ABOUT THE AUTHOR

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EMPOWERING WOMEN FARMERS

Economic Survey 2020-2021 states that the share of agriculture in the country's GDP has reached almost 19.9 percent. Close to two-thirds of our population works in the agri sector, including women. While they comprise a large percentage of the agricultural workforce, women have majorly been engaged in non-mechanised farm occupations. These include important activities such as sowing, winnowing, harvesting, as well as labour-intensive processes such as rice transplantation. Their talents can be furthered to contribute significantly to the agricultural sector. The Food and Agriculture Organisation stipulates that globally, food production could increase by up to 30 percent and can help eliminate hunger for 150 million people, if women farmers are provided with the same resources as their male counterparts.

In India too, regardless of their large presence and contribution, women farmers are not adequately equipped to succeed in farming. They are held back by barriers that prevent them from investing in their livelihoods. Due to cultural norms, women are considered the primary domestic caregivers and caretakers. The combination of productive labour-intensive farm work and domestic role takes a toll on their health, community engagements and economic options. This inequality is heightened by their limited access to labour-saving technologies, time-saving services, as well as farming infrastructure and best practices.

This insufficient access to land, information, loans, and machinery become critical deterrents for sustaining and improving their lives as farmers. According to statistics released by the University of Maryland and NCAER 2018, women constitute over 42 percent of the agricultural labour force in India, but own less than 2 percent of farmland. In fact, 83 percent of agricultural land in India is inherited by

male members - the reason why women in agriculture are not able to make their own decisions.

GOI Initiatives For Gender Balance in Agriculture

GOI has rolled out many initiatives with a thrust on strengthening community practices and alleviating poor women farmers. For example, the National Rural Livelihood Mission aims to empower women farmers to improve productivity, enhance participation, learn and practice sustainable livelihoods. The program does this by investing in knowledge-building, skill-building, and capacity-building activities. One of its sub-programs, the Mahila Kisan Sashaktikaran Pariyojana, has also helped women in self-help-groups access services and resources that have helped them enhance agricultural productivity. While these programs are helping the community, there is an ardent need for a more focused approach.

Being an agri company at heart, PepsiCo India has a longstanding relationship with farmers for over 30 years. We have been working closely with 27,000 farmers, including women, across 14 states in India. We are focused on transforming their lives through our agricultural initiatives - Collaborative Farming and Sustainable Farming. Through these programs, we have been able to benefit thousands of farmers across the country - improving their overall income and livelihood - and continue to work towards uplifting farmer communities with a special focus on women farmers.

For example, we have been empowering women farmers to create a gender-inclusive supply chain in partnership with the US Agency for International Development (USAID) under the Women's Global Development and Prosperity (W-GDP) initiative. The initiative aims towards including women in agriculture and helping build a more sustainable food system.

Potato Farming in West Bengal

We started with a pilot project for potato farming in West Bengal (WB). We have successfully empowered women farmers through training and offering on-ground support. In order to expand their horizons and educate them on sustainable farming practices, the PepsiCo team has meticulously crafted training programs that focus on the best irrigation and crop rotation techniques, financial literacy and entrepreneurship. The project phases capture all the important aspects of potato cultivation, starting from land preparation and seed cutting; to harvesting, sowing and storing the produce. To make the process easily comprehensible and immersive, we make use of flip charts, videos and matching cards. We have also been supporting women farmers to lease land. We have trained men and women to support gender norms and engage champions who are working to design local approaches to more equitable and sustainable agriculture.

ABOUT THE AUTHOR

Mr Pratap Bose is Associate Director, PepsiCo India

PepsiCo and USAID Partnership

To further boost the initiative, PepsiCo and USAID announced a $20 million partnership in September 2020 to drive inclusivity across the food and beverage industry. We demonstrated that actively engaging women as critical drivers of PepsiCo's sustainable sourcing strategy leads to better business results. We have provided potato production training for 500 women farmers. The partnership expects to reach 1,500 women farmers in WB. Our aim is to take the program to 300,000 women in WB through direct and community engagement measures.

PepsiCo plans to take the programme to other states starting from Uttar Pradesh. Under the women empowerment initiative, we have started to empower women and create awareness on leveraging women in the management of demo farms in the state. We are working closely with women agronomists who successfully manage the demo farms and train connected growers' family members.

There is a significant contribution of women in rural and agrarian economies and their role is only going to grow in the coming years. From earning to providing for family nutrition, to advancing agricultural practices within their communities, the role of women farmers is becoming multi-dimensional. From a national standpoint, recognizing that women need to be made a critical factor for agriculture and food production, either by way ownership or resources or ability to make decisions, can strengthen the sector. The National Policy for the Empowerment of Women 2001 pushes for the economic and social empowerment of women. One of its primary mandates includes women in agriculture, among others.

PepsiCo India believes that closing the gender gap in agriculture shall accelerate food production and build a sustainable future for women farmers. Promoting women empowerment in agriculture is an opportunity to progress towards a more sustainable food system. The enhanced role as primary producers and higher participation in decision making will lead to the overall development of the rural economy.

INDOVATION
DRIVING HEALTHY FOOD SYSTEMS

The role of food today is not limited to satiating one's hunger. It has evolved to meet the health and wellness needs of an individual. In today's circumstances, the famous quote from Hippocrates *'Let food be thy medicine and medicine be thy food'* holds true more than ever, as the pandemic puts the spotlight on health, wellbeing, diet, and immunity. All these are essentially linked, and we can no longer ignore the fine balance between food and health. There is an increased focus on immunity boosting foods and wellness products. The role of innovation has become critical to address these emerging trends.

Consumers are fueling innovation

Innovation is a mindset. Food companies today are focusing on consumer centric innovation and renovation to address the gaps that currently exist in our market. Food innovators are leveraging new technology to design sustainable and healthier food offerings. At Danone, we believe that innovation should address local health and taste preferences. We call this process *Indovation*. To boost innovation, we listen to our target groups and take insights from stakeholders while trying to anticipate future trends. Our approach to innovation is reflected in our vision of *One Planet Gearing One Health*. We believe that health of people and that of the planet are interconnected. Hence everything we do reflects that belief. For example, we launched Protinex in popular local flavors and we are committed to make our packaging 100 percent circular by 2025.

Food industry is gearing up for innovation as food literacy among consumers goes up. Their dietary sensibilities have changed, and it will reset the innovation in the food industry in the long run. Here are some trends that will shape innovation and fuel consumers' demand.

- **Food fortification** is a growing trend in India with Government, NGOs

ABOUT THE AUTHOR

Mr Himanshu Bakshi is Managing Director, Danone India and is responsible for leading India operations. A results-driven business leader, Mr Bakshi comes with more than 20 years of experience in some of the most competitive FMCG, OTC Healthcare and Surface Care categories across multiple geographies and cultures. Under his leadership, Protinex started its trajectory from an OTC brand to a consumer-facing brand with key initiatives launched to forge awareness around the relevance of protein

and Industry committing to innovation in the area and rolling out fortified foods over the last two years. For example, we see daily staples like rice, wheat, pulses, milk, and breakfast cereals being fortified with minerals and multi-vitamins. Consumers are becoming more aware about the evolving nutrition landscape and the plethora of purchase choices that are now available.

• **Rationalization of food choices** is another aspect that is driving innovation. Consumers are opting for products that are low in salt sugar and fat. It is complemented by the growing quest for products that offer health benefits.

• **Preventive nutrition** is growing as a category with need for functional foods that endorse health, mental and physical wellbeing, and an active lifestyle. Health foods or foods that will help to lead a healthier and more active life have become a main priority for product development in the food industry.

• The pandemic has propelled the rise of **Immunity boosting foods** where traditional foods like Tulsi, Ginger, cinnamon and Turmeric have become critical to innovation. Consumers are revisiting immunity from a multi-system, holistic health lens and are now focusing on mental and physical wellbeing alike. Emerging food technologies have carved another healthy trajectory for individuals looking for ready to cook and ready to eat fortified food choices with functional ingredients that help to improve nutrition, boost the immune system and stamina, avert chronic diseases, and postpone the aging process.

Food companies can innovate to favorably impact health behaviors, since the consumption of packaged food is on the rise

• **Naturality:** Consumers prefer products which are locally made with natural ingredients and whose origins can be traced easily. There is a clearer understanding and awareness regarding ultra-processed foods.

• **Personalized Nutrition:** Consumer demand for custom made products that are tailored to their individual needs is growing especially in the functional beverage space. This personalization is increasing in the B2C category with gradual extensions into the mass market.

• **Sustainability:** The green consumer behavior is driven by food choices that are targeted at conserving the environment and the local biodiversity. This cohort of sustainable consumers will not purchase and consume foods that have a perceived impact on environment. Instead, they seek products which have a limited carbon footprint and benefit the environment directly. Seventy percent of Indians surveyed last year said environment had become a bigger priority since the pandemic (Source: Lightspeed/Mintel).

