



Vergheze Kurien Centre of Excellence

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Contributions

From the Editor's Desk	03
Prof. Tushaar Shah	04
Shri Dilip Rath	06
Shri Balu Iyer	08
Prof. (Dr.) G.S. Rajorhia	09
Dr. J.B. Prajapati	12
Dr. R.S. Sodhi	14
Shri K.C. Supekar	15
Shri Abhishek Rajan	17
Dr. Pankaj Parmar	18
Shri Yashobanta Parida & Ms. Deepika Yadav	20
Shri Sandip Das	22
Ms. Shweta Krishnan	24
Shri Ankit Sontakke	26
Prof. Harekrishna Misra	28
VKCoE Interview Series	30
Remembering Dr. Verghese Kurien	32

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From the Editor's Desk

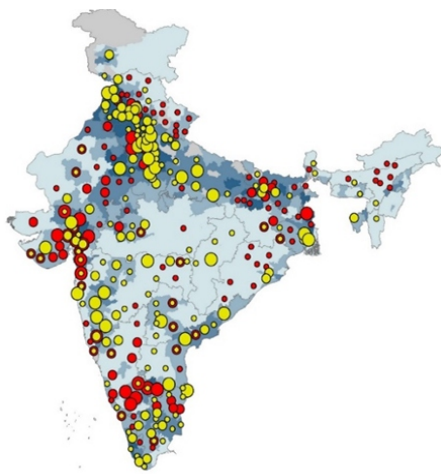
On 1st June 2020, the world celebrates the 20th anniversary of World Milk Day. It was on this day, 20 years ago, that "World Milk Day" was launched by the Food and Agriculture Organization (FAO) of the United Nations (UN) in recognition of the centrality of milk in the global food and dairy sector. Reaffirming the contributions of the Indian dairy sector, which stands tall as the world's largest milk producer, would be gratuitous to say the least. At this point, we need to recall the vision of Dr. Verghese Kurien, the Milkman of India, in the context of achieving global leadership in milk production and innovatively using technology to benefit farmer producers. Dr Kurien is a global figure, known for his excellent managerial and leadership qualities. In many of his speeches and writings he demonstrated rare thought leadership revealing his sharp insights into the makeup of rural India that were far from commonplace. Dr. Kurien has been quoted as saying, *"Innovation cannot be mandated or forced on people; it is everywhere, a function of the quality of the people and the environment. We need to have enough skilled people working in a self-actuating environment to produce innovation"*. His passion was unflagging not only in the context of creative and revolutionary technology for the benefit of farmers in the dairy sector, but also for some extensive and effective transformational initiatives in other industries, including fruits and vegetables, edible oil and energy. His primary objective was to give shape to a converged and technology-enabled social structure through the ownership of producer members. Such a value chain is still relevant to the sustainable development goals set by the UN.

The Verghese Kurien Centre of Excellence (VKCoE), was established at the Institute of Rural Management Anand (IRMA) in 2015 to keep alive Dr V Kurien's intellectual legacy. VKCoE strives to traverse the visionary path set by Dr. Kurien and continues to share his contributions through ongoing research, knowledge creation, and dissemination. The release of the VKCoE digest is an attempt of the VKCoE towards fulfilling this vision.



MAINSTREAMING UNORGANIZED DAIRY FARMERS IN MODERN DAIRY INDUSTRY

Prof. Tushaar Shah
Professor Emeritus,
Institute of Rural Management (IRMA), Anand



**District-wise Milk Processing Capacity
Private Dairy Farmers (in lpd)**

1,00,000	•
100000-500000	•
500000	•

Cooperative Dairy Plants (in lpd)

1,00,000	•
100000-500000	•
500000	•

Milk Production per sq. km. (MT/sq. km.)

25	■
25-50	■
50-100	■
100	■

India has made rapid strides in dairy production over the past 50 years relative to the rest of the developing world. Thanks largely to the efforts by Dr Kurien, and those of the NDDB, to underpin our modernizing dairy economy by giving primacy to farmers' cooperatives, India has been the world's largest producer of milk for over 20 years. Yet persistent regional inequity remains a major infirmity in our dairy economy. Much of India's modern dairy industry is concentrated in the north, west, and southern regions. But large swathes of eastern India and central Indian tribal belt have remained 'dairy deprived' while being denied the fruits of modern dairy development. Figure 1, which overlays district-wise milk processing capacity over the milk production density (metric tonnes/km²) map, shows that private as well as cooperative investments in dairy processing have gone where they are most rewarded rather than where they are most needed. Such spatial inequality is understandable in industrialized countries. But dairying in India has emerged as a powerful instrument of poverty reduction. Our tragedy is that dairying is least developed where India's poverty is most concentrated.

Many of these 'dairying deprived' districts will require years of patient effort and resource investment in improving milk production.

It took the Vasudhara Cooperative Union in the tribal districts of Valsad and Dang in Gujarat 25 years of such investment before it could build a profitable business. Needless to say, private entrepreneurs will not wait for so long. Only the old and new generation of dairy cooperatives would need to fill this vacuum while requiring government "smart" policy support. Karnataka shows one way of providing such 'smart' policy support. For over two decades, the Karnataka government has operated *Ksheera Bhagyam*, a state-wide School Milk Gift Scheme for children aged between six months and 10 years exclusively through dairy cooperatives. In 2018, Rs 1800 crore was spent offering Rs 6 / liter bonuses directly to 2.5 million dairy cooperative members. In return, the cooperatives provided 150 gms/day flavoured milk to 12 million children at a cost of Rs 750 crore/year. The scheme has achieved three objectives: improving child nutrition status, reducing school absenteeism, and improving children's learning outcomes. What is more, by offering farmers a stable market for their milk production at an incentive price, *Ksheera Bhagyam* arguably gave a big boost to Karnataka's dairy cooperative movement, which is today second only to Gujarat.