Call to Action for a healthy food system

As we grapple with the need to provide food to millions, the pressure on the food system has never been greater. Innovations can tip consumer behaviors in favor of healthy eating. It may prove to be a first step toward refining better health outcomes. For innovation to occur, all stakeholders must come together to contribute to a healthy and sustainable food system. Food companies can innovate to favorably impact health behaviors, since the consumption of packaged food is on the rise. Innovation in formulation of new food products which are rich in positive nutrients and low on negative ones is one step in that direction. For example, at Danone we are committed to improve the nutritional profile of our products. We have introduced zero added sugar variant of our two popular brands Protinex Tasty Chocolate and Vanilla without compromising on the taste of the product, which is an important criteria for regular consumption. The point-of-purchase interventions at restaurants, modern retailers, offices, and schools is another area which can be focused upon for promulgating healthier food choices and bring in positive changes in the food selection behavior.

TOP AGRI-BUSINESS MANAGEMENT B-SCHOOLS IN INDIA

AGRI-B SCHOOL SURVEY 2021 BY CONCEPT AGROTECH CONSULTANTS LIMITED

Survey Objective

The pandemic has again proven the mettle of India's Food and Agribusiness Management Sector. The sector is emerging as the backbone of the nation with GDP contribution to the tune of 19 pc, which is higher than the previous years. In order to achieve sustainable growth in the sector, a pool of qualified agribusiness professionals is needed every year to introduce approaches and reach the last mile users. Hence the role of agri-business management institutions, which generate qualified agri-business professionals in India.

Survey Sample Size

CACL conducted the survey in Feb-March 2021. The survey team connected with more than 200 industry professionals, industry bodies and more than 1000 students from agriculture and allied streams to understand the performance of agribusiness management institutions in India.

Primary Desk Research

In this research module, industry professionals and students were approached directly to get feedback regarding agri-business management institutions. The following methods were used to college primary data: e-questionnaire, expert interviews and

The purpose of the survey was understand the gap between top and bottom ranking agribusiness institutions, study the tools and techniques used by Agri-B schools for better performance, categorize the various aspects of perception and align them as per weightage

Rating	Name of the Institution	Logo
1	Indian Institute of Management, Ahmedabad	
2	Indian Institute of Management, Lucknow	
3	National Institute of Agricultural Extension Management, Hyderabad	
4	Institute of Rural Management, Anand	
5	Xavier Institute of Rural Management, Bhubaneshwar	
6	Symbiosis Institute of International Business , Pune	
7	National Institute of Agricultural Marketing , Jaipur	
8	Imperial School of Agri-Business, Greater Noida	
9	National Academy of Agricultural Research Management, Hyderabad	
10	National Institute of Food Technology Entrepreneurship and Management, Sonepat	
11	Indian Institute of Plantation Management, Bengaluru	
12	College of Agribusiness Management, Pantnagar	
13	Institute of Agribusiness Management, Bikaner	
14	School of Business Studies, Punjab Agriculture University	
15	Department of Agricultural & Rural Management, TNAU	

telephonic survey. The institutions were ranked on the basis of Inside Campus Offering and Outside Campus Offering.

Inside Campus Offering included infrastructure & facilities offered; faculties with corporate backgrounds, industry-orientated curriculum, innovation in pedagogy, fee structure, admission selection process, and sports and fitness amenities. The Outside Campus Offering included global exposure events, student exchange program, extracurricular and co-curricular activities, industry interaction and webinars, relevant placement tie-ups and scholarship support for needy students.

The secondary research module was followed and Perception Survey was also conducted. In the Perception Survey, a conscious attempt was made by CACL to understand the attitude towards agribusiness management institutions in India. The purpose of the survey was understand the gap between top and bottom ranking agribusiness institutions, study the tools and techniques used by agri-b schools for better performance, categorize the various aspects of perception and align them as per weightage.

About CACL

Concept Agrotech Consultants Limited (CACL) is a Delhi-based total solutions providing consulting company, catering exclusively to the agribusiness and rural sector.

FORTIFICATION OF SELECT FOODS

FSSAI REGULATIONS FOR FOOD PROCESSING INDUSTRY

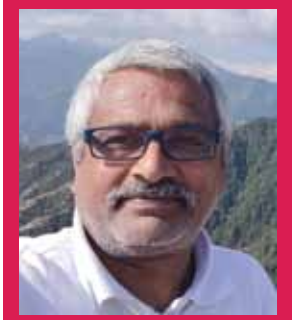
The Food Safety and Standards Authority of India (FSSAI) is the Nation's food regulator specifically established under the Food Safety and Standards (FSS) Act, 2006. It is mandated to lay down science based standards for articles of food and to regulate - their manufacture, storage, distribution, sale and import - to ensure availability of safe and wholesome food for human consumption. Besides establishment of FSSAI or the Food Authority, rules and regulations have also been framed under the FSS Act 2006. As on date, one rule (i.e., Food Safety and Standards Rules, 2011) and 21 principal regulations (of which one will be superseded, taking the total principal regulations to 20) have been framed under the Act. The Food Safety and Standards Rules 2011 basically outlines the structure for the enforcement of its rules and regulations, and procedure and processes for adjudication and appeals, and also the related forms in the prescribed format.

FSSAI primarily focuses on establishing standards and limits of parameters based on two major aspects of foods/ingredients i.e., safety (horizontal parameters) and identity (vertical parameters related to quality). Every food or ingredient has to comply with these parameters. To achieve this, FSSAI enacts Regulations that are product specific, which is covered under FSS (Food Products Standards and Food Additives) Regulation, 2011 and provides the limits for various horizontal and vertical parameters apart from providing for different additives (with limits) that can be used in a specific food product/ingredient. The other set of Regulations i.e. Contaminants Regulations cut across all the product categories covering parameters in terms of contaminants such as heavy metals, pesticide residues etc. In terms of implementation, these Regulations are aided by FSS (Licensing and Registration of Food Businesses) Regulation, 2011. Any FBO can apply for license/registration through Food Safety Compliance System (FoSCoS).

Overall, FSSAI has enacted various regulations that prescribe quality and safety standards for food processing industry for ensuring safe and wholesome food products for the consumers. A brief overview of each of these regulations is as under –

1. FSS (Licensing and Registration of Food

ABOUT THE AUTHOR



Dr N Bhaskar is Advisor (Science & Standards) at the FSSAI, New Delhi and has an outstanding contribution to food science and technology

Businesses) Regulation, 2011 specifies the procedure and conditions of registration and licensing of food businesses. Further, general hygienic and sanitary practices to be followed by petty food business operators (FBOs) for registration and food business operators applying for license are also covered in detail. Under these regulations no person shall commence any food business unless he possesses a valid license from either state or central Licensing Authority. A petty FBO has to register with the Registering Authority. License for commencing or carrying on food business, which falls under Schedule 1, shall be granted by the Central Licensing Authority.

2. FSS (Food Products Standards and Food Additives) Regulation, 2011 specifies the product quality standards for different food categories like milk, cereals, fruits, meat and poultry, spices and culinary herbs, water and beverages, food additives etc. Limits of additives permitted under different food products as well as microbiological parameters (both hygiene and safety indicator organisms) are also part of these Regulations. Recently, under these regulations processing aids and their residue levels were also specified which serve to fulfil a certain technological purpose during treatment or processing.

3. FSS (Prohibition and Restriction of Sales) Regulation, 2011 deals with the prohibitions and restrictions on sales of various food products, ingredients and their admixtures.

4. FSS (Packaging and Labelling) Regulation, 2011 specifies the labelling provisions for pre-packaged foods. To make the national labelling regulations more robust and effective, FSSAI undertook comprehensive revision of FSS (Packaging and Labelling) Regulations, 2011 with the objective of having three different regulations dealing separately to packaging, labelling and advertisement & claims requirements. Accordingly, FSS (Packaging) Regulations, FSS (Advertising and Claims) Regulations and FSS(Labelling & Display)Regulations

FSSAI constantly works toward building consumer confidence by assuring safe and nutritious foods through its various regulations and standards

have been notified.

5. FSS (Contaminants, Toxins and Residues) Regulation, 2011 broadly covers the maximum limits (MLs) of all the contaminants such as heavy metals, mycotoxins, naturally occurring toxic substances etc. The maximum residue limits (MRLs)/tolerance limits of insecticides or pesticides residues, veterinary drugs residues and antibiotics on various food commodities are also specified. Currently MRLs of more than 213 pesticides have been notified and many more are at the stage of draft notification. Further, FSSAI has also notified 20 insecticides which are banned as per the Insecticide Act, 1968. Further tolerance limits for 103 antibiotics and veterinary drugs on various food commodities have been notified. This regulation also includes a prohibited list of antibiotics and veterinary drugs.

6. FSS (Laboratory and sampling analysis) Regulation, 2011 specifies the procedure of sampling including sample size, number of samples (type and quantity) etc. to be sent to the Food Analyst/Director of the Referral Food Laboratory for analysis. A provision for approval of rapid analytical food testing kit, equipment or method has also been included.

7. Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food, and Novel Food) Regulations, 2016 are one of its kind regulations across the globe. These regulations provide for the manufacture and sale of the various categories of foods mentioned in the title of the regulations. Apart from the general conditions for manufacture and sale of these foods and requirements related to claims, they also provide various Schedules dealing with the permitted ingredients (viz. vitamins, minerals, amino acids, plants/botanicals, nutraceuticals, probiotics, prebiotics) and additives.

8. FSS (Food Recall Procedure) Regulation, 2017 specifies the recall provisions and requirements. It includes

Dr Bhaskar is fond of cooking, trekking and listening to Carnatic music. He is a licensed scuba diver!

detailed food recall procedures covering the responsibilities of Food business operators, Commissioner of Food Safety of the State or Union territory and the Food Authority.

9. FSS (Import) Regulation, 2017 specifies provisions and procedures dealing with import of foods, food products or ingredients.

10. FSS (Approval for Non-Specific Food and Food Ingredients) Regulation, 2017 specifies the process of approval of non-specified food and food ingredients, new additives and processing aids, including novel food. It also provides details on the kind of information to be submitted for such approval.

11. FSS (Organic Food) Regulation, 2017 specifies the standards and requirements for any food to be called 'Organic Food'. Also highlighting the requirements of organic food labelling, certification including imports and reciprocity.

12. FSS (Alcoholic Beverages) Regulation, 2018 specifies standards for alcoholic beverages namely Distilled Alcoholic Beverage (Brandy, Country Liquor, Gin, Rum, Vodka and Whisky, Liquor or Alcoholic cordial), Wines and, Beer. It also specifies the specific requirement for labelling of Alcoholic Beverages in addition to the labelling requirements of Food Safety and Standards (Packaging and Labelling) Regulations, 2011.

13. FSS (Fortification of Food) Regulation, 2018 specifies provision for fortification of select food commodities and/or staples with various micronutrients and vitamins at specified levels along with use of +F logo (except in case of Iodised salt). Besides, the regulation also provides for fortification of some processed foods and bakery ware with micronutrients and vitamins. The provisions under these regulations are voluntary in nature except for iodised salt.

14. FSS (Food Safety Auditing) Regulation, 2018 provides procedures and provisions for third party auditing of FBOs for compliance to food safety management systems and other regulations laid under the FSS Act.

15. FSS (Recognition and Notification of Laboratories) Regulation, 2018

New Initiative

In order to help Food Business Operators and other stakeholders, FSSAI is developing information repository of food standards where all compliable provision of particular food products will be present in the form of monographs referred to as Food-'o'-copoeia. It will facilitate stakeholders with all the information at one place and avoid issues which they face while sourcing information of a product from multiple Regulations. It will provide stakeholders with requirements relevant for compliance to food safety regulations. FSSAI is also working on drafting guidelines/standards for cultured meat, cell based animal meat and vegan foods. The Authority is in process of consultation with various stakeholders, academician and scientific bodies to bring in the policy paper and aspects related to these areas.

describes provisions for recognition and notification of laboratories by FSSAI.

16. FSS (Advertising and Claims) Regulation, 2018 specifies general principles for claims & advertisements. Apart from defining criteria to be met in case of different types of claims, it also specifies procedure for approval of disease risk reductions claims

17. FSS (Packaging) Regulation, 2018 species both general and specific requirements for packaging materials. In particular, overall migration limits and specific migration limits for certain contaminants in plastic packaging materials have been prescribed. It also specifies that food packaging materials must now comply with Indian Standards (IS) listed under various schedules.

18. FSS (Recovery and Distribution of Surplus Food) Regulation, 2019 specifies provisions for recovery and distribution of surplus food in India by providing a legitimate backup to the food donation. It aims to encourage individuals and organizations to donate food for those in need and to reduce food wastage,

19. FSS (Labelling and Display) Regulations, 2020 specifies labelling requirements of pre-packaged foods and display of essential information on premises where food is manufactured, processed, served and stored. It is important to note that this regulation along with FSS (Packaing) Regulations 2018 supersede the FSS (Packaging and Labelling) Regulations, 2011.

20. FSS (Foods for Infant Nutrition) Regulations, 2020 relates to infant foods applicable up to the age of 24 months. The regulations cover standards like infant formula, follow up formula, milk and cereal based complementary foods, infant foods based on traditional ingredients as well as food for special medical purpose intended for infants. It elaborates on composite/identify standards, specific labelling requirements, source of nutrients permitted etc.

21. FSS (Safe food and balanced diets for children in school) Regulations, 2020 aims to ensure safe and wholesome

food for school children, FSSAI has notified these Regulations. At the heart of these regulations is a fundamental idea to make it clear what is healthy for children and what is not.

The complete details of regulations/ standards notified by FSSAI can be accessed through the link https://www.fssai.gov.in/cms/food-safety-and-standards-regulations.php.

Standards for fortification of processed foods

The standards on fortification are intended to prevent micronutrient deficiencies among Indian population, majorly through mandatory supply of fortified staples in government-run programs and also through voluntary fortification in open markets. Besides, fortification of staples, the regulation now permits voluntary fortification of select processed foods, bakery wares and fruit juices. The regulations specify levels of micronutrient and vitamins (as a range of minimum and maximum) with a principle that fortified Processed Food shall provide 15-30% of the Indian adult recommended dietary allowance (RDA) as specified by ICMR for micronutrient and vitamins, based on an average calorie intake of 600 kcal from processed foods. The enforcement of fortified processed foods standards is from 01 July 2021.

FBOs are allowed to use of +F logo for staples and processed foods that are covered under the FSS (Fortification of Foods) Regulations, 2018. They can obtain the endorsement to use the +F logo for their product by uploading the test report from FSSAI notified laboratory showing level of fortificants present in the fortified food articles. The Registering Authority after verification of the application submitted by the FBO endorses the license to use the logo. For further details on categories in which license/registration will be granted, the following link can be accessed - https://fssai.gov.in/upload/advisories/2021/04/6075664fc329dLetter_Fortified_Food_FoSCoS_13_04_2021.pdf.

Being the nation's food regulator, FSSAI constantly works toward building consumer confidence by assuring safe and nutritious foods through its various regulations and standards that eventually inspire trust in the foods they consume.

Disclaimer: The views expressed are the personal views of the author

FOOD PROCESSING

The Vital Link Between Agriculture & Industry

The food processing industry is the vital link between agriculture and industry. From the nutritional point of view, processed foods and ultra-processed foods have altered nutritional profile compared to the raw material. The effect on nutritional composition would depend on the temperature, light exposure, humidity, pH, addition of food additives, time of processing, presence of oxygen, suitable packaging and conditions during shelf-life.

Beneficial Effects on Nutritional Quality

- Proteins undergo denaturation (changes in structure leading to aggregation or unfolding or hydrolysis) that make them more digestible and readily absorbable.
- Carbohydrates – starch, the abundant carbohydrate in plants, gets gelatinized during heating or cooking and this makes its more digestible.
- Reduction or inactivation of antinutrients that make the food more digestible and increase bioavailability of minerals like iron, calcium, zinc and phosphorus.
- Proteolysis of proteins, either by enzymatic, acidic, alkali, fermentation or ageing can produce bioactive peptides that have one or more activities like antioxidant, antimicrobial, antihypertensive, immune-modulatory, hypercholesterolemic, prebiotic or opioid activities.

cftri
Giving Food a Future

With more than 50 pc of India's population in agriculture and allied sectors, contributing 15.4 pc of GDP and employing around 11.36 pc industrial workforce in 2020, the food processing sector is extremely significant for India's economic development

ABOUT THE AUTHOR

Dr Sridevi Annapurna Singh is Director, CSIR-Central Food Technological Research Institute, Mysore

Undesirable Changes During Food Processing

■ Some nutrients are more labile to processing compared to others. In general, water soluble vitamins, B-complex and C are the most labile. Folic acid, thiamine and vitamin C are most unstable, while, vitamin D, niacin, vitamin K, biotin and pantothenic acid are stable to most processing conditions.

■ At high temperatures, protein (lysine residues) react with reducing sugars to form schiff's bases that undergo amadori rearrangement and the products polymerize to form melanoidins through non-enzymatic browning (Maillard reaction eg. Baked goods).

■ Cutting or mincing or pulverizing leads to disruption of cell walls that allow the enzymes like polyphenolase, peroxidase, lipoxygenase to come in contact with their substrates to form undesirable products which affect the nutritional quality of fats (rancidity, eg. Soybean oil) or cause undesirable colour (enzymatic browning eg. Apple juice).

■ Frying, roasting or baking of foods at very high temperatures causes formation of acrylamide through reaction of aspargine with sugars like in potato fries.

■ Proteins treated at alkaline pH may cause reaction of lysine with dehydroalanine to form lysinoalanine, which is toxic (eg. Protein isolation at pH greater than 9.5).

■ During smoking of meat, formation of polycyclic aromatic hydrocarbons are of concern (eg. Ham, bacon). Similarly, generation of heterocyclic aromatic amines in grilling/ heating conditions can be hazardous to health.

■ Fats, especially unsaturated fats, get oxidized during heating. They also help solubilize fat soluble vitamins and aid their absorption. Oxidation reactions of lipids and proteins are required for flavour and texture but can be of concern for food safety (eg. Reheated frying oils with high PUFA contents).

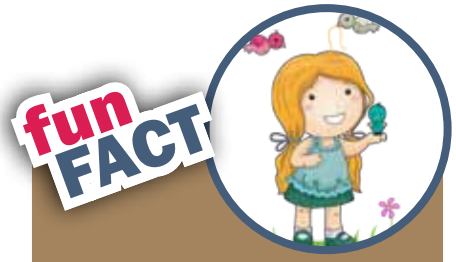
■ Several food additives are used for preservation, colour, flavour, emulsification and so on to retain the natural quality of food. Many of these additvies are known to have a deleterious effect on the health of the consumer. Addition of phosphates that enhance texture, taste and shelf-life ¬cause weak bones, kidney damage and ageing.

■ High amounts of refined flours, saturated fat, salt and sugar are generally used in processed foods to improve shelf-stability, palatability and these are known to promote inflammation leading to life oxidative stress and lifestyle related diseases.

■ Ultraprocessed foods overstimulate the production of the neurotransmitter dopamine that leads to the consumer getting addicted to the food and craving for it. The overconsumption of such foods can lead to obesity and related pathologies.

■ Ultraprocessed foods made from refined flours, high fat, salt, sugar and food additives are often poor in natural fibers, enzymes, micronutrients. They do not support the growth of beneficial gut microflora and cause gastrointestinal problems and compromised immunity.

Moisture, temperature, pH and oxygen are the factors that affect the chemical reactions, microbial contamination, sensory attributes and ultimately, the shelf-life of foods. Controlling these factors help in preserve freshness and nutritional quality of the food product, even at ambient temperatures. Optimal packaging helps to preserve food quality through preventing water vapour or oxygen transfer. Fresh fruits and vegetables are coated with waxes or dipped in specific solutions to reduce respiration and transpiration and increase shelf-life. All packaged foods in every countries, including India, declare nutritional information on the product labels. Nutritional labelling enable consumers to make informed choices during purchase. Packaging too is of great importance in prevention of product deterioration during its shelf life.



Dr Annapurna has a passion for travelling to different cultures, bird watching and researching into Indian food traditions and cultural practices. She is trying to scientifically validate traditional food practices and nutraceuticals

INNOVATIONS IN FOOD PROCESSING

EXECUTION TIME FOR INDIA INC

Having significantly grown its agricultural, dairy, meat and horticultural produce, India as a food surplus nation offers raw material for global food processing giants. The Indian food and grocery market is the world's sixth largest, with retail contributing 70 per cent of the sales. The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. It contributes around 8.80 and 8.39 per cent of Gross Value Added (GVA) in Manufacturing and Agriculture respectively, 13 per cent of India's exports and six per cent of total industrial investment. The Indian gourmet food market is currently valued at US$ 1.3 billion and is growing at a CAGR of 20 per cent. India's organic food market is expected to increase by three times by 2020.

Of late, several measures as taken by the Government and the new farm laws have created a new hope and boosted the opportunity of a well-developed food processing industry. This creates the front end for the agricultural produce and stimulates the backend activities of value added farming, increase farm gate prices, reduce wastage, promote crop diversification and increase export earnings. This shall do a world of good for the rural economy.

Current Food Processing Activity

Innovations emerge not just as an opportunity but also as a pre condition to assure the sustainability of the food sector. Indian consumers are now more knowledgeable on food than ever! A strong social media presence and favourable access to all other digital mediums, coupled with technical and economic changes, the millennial, consumption trends and the food processing demands have gone through multiple changes. These facts have affected significantly the entire food supply chain, driving companies to pay high attention in food products that meet the consumers' demand for a transparent

ABOUT THE AUTHOR

Mr Saikat Sarkar is CEO, Fresh Greens Pvt. Ltd, Essar Group. He is a food and beverage specialist with 23 years of functional experience as a Retailer, Hotelier and Entrepreneur. Mr Sarkar has driven new product development, packaging, channel activation, developing new age retail innovations and retail sales

and healthy lifestyle. As a consequence, there is an extensive dialogue about the need of food industries to upgrade quality and introduce innovation in the market in order to survive competition. With increasing disposable income, consumer spend allocation tends to show a steep increase towards the different types of foods that consumers are wanting/willing to try. This need to try new tastes, flavours and palate is one of the reasons why the food industry has evolved so much over the last decade. While the industry is grappling with distribution challenges, shelf life will remain a key focus, post the pandemic hit supply chain and overall economic environment.

Technological innovations

In today's times, food safety and innovation have become a pre-requisite aspect to improve process, keep products and services relevant to our customers and stay ahead of competition. By embracing technology, new science and innovation, and ultimately develop holistic plant-based ingredient solutions that nurture nutrition, support greater food sustainability, our food processing industry in coming in line and in requirement with the futuristic food trends.

Category Innovation, Quality & Sustainability

Today's consumers are looking for customizable foods, beverages and dietary solutions that will help them more aggressively meet their own unique nutrition and personal health goals. General health and wellness products and programs no longer fit all.

Functional foods are becoming more influential in foodservice. High-protein, vegetable-rich foods and super foods are the most attractive to diners; heart health, energy, weight management, and gut health are becoming influential issues in cities. Increasingly, such consumers are opting in to buying foods and beverages that have specific healthy ingredients. Fibre, followed by protein, vitamin D, calcium, nuts/seeds, and whole grains are the

Today's consumers are looking for customizable foods, beverages and dietary solutions that will help them more aggressively meet their own unique nutrition and personal health goals

healthy ingredients consumers are looking for and are ready to pay a premium.

When we are talking about innovation in food processing industry, we are hinting at combining technical innovation with social and cultural innovation. It occurs throughout the food system, from harvesting to production, primary and secondary processing, manufacturing, cold chain and pack houses till distribution.

Food Start-Ups

In India we have made a strong name for ourselves in the global start-up community and ranking among the top five countries in the world in terms of number of start-ups founded. It is estimated that the job creation from these entrepreneurs is likely to reach 2 million during the current year. The Indian food start-ups are now playing a pivotal role in accomplishing transformation, and trying and testing innovative technologies and business models. The innovations in this segment have been the result of improving technology in three segments: ordering food, food preparation and finally delivery. To seize the opportunity for the food industry, it is important to understand the dynamics around the start-up ecosystem. The challenges in the space are many, but it is the passion and ability of the young start-ups who are working towards accomplishing their goals with resilience even during this difficult time.

Growth & Profitability

India processes only 10 percent of what it produces and smaller countries like Malaysia and Indonesia process almost 70-80 percent of what they produce. With the new found demand of processed food during the pandemic, the intervention in category innovation, technology and the value added food processing is sure to put a lid on the rampant food wastage. It shall also enthuse the farmers for value added farming. Providing value can be in the form of marketing unique products, filling a market niche, simplifying the supply chain, lowering costs and in many other ways, as already explained. The more value is provided this way, the more return can be extracted from the marketplace and passed on to the farmers, towards a targeted doubling of their income. It's execution time for the India Inc.

EYE ON FUTURE

AGRO-PROCESSING AND MARKETING YARD

RURAL EMPLOYMENT AND INCOME AUGMENTATION

Indian agriculture is booming. Its food production is all time high despite adverse climate conditions, flooding, drought and current continuing pandemic. The recent third estimate indicates that total food, oilseeds, and sugarcane productions for 2020-21 is more than 305.44, 36.57, 292.8 million tonnes respectively, which are all time high in Indian history.

ICAR led National Agricultural Research System, farmers' intense endeavour and government policies have contributed immensely in keeping this increasing trend of our production system. Despite this, majority of our farmers are not happy because of their income is not increasing in the same proportion.

I think each farmer family must have some additional assured monthly income like a salary through employment of their wards at local level. Their income can increase if they do not sell their produce just after production. Instead, they must process pack, label/brand their produce and market it globally.

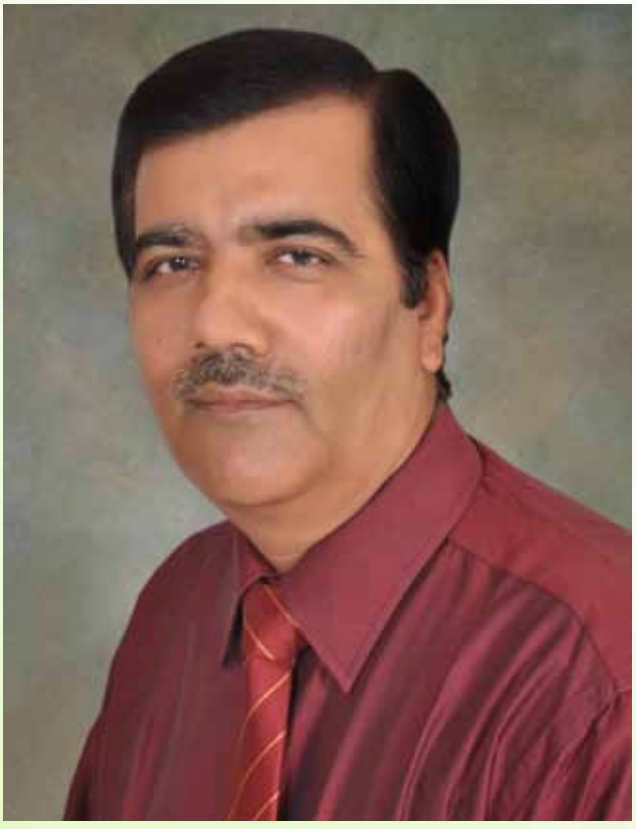
This may not be possible for individual farmers, particularly for small and marginal farmers. This is possible if an Agro-processing and Marketing Yard (APMY) is established in each village either in PP mode or by the government or some other agencies with partnership of farmers, may be in cooperative mode.

For this purpose, first we should have de-centralized storage and controlled raw material movement system. This can respectively be at village-level APMY, panchayat level storage/godown, block-level food bank, district level warehouses, and finally state level grain yard.

The surplus produce must be procured by the respective states and should be stored at the grain yard. Each district, blocks and panchayat should have warehouses/godowns for their produces. At panchayat level, we can call it the food bank. Farmers can go and deposit their produce in that food bank. Instead of their deposits, they can get any other produce of equivalent values for their consumption, if needed. Surpluses items should be used for processing, value addition, labelling and marketing locally, in national markets through e-NAM/online marketing systems to be established in processing yard or we can call it as Village Economic Zone (VEZ).

Village Economic Zone

Each VEZ may comprises of at least two centres of each such



ABOUT THE AUTHOR

Mr Shyam Narayan Jha is ADG (Process Engineering) at ICAR, New Delhi. He is pioneering research on non-destructive evaluation of food quality and makhana processing in India. He is the author of numerous international books and papers, fellow of various academies and professional societies. Dr Jha is an ICAR Rafi Ahmed Kidwai awardee


Improved Evaporatively Cooled Store for fruits and vegetables

Fig. 1

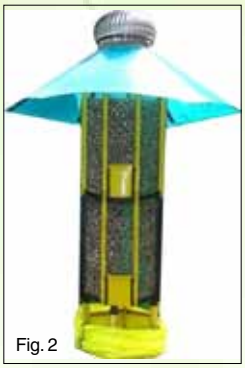


Fig. 2

as food grain, oilseeds & pulses processing; fruits & vegetables processing; milk & milk products processing; sugarcane/jaggery processing and value addition; feed, fodder and fibre processing; by-products processing and value addition/power/energy generation; local artisan/arts & craft centre and at least one IT hub. Each VEZ can employ directly at least 200 youth of the village and indirectly many more. So, if at least one person from each needy household is employed and get assured salary from this VEZ, economic conditions of villages may improve drastically and remain sustainable.

For implementing the above concepts, we need modern storage systems, online quality determination of raw and processed products and quality based pricing systems. We have majority of these technologies and these can be multiplied in suitable way.

Important innovations

Some important innovations are sensor and Internet of things (IoT) controlled grain siloes, Evaporatively Cooled Storage Structure (ECS) for fruits and vegetables for hot and dry seasons. An ECS is shown in Figure 1. These can run with or without electricity. Solar energy may also be used to enhance efficiencies. Temperature and humidity within this structure can be maintained at 25 - 30oC without using any electricity, when outside temperature is 46-48oC and relative humidity only about 10 percent.

If the same structure is equipped with solar energy system for running a small mechanical cooling system, temperature may even be reduced further. It is most suitable for small period storage at farm and in rural India. Potato, kinnow, tomato can be stored for more than 55- 65, 22-25 and 5-7 days respectively at farm at about 45 percent lesser hiring charge than that of the cold store, which is hardly available in peak summer.

Similarly newly developed onion storage system (Fig 2) is foldable, modular, light weight, corrosion and UV resistant. The structure is equipped with sensor based automatic forced ventilation system with ensured uniform distribution and controlled storage micro environment to control sprouting and rotting. Losses and manpower requirement for handling in six month storage are about 53 and 65 percent lesser than that of the conventional type of onion storage. It can be made of any capacity.

Fig. 3

Numerous works are going on for online quick and non-destructive evaluation of multiple parameters of quality of food grains and fruits and vegetables. Using the developed formulae we can calculate maturity/ripening index of mango, which hitherto is decided based on experience. This can be predicted non-destructively employing well proven machine visions system and NIR spectroscopy methods for which our country has expertise and capabilities. Online quality (multiple parameters at one go) predictions system will enable quality based pricing from VCY. For example maturity/ripening, total soluble solids of mango either in field (Fig 3) or in market place, which may be linked with Internet for National and Global marketing. In the said technology one measure the colour values in terms of “a” and “b” and can even read the maturity/ripening level using a graph shown in Fig 3. A similar and better system using NIR spectrometry has also been patented. Similarly development of robotics coupled with IoT for automatic mechanized activities on and off the farm activities will attract youth in agriculture as their profession. Otherwise they are disinterested in agriculture.

If we go on producing more and more, one question comes to mind. Do we produce more to lose more? We must focus at least for a few years on implementing the concepts suggested above and devoting more funds for R & D in India’s post-harvest sector.

Disclaimer: The article is totally based on my personal views and ideas. ICAR is not liable to be responsible for any statement in it

Dr Jha’s energy-booster is ideating on innovations for the post-harvest sector and their implementation. He also enjoys creative writing in his leisure hours

DOUBLING FARMERS' INCOME

INNOVATIONS IN AGRO PROCESSING

Agro-processing industries in rural areas are getting the increased focus of planners, financial institutions, rural development agencies and R&D institutions. Such industries cover value-addition activities of agriculture produce through primary and secondary processing and utilization of agricultural wastes/residues/by-products for food, feed, fuel, and other industrial products. They can lead to immense changes in the rural economy.

These agro-processing enterprises, preferably of small scale or cottage sector, do not need huge capital requirement. The government is also encouraging primary processing in production catchment. The output of these primary processing enterprises could feed big processing facilities that are mainly involved in secondary and tertiary processing.

The food processing sector has been receiving tremendous attention in the country in light of low level of processing in India. The Ministry of Food Processing Industries has been allocated Rs. 1,308.66 crore (US$ 180.26 million) in the Union Budget 2021-22. The percentage of agricultural produce being processed in the

country is far lower than that of developed countries like China (23 pc) and USA (65 pc). Preference of Indian population towards consumption of fresh and home-cooked food over processed and packaged food may have some bearing on demand for processed food in India. The government is aiming to triple the capacity of the food processing sector and in the process, double the farmers' income.

Importance of Primary Processing

Although primary processing of agricultural commodities adds little value as compared to secondary and tertiary processing of the same commodities, it plays an important role in improving the uniformity and shelf life of the produce. For instance, cleaned, graded, and packed food grains, precooled fruits and vegetables can be stored for a longer duration and can directly be used for further processing without compromising on food safety and quality. The ability of farmers to carry out primary processing operations at production sites has been enhanced through design and development of custom-made, small-size, cost-effective agricultural processing machinery. This equipment is being promoted by many programmes of central and state governments.

The innovations in agro processing suitable for doubling farmers' income could be grouped into efficient machineries, novel processes, inventive products, modern tools to ensure quality and safety, and professional post-harvest management.

Dr Nachiket's favourite stress buster is watching sports-related videos, live or recorded

Machines for primary processing

Machines for primary processing with higher capacities, reduced drudgery and gender neutrality are now available at affordable prices for small entrepreneurs like farmers. These machines are made of food-grade materials. Better control and appropriate automation are some of their innovative features. Tractor-operated multi-commodity processing and mobile units are also now available for farm-level processing and also as a custom-hiring business opportunity.

There are novel processes for processing of different commodities and cultivars on the same set of machines. There are more energy-efficient, environment friendly, standardized well documented protocols to harness best product recovery and reduce losses of all forms. Novel processes like fermentation, hydro-thermal treatment, extraction methods, thermal and non-thermal methods, controlled fumigation, etc. have been successfully demonstrated at scales appropriate to farm level processing.

Inventive Products

Numerous inventive products have been developed which are high in functionality, designed for specific consumers, retaining appropriately balanced nutrition and use of locally available inputs and specialty cultivars. We now have traditional products with better

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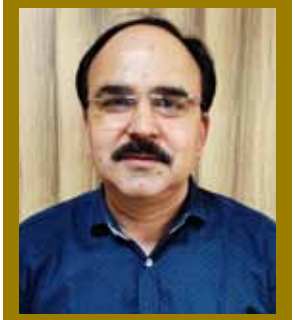

Dr Sandeep Mann is Principal Scientist CIPHET

Dr Sandeep Dawange is Scientist, CIPHET

Simple, affordable, and reliable protocols, gadgets, kits and field-worthy sensors are now available to the farmers to test quality and safety of their product on the farm as well as during processing for a variety of products

sensory traits, ready to eat and ready to cook convenient foods made from appropriate combinations of grains, pulses, millets, oilseeds, preserved fruits and vegetables, animal origin products, etc. Different regions of India have some specific crops or cultivars having unique saleable property or nutritional advantage, e.g. black rice, mushrooms, millets, makhana, soybeans, etc.. Food products have been developed through their appropriate fortification into the food matrix, giving due consideration to their synergistic and antagonistic effects.

Maintaining quality and safety of the product has been always been a challenge for small enterprises, especially at the rural level. Simple, affordable, and reliable protocols, gadgets, kits and field-worthy sensors are now available to the farmers to test quality and safety of their product on the farm as well as during processing for a variety of products like milk, spices, cereals, fruits & vegetables, etc. The devices are not only useful to maintain quality of product during production, handling, and trade but also help the farmers/ producers to maintain domestic and international standards and thereby realise a better remuneration for their product if quality and safety could be maintained.

Technology adoption at farmers' level is increasing due to access to technologically advanced and adaptable solutions for on-farm processing. Multi-commodity, multi-machinery agro processing centers are being promoted as stand-alone enterprise as well as custom hiring businesses. Such enterprises have a good potential to provide attractive dividends to farmers while increasing the availability of value-added agricultural produce in the market. Besides, there is good scope for specialised product processing centers for commodities like millets, jaggery, honey, soybean, oilseeds, etc. All these models could be very effectively implemented by engaging FPOs or giving financial and technical support to budding entrepreneurs. There is also a good possibility for rural entrepreneurs in the areas of operation of pack-houses, cold chain management, supply chain operations, and processing service provisions.

Tools and protocols are now available for geo-tagging of the produce and ensure traceability so as to capture export markets and fetch better prices for fresh and processed products

The Indian Council of Agricultural Research with flagship institutes like CIPHET, CIAE, along with its commodity institutes and network of State Agricultural Universities are providing the technological and knowledge support for agro-processing enterprises. Institutes under MOFPI namely, NIFTEM, IIFPT; and CSIR institutes like CFTRI are also providing support to food processing enterprises.

Agro processing at production catchment by the farmer-entrepreneurs is a technically feasible and commercially viable proposition. Plethora of technological solutions and institutional support are available to realise the goal of doubling farmers' income. Government is extending support in the form of investments for mega food parks in the country, 100 pc FDI in marketing of food products, launching programmes such as Pradhan Mantri Kisan Sampada Yojana, Agri Infrastructure Fund, Sub Mission on Agricultural Mechanisation, One District One Product, etc. Skill development facilities and business incubation centers are ably supporting these techno-preneural activities and also helping create huge employment potential in the rural sector.

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Prasad Seeds (PSPL) as India's largest outsourced partner in the seed processing domain, delivering end-to-end turnkey solutions to global seed companies. For more than 3 decades into the business, PSPL is providing state-of-art Seed Processing & Drying infrastructure facilities helping its customers reach the international quality standards. Groups core business expertise includes customized seed production, drying, processing, packaging and Cold storage.

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Founder, Chairman

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Modern Role of Packaging Material

ENSURING LONGEVITY AND MARKETABILITY OF AGRO PRODUCE

Change in the life style and consumer's inclination towards health-promoting fresh and processed foods is growing fast. With the increasing demand, agro-based food industries have stepped up the game for manufacturing different varieties of food and food products. Foods are rich in proteins, carbohydrate, fats, vitamins, enzymes and antioxidants. This makes them highly heat sensitive and susceptible to spoilage. With their nutritional composition and sensory attributes, all foods – fresh, cut or minimally processed – offer great value. There is now a vast range of foods that are recognized as novel foods with innovative concepts. They meet the demands of our modern lifestyle because they provide convenient, fresh, safe, nutritious and functional food options.

MODERN TRENDS IN PACKAGING

Active Packaging

Active packaging involves incorporation of additives called as active components into the packaging material or else into the packaging container, which comes in direct contact with the product and leads to quality maintenance and shelf life extension. The active compounds control all the endogenous factors. It delays oxidation, controls the rate of respiration, microbial growth and moisture content. The active compounds either release or absorb substances into or from the packaged food or the environment surrounding the food.

Intelligent/Smart Packaging

According to Food and Agricultural Organization, UN, approximately 1.3 billion tonnes of food is wasted every year which accounts for one-third of total food produced globally. This includes 45 pc wastage of freshly harvested horticultural produce such as fruits and vegetables. The wastage happens at post-harvest

Packaging for Better Living

भारतीय पैकेजिंग संस्थान
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stage, during processing, distribution and even consumption stages. There are enough techniques that are being followed during food processing and packaging to detect, reduce or eliminate contaminants and hazards. But there is a lack of technology to monitor losses during distribution. Intelligent packaging can attempt to overcome this issue by monitoring the interaction of beverage or its environment within the described six functions of Intelligent Packaging viz, monitoring, detecting, sensing, recording, tracking and communication.

The brewing sector has shown the most pioneering spirit in adopting intelligent packaging technology that delivers extra cold beer in an innovative way. This technique allows the content of the bottle to be chilled to a drinkable temperature of zero degree Celsius in consumers' freezers. It is packed in ultra-resistant PET, which allows the beer inside to remain liquid even at sub-zero freezer temperatures. Thus, the active and intelligent packaging technologies can definitely be adopted and scaled at a better level for use in beverage packaging applications. Cost inefficiency, stringent procedures for regulatory approval and package designing are some of the major challenges that halt the widespread adoption of intelligent packaging systems in India.

Mr Alam is passionate about Yoga and Meditation.

Cold Plasma Applications in Food packaging

Cold plasma technology has generally been associated with modifying the bio-responsive properties of foods. These are also related to the physical and chemical modification of polymeric surfaces. Cold plasma technology provides the polymeric packaging materials with greater flexibility, transparency, adequate chemical inertness. Most importantly, it costs less. Surface treatments of packaging can serve various purposes including surface functionalization, surface cleaning or etching, and surface deposition (Pankaj et al., 2014).

Intelligent packaging is defined as a system which can make decisions to increase the shelf life, notify information, improve quality and report spoilage of a product by utilizing intelligent techniques

Time-Temperature indicators

These indicators are basically tags or labels that display the visual summary of time-temperature history of package. Any physical, chemical, enzymatic or any microbial change in the product is expressed by an irreversible color change. Hence any sort of deformity is also visible. Consumers, producers and retailers can check at a glance if product was in good condition during storage and transportation. A recent intervention is a milk or juice pack which uses three-dimensional (3D) additive techniques to make a smart cap. This has an embedded inductor/capacitor tank as the wireless passive sensor, which monitors the quality of the liquid food wirelessly.

FOOD PACKAGING AND SUSTAINABILITY

In the very dynamic worldwide food packaging sector, marketed innovations essentially focus on practical and easy-to-use aspects as well as conviviality and aesthetics for consumer attractiveness. Some of the marketed innovations claim to be sustainable either by their resources (bio-based) or their end of life (bio-degradable). There is a real need to develop convincing sustainable packaging materials decoupled from fossil feedstocks, with no competition with food resources and with a real advantage to solve the issue of the accumulation of persistent plastics in our environment. This could be achieved by enhancing the conversion of agricultural and agro-food residues into naturally bio-degradable packaging with a fair and transparent eco-efficient performance assessment.

The global agro based food industry has one of the most rapidly growing food processing markets in the world. Consumers are looking for wholesome healthy products with high quality and an appreciable shelf life. Food manufacturers are resorting to innovative packaging tools for achieving the same. Marketing of these products, keeping in view food safety and quality control will be possible only after adopting proper packaging systems. Food safety and quality control are the prime factors for food technologists. Nothing would be better than utilizing and implementing intelligent/smart packaging systems for functional beverage packaging.

AGRICULTURAL HIGHER EDUCATION

LEARNINGS FROM NATIONAL AGRICULTURAL HIGHER EDUCATION PROJECT

With the contribution of 16.5% to India's GDP, agriculture plays a crucial role in the economy, largely because of the employment opportunities the sector provides and the food security it guarantees to 1.3 billion Indians. On the one hand, the sector is being driven by factors such as a growing population, increased demand for agriculture and food products and an enhanced focus on doubling farmers' income. On the other hand, the overall ecosystem is being constrained by certain systemic challenges. These are leading to reduced resource use efficiency and farm incomes. Small and fragmented landholdings, lower yield compared to global benchmarks, uncertainties and risks involved in traditional farming, dismal primary and secondary processing infrastructure, a convoluted supply chain with multiple levels and intermediaries etc. are some of the challenges faced by the agriculture sector.

Agribusiness industry players including agri startups have been playing an important role while consistently addressing the evolving needs of sector and addressing most of these challenges existing across agri and allied value chain.

Need for AU- Industry Collaborations and Convergence in Agricultural Higher Education

With India's emergence as a major world economy, quality assurance as well as relevance of agricultural higher education has become very crucial. Indian Council of Agricultural Research (ICAR) has been playing a leadership role while building and nurturing future ready agri graduates and skilled human resources for tomorrow, equipped with research as well as entrepreneurial acumen. The Education Division of ICAR has been entrusted with strengthening and ensuring quality and relevance of higher agricultural education in India through implementation of program 'Strengthening and Development of Higher Agricultural Education in India' and 'National Agricultural Higher Education Project (NAHEP)'. Herein, the relevance part is majorly being driven through industry collaborations and engagements. Post Covid, it has become more pertinent to further deepen the ICAR-AU-industry linkages for better employment opportunities for students, enhanced entrepreneurship capabilities, improved technology transfer and knowledge exchanges to meet current market needs etc.

AU – Industry convergence areas: Learnings from NAHEP

NAHEP is a Multi-Global Practice Collaboration (Agriculture and Education)

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project of ICAR and WB. Knowledge exchange programs are being conducted by AUs to collaborate with private players / business entities and orient the AU students as well as faculties on current market needs and cutting-edge areas of science and technologies, industry-oriented capacity building initiatives, collaborative research etc. Private players get benefitted through advanced research output relevant to industry, market ready students for internships and placements etc. The key project outcomes that can be envisaged through these knowledge exchange programs are increased student placement rates, increased on time graduation rates, improved research effectiveness of faculty etc.

- MPKV Rahuri has collaborated with Lupin, Pune for collaborative work on development of climate smart villages with IoT.
- MPKV Rahuri has entered into MoU with Sahyadri Farms, Nashik and Netafim Irrigation, Pune for trainings to students and farmers based on processing of agro products and collaborative research work in water management respectively.
- CIFE Mumbai has partnered with West-Coast Frozen Foods Pvt. Ltd, Surat, Gujarat for Technology transfer possibilities in the field of Fisheries
- UAS Bangalore has entered MoU with Jain Irrigation for technology transfer opportunities
- Technology transfer and commercialization

Under NAHEP, AUs have been developing or deploying emerging technologies around various thematic areas such as sustainable agriculture, market intelligence, digital farming, protected agriculture and natural farming, animal food safety etc. Technologies developed through research in these areas will ultimately be transferred to the industry for scale up and commercialization where AUs can suitably identify the requirements and collaborate with private players in agriculture and allied space that will further strengthen the ICAR – AU- Industry linkages.

> Post Covid, it has become more pertinent to further deepen the ICAR-AU-industry linkages for better employment opportunities for students, enhanced entrepreneurship capabilities, improved technology transfer and knowledge exchanges to meet current market needs etc.

Such collaborations or linkages can be further scaled up through following ways:

1. Research Partnership Agreements: Company or a group of companies working with researchers at HEIs to solve a sub-sector specific challenge
2. Industry sponsored Research Projects: Includes research activities which are commissioned to HEIs by industry clients/private players on fee basis (consulting, certification, testing, quality checking etc.)
3. Tech Parks and University Incubators: Collaboration where HEIs make use of advanced labs and equipment situated at tech parks or incubation centers developed by industry partners
4. Intellectual Property commercialization: Transfer of intellectual property such as patents which are developed at university to industry participants (for example, sub-licensing)

In order to further strengthen ICAR-AU-Industry linkages and deepen the collaborations, agri-business industry partners and ICAR may play a pivotal role in bringing other relevant stakeholders including AUs and policymakers on one platform, and facilitating and converting the industry engagement opportunities into strategic partnerships through signing of Memorandum of Understandings (MoU) among partners.

Short / Medium term MoU: Industry internships and placements, Professional workshops, Knowledge exchange programs, Industrial training and exposure visits

Long term MoU: Collaborative R&D, Technology transfer and commercialization

A detailed MoU will help industry partners and ICAR to better understand and adhere with the scope of work, timeline and achievement milestones.

MUSHROOMS

IMMUNITY STIMULATORS, INCOME GENERATORS

Mushrooms are achlorophyllus macrofungi without leaves, stems and roots. They are cultivated abundantly all over the globe. There are 13 million species of fungi, of which 1,40,000 species of macrofungi are commonly called as mushrooms. Many of them are edible, non edible, medicinal, poisonous and miscellaneous species. The edible and medicinal mushrooms are now widely recognised, consumed and used as herbal medicine to boost the human immunity against biotic stresses, particularly viral infection including Covid.

High awareness is being created for the production and consumption of mushroom globally. The production of mushroom in India has reached 2,25,000 tons. Our per capita consumption is only 25g as against a global average of 5-6 kg. There is strong need to diversify mushroom species for cultivation in India having suitability for varying climatic conditions, rich in nutritional and medicinal value and have commercial potentiality to generate income.

In September 2020, the government explored the feasibility of inclusion of mushroom and honey in mid-day meal scheme for children. Mushrooms can ensure food and nutritional security and also income, employment and livelihood security in rural India.

There is shift in consumption of mushroom from processed to fresh mushroom. Many countries of the world earlier consumed canned or processed mushrooms. Now, consumption of fresh mushrooms is being preferred.

Naturally growing mushrooms in India still needs to be investigated for their huge nutritional, pharmacological and

ABOUT THE AUTHOR

Prof MP Thakur is State Nodal Officer (Mushroom) and also Director Instructions & Controller of Examination, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh

commercial potential. We can examine the value of processing wild edible mushrooms which grown in plenty during congenial climatic conditions.

Mushroom as Immunity Booster

Mushrooms are rich in several phytochemicals and multi nutrients which are essential for the growth, development, protection and immunity of the human body. More than 30,000 species of bioactive secondary microbial metabolites have now been recognized. Over 40 pc of these are of fungal origin. Mushrooms are the only natural source of Vitamin D for the vegetarian diet. It is highly rich in minerals (particularly sodium and potassium), crude fibres, vitamins, proteins and carbohydrates but low in fat and sugars. Mushrooms are considered as low calorie food which is most ideal for patients suffering from diabetes, blood pressure and hypertension. Mushroom protein (22-32pc) is highly digestible because of the presence of all essential amino acids required for the growth of human body. Pulses and cereals are the main ingredients of the vegetarian diet which are proficient in proteins and carbohydrates respectively. Some essential amino acids which are not present in pulses or cereals are present in mushrooms. The amino acid score of mushroom is at par with that of milk and meat.

Presence of polysaccharides and other bioactive compounds in edible/ medicinal mushrooms have anti-tumour activity. Mushrooms have attracted the attention of scientists globally for their health benefits. These biologically active compounds have been identified, characterised and commercially exploited for varying health benefits against varieties of pathogenic microbes using latest biotechnological and bio medical engineering tools/techniques. Mushrooms can be explored as a valuable source of herbal medicines, pharmaceutical drugs and agrochemicals. It can be a multi-million dollar business.

Dr Thakur enjoys listening to music. He is passionate about helping students, entrepreneurs and rural women in shaping their career through mushroom production, processing and marketing technology

Income generation from Mushrooms

Mushroom is capable of bringing prosperity to rural areas, as has been the experience in China. It has the capacity to mobilise about 12 crores migrant labourers as a source of income generating ventures. It can target the peoples from low income group to enhance their income and provide business opportunities. There are several successful examples of mushroom spawn production, mushroom crop production, mushroom processing & value addition, mushroom marketing and export in India. These need to be replicated throughout the country as a sole source or additional source of income. The youths of rural, urban and peri-urban areas of India may be sensitised, motivated and convinced to take up mushroom activities in a small to large scale so that they may become job providers rather than job seekers.

Mushrooms can ensure food and nutritional security and also income, employment and livelihood security in rural India

India still does not have fully mechanised and automated mushroom spawn laboratory which can produce quality spawn in time and make it available to all those who wish to grow varieties of mushrooms. The demand of the spawn is still more than its supply in India. We need to standardise the production technology of different edible/medicinal mushroom species, depending upon the prevailing climatic conditions and availability of cheap resources. This way, production cost may be minimised and profit may be maximised.

In order to enhance shelf life of mushroom during transit and export, it is essential to study and validate different processing and preservation technologies suited to Indian conditions. It is also important to explore the commercial value in export of mushrooms. Mushrooms can be used for the production of nutritionally fortified foods (vitamin D enriched mushroom, Calcium, Zinc, iron fortified mushrooms) or value added food (royal oyster capsule, mushroom fortified wheat flour, mushroom nuggets, mushroom papad etc.) This shall open up a whole new market for mushrooms globally. It can also ensure nutritional security for our country.

ECO AGRICULTURE IS THE WAY FORWARD: DR DALWAI

Mono cropping is not the right choice for the farmers. It may be convenient for them, but farmers shall be able to prosper only if they opt for diversification in agriculture.

This was stated by **Dr Ashok Dalwai, CEO, NRAA and Chairman, DFI Empowered Body, Ministry of Agriculture, GOI,** at the Algae Energy Eco Agriculture Revolution Seminar and Awards 2021, organized by the Agriculture Today Group on May 21. Dr Dalwai was the chief guest for the first edition of the Eco Agriculture Awards.

Speaking on the occasion, Dr Dalwai said that Green Revolution was essential for India's food security, but now we need more sustainable systems in agriculture that can meet the nation's need for food and nutrition.

Addressing the winners, **Dr MJ Khan, Chairman Indian Chamber of**

Food and Agriculture (ICFA) said that eco agriculture is the practical approach for the shift towards sustainable agriculture. Dr Khan said that it is the middle path which farmers can easily follow in order to refrain from heavy use of chemical fertilizers, pesticides and other inputs. Dr Khan emphasized that there is while productivity should not suffer, it is also essential that the consumers must eat healthy food. Dr Khan said that eco agriculture reduces the load of chemicals on the crop, leading to safe food. It is important to finalize standards at the national level which can provide the roadmap to the farmers to follow eco agriculture, he said.

Ms Mamta Jain, CEO and Editor of the Agriculture Today Group welcomed the distinguished guests, the awardees and the other participants in the conference. She spoke about how the indiscriminate and prolonged use of chemicals has led to concerns regarding the impact on human health and the environment. Ms Jain said that the Agriculture Today Group is awarding the game changers and role models who have created success stories in the Eco Agriculture sector in order to acknowledge their role, and also inspire other farmers to follow their example.

The event began with the conference on *Eco Agriculture Revolution – The Blueprint.* Initiating the discussion, **Padmashri Dr MH Mehta** gave the introduction to Eco Agriculture Revolution, and provided the roadmap for the way forward. Dr Mehta said that India has made good beginning in bio input industry. "Now, the question is not Why, but How, and also How Soon?" noted Dr Mehta. He stressed that the 20:20 model is the right model for doubling farmers' income in a sustainable manner. Padmashri Dr MH Mehta is Hon. Chairman – The Science Ashram and Gujarat Life Sciences.

Dr Sudhanshu, Secretary APEDA (The Agricultural and Processed Food Products Export Development Authority) said that major initiatives have been taken to boost the export of organic products from India. He stated that APEDA has initiated the first traceability system of the country for a wide variety of agricultural products. He informed that the Tracenet system enables the farm or the production unit to establish credibility and creates transparency for all stakeholders.

> Eco agriculture reduces the load of chemicals on the crop, leading to safe food. It is important to finalize standards at the national level which can provide the roadmap to the farmers to follow eco agriculture

Shri Lok Nath Sharma, the Agriculture Minister of Sikkim said that from 2003 to 2010, the state prepared its farmers for organic farming. He said that with the handholding provided to the farmers to excel in the organic sector, the state has gained significantly through cultivation of agricultural products that were majorly in demand following the pandemic, like ginger, turmeric and cardamom. Organic farming is good for farmers and good for health, said Shri Sharma.

The message from **Mr Rajeev Ranjan Mishra, Director General Namami Gange,** was read out by Ms Priyanka of NMCG. She said that the government is promoting organic farming along the banks of Ganga river to help in achieving *Nirmal* and *Aviral Dhara*. She informed that the National Ganga Council (NGC), chaired by the Hon'ble Prime Minister, accorded top priority to promoting organic clusters in a 5-7 km stretch on both sides of the river. It was also decided to encourage natural farming along the Ganga and suitably train farmers.

Mr Sanjay Nath Singh, Secretary General of All India Farmers Association, said that eco agriculture cannot be confused with organic farming. Mr Singh said that the shift to organic farming is not easy. Like Sikkim, it takes a lot of time and patient handholding to prepare farmers for eco agriculture. Mr Singh said that safe food is a major priority but our farmers are small and marginalized. They need capacity building to shift to organic farming. The government shall have to train and educate the farmers in this regard, he said.

Dr PVSM Gouri, Executive Director, Association of Indian Organic Industry, said that there is low awareness among farmers regarding organic farming. She said that in order to enable the shift to organic agriculture, skill development and empowerment of farmers is essential. Dr Gouri highlighted that the 20:20 model inspires confidence among farmers and can be steadily upscaled.

Shri Bharat Bhushan Tyagi, a nationally awarded organic farmer said the nation shall prosper if we balance the economy and the ecology. Shri Tyagi said that co-existence with nature is essential. He stated that we need a paradigm shift in both skill and knowledge in order to have an integrated approach to agriculture.

Dr Praful Gadge, Managing Director Biome Technologies said that farmers cannot shift to organic farming suddenly. He said that farmers are ready to accept ideas which can enable them to reduce the cost of production. The move to organic agriculture, he said, needs a major government push. Dr Gadge highlighted that bio inputs help a farmer to reduce costs and increase profit. He maintained that skill development of farmers is essential, and the government must promote start-ups and entrepreneurs in this sector.

ADOPTION OF ECO-AGRICULTURE A LONG PROCESS, WE ALL ARE STAKEHOLDERS: EXPERTS

Challenges like acute water scarcity, rising input costs for agriculture and climate change will make the farmers shift towards eco agriculture. This was the view expressed by some speakers at the conference on Bio Inputs and Waste Management organized as part of the Alga Energy Eco Agriculture Revolution Seminar and Awards organized by the Agriculture Today Group.

Dr Debabrata Sarkar, Managing Director Alga Energy was the moderator for the conference. Addressing the panelists, Dr Sarkar said that eco agriculture initiatives have been introduced by some state governments in order to address emerging challenges like water scarcity. Dr Sarkar said that a study has revealed that rice and wheat production may go down by 40 percent by 2050. He said that sustainable agriculture is the need of the hour. He said that we need to educate farmers about these critical challenges so that the shift in the right direction happens.

Dr SS Marwaha, Chairman Punjab Pollution Control Board said that the Board launched an intensive program for educating farmers in the state regarding the damage caused by parali burning. With the support provided by NSS volunteers from six universities of Punjab, farmers across the state were made aware of the need to end the practice of burning parali. Dr Marwaha said that the mulching of paddy straw using the specially-developed microbial consortia Relife by Gujarat Life Sciences had shown excellent results. Continuous awareness of farmers is very important, said Dr Marwaha.

Dr Ajay Ranka, Managing Director Zydus Industries said that it is imperative for the farmers to make the move from chemical farming to bio farming. He said that with sustained effort and farmer education, it is possible to bring down the usage of crop care chemicals to zero. Dr Ranka said that land with intensive use of chemical inputs has become hard and compact. Farmers are observing that the field cannot breathe and they have to till it more and more. He said that organic protection of crops has shown excellent result and minimum pest attack. He also spoke about Project Sanjeevani of the Zydus Group, which has shown excellent result.

Dr Nutan Kaushik, Director General Amity Foundation, said that with adequate training, farmers shall be able to make the shift to eco agriculture.

> Sustainable agriculture is the need of the hour. We need to educate farmers about these critical challenges so that the shift in the right direction happen

Dr Kaushik spoke about biological solutions which protect plants from various diseases and aid growth.

Mr Vipin Saini, CEO BASAI (the Biological Agri Solutions Association of India) said that minimum waste and pollution can be achieved by a fusion of technological and biological systems. Their integration is very important, said Mr Saini. He highlighted that social and institutional innovations shall be required for sustaining agro ecological production and consumption. The circular economy is the way forward, he stressed.

Mr RK Mehta, Chairman, Bamboo Society of India, Telangana and Andhra chapter said that biochar offers huge benefits to farmers. It can be made with simple equipment and can lead to 10 to 30 pc increase in production. Mr Mehta said that we must promote the bio char culture. He revealed that bio char applications started in Europe and are highly popular in the US now.

Dr Suresh Motwani, Director Solidaridad India said that there has been a highly encouraging response to their initiatives in India to improve agricultural practices. Dr Motwani said that the middle path of Buddha – the 20:20 Model is the right approach to follow in the agriculture sector too. He stressed that agri waste can be utilised on the farm in order to minimize the carbon footprint.

Winding up the discussion, Dr Sarkar said that the eco agriculture revolution cannot happen overnight. It is a long process and we all are stakeholders in the journey, he said.

RECOMMENDATIONS

* India must ensure agro-ecological cropping. Sugarcane cultivation must not be allowed in arid or semi arid areas.
* Finalize standards at national level to give a roadmap to farmers who want to practice eco agriculture
* 20:20 Model is the right approach for farmers to shift to eco agriculture
* We must eliminate the wastage of any produce or by-product from the farm, including crop residue
* Traceability of farm produce must be ensured
* Handholding, education and training of farmers essential for adoption of sustainable agriculture
* The government must push agro industries to boost eco agriculture
* Very smooth process and standardized procedure essential for certification of organic agriculture
* Students and NSA volunteers can be involved to raise awareness against crop residue burning

WINNERS OF ECO AGRICULTURE AWARDS 2021

Innovation in Organic Farming	Suminter India Organics, Mumbai
State with Sustained Focus on Eco Agriculture	Sikkim
Advocacy for Promoting Eco Agriculture	Solidaridad India, New Delhi
◆ Leadership Role in Curbing Parali Burning	Dr SS Marwah and Dr Arjun Singh Mehta
◆ Leadership Role in Curbing Parali Burning	Krishi Vigyan Kendra, Rohtas, Dr RK Jalaj
Exemplary Success Story in Organic Farming	Dr Debasish Borah, KVK Udalguri, ASSAM
Oraganization Promoting Agro Exports	Nature Pearls Private Limited, Kundli
Organic Farmer in Leadership Role	Padmashree, Sh Bharat Bhushan Tyagi
Institution with Programs on Organic Farming	University of Agricultural Sciences, Bangalore
Best Company for Bio Inputs	Geolife Agritech India, Mumbai
Best Extension Service for Waste Management	Dr Arjun S Tayade, Sugarcane Breeding Institute
◆ Best Start-up in Organic Farming	Basillia Organics, Pune
◆ Best Start-up in Organic Farming	Arham Organics, Baroda
Lifetime Achievement Award	Dr Suseelendra Desai, CRIDA

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