Ksheer Bhagyam's role in strengthening dairy cooperatives comes into sharp focus compared with dairy cooperatives in Telangana and Andhra Pradesh that give their dairy cooperative members no milk and no incentives. The once vibrant dairy cooperative movement of Andhra Pradesh (and Telangana) has witnessed stagnant growth in village societies, farmer memberships, and milk procurement since 2000. In contrast, Karnataka increased its village societies from 8500 in 2000 to 15900 in 2018; farmer members from 1.5 million to 2.5 million; and milk procurement from 1.9 million liters/day(mlpd) to 7.5 mlpd during the same period. Crossbred cattle accounted for only 4% of Karnataka's bovines according to the 1992 livestock census; according to the 2012 census, they accounted for 22%. All that small farmers need to make a living from dairy farming is a cooperative at their door-step and an assured remunerative price.

Gujarat piloted a *Dudh Sanjivani Yojana* for a million tribal children. NDDDB piloted a similar school milk gift scheme in Jharkhand for 14000 children. Both showed positive and significant nutritional benefits. But *Ksheer Bhagyam*'s lesson to the 'dairying deprived' states of Jharkhand, Bihar, Chhatisgarh, West Bengal, Assam, and Orissa is that improving child nutrition through a well-managed state-wide milk-gift program can also promote strong dairy cooperatives and accelerate dairy development at a modest public resource cost. ●



KICK-STARTING EASTERN INDIA'S WHITE REVOLUTION

Shri Dilip Rath

Chairman

National Dairy Development Board and
Institute of Rural Management (IRMA)

Anand

Despite being blessed with abundant natural resources viz., fertile soil, water resources, good rainfall, conducive climate, minerals etc., the eastern part of our country has lagged in most of the development indicators with limited employment opportunities for livelihoods. Our experience with the successful implementation of Operation Flood demonstrates that, given the resource endowment in the dairy potential areas of the Eastern Region namely, Bihar, Odisha, West Bengal, Jharkhand, Chhattisgarh, Assam and Eastern Uttar Pradesh, another White Revolution in this part of the country may be launched. Out of the dairy potential states in the Eastern region, Bihar has already witnessed this revolution through dairy cooperatives in many pockets of the state, and there are already glimpses of it in Jharkhand and Assam.

Although this region accounts for about 32% of the country's female animal population, its share in the national milk production is only about 17%. There is a huge scope for undertaking scientific animal breeding, nutrition and health

interventions to improve the genetic potential of milch animals and to improve their productivity. Furthermore, the coverage of dairy cooperatives in this region lacks depth and spread, with only 23% of potential villages covered as against the national average of 34%. This limits the access of milk producers to the organized market and to fair and transparent operations. It has also been our experience that wherever autonomy, governance, market focus and putting in place qualified human resources have been under-emphasized, dairy cooperatives have not been able to effectively reach out to milk producers and consumers.

In order to usher in white revolution in Eastern India, holistic, focused, and targeted scientific productivity enhancement measures are required. At the same time, milk producers are required to be provided market access to the organized sector through efficient Producer Centric Institutions. ●





COOPERATIVES, COVID-19 AND THE SUSTAINABLE DEVELOPMENT GOALS

Shri Balu Iyer
Regional Director,
International Cooperative Alliance
Asia Pacific ICA-AP

The world is in the throes of a crisis, living through the impact of the coronavirus via loss of lives, lockdowns, loss of jobs, steep business declines, and a toll on mental and physical well-being. In the crisis, it is heartening to see cooperatives, with essential attendant services (dairy, agriculture, health, and credit) perform admirably. It is encouraging to see many cooperatives taking part in the COVID-19 response, the contributions pouring into funds set up to provide short and long-term relief, and the steps towards options offered under stimulus packages by the government.

The 2020 edition is the 26th United Nations International Day of Cooperatives, and the 98th International Cooperative day (ICD) will focus on the Sustainable Development Goal (SDG) 13 around the theme of Cooperatives for Climate Action. Given the ravages of COVID-19, the focus on Climate Action is more critical than ever. According to the WHO, changes in patterns of transmission of infectious diseases are possibly a significant consequence of climate change. Rising temperatures may create favourable conditions for the spread of certain infectious diseases. At the same time, the disappearance of habitats may force different animal species to migrate, increasing the chances of pathogen-spillovers. Whether it is health, economic, or some form of shock, the poorest and most disadvantaged are the ones most affected. When health crises strike – and they'll do so increasingly in a business-as-usual scenario – global inequality is sustained and reinforced and paid for with the lives of the poor and marginalized.

Similar to the spirit of celebrating ICD in 2012, the International Year of Cooperatives, cooperatives this year, needs to spread the message aloud that our environment-attacking methods of production and consumption cannot continue. We must ensure that development does not incur a toll on the very soil it relies on. Through maximizing consumption, creating direct supply chains between producer and customer, substituting animal proteins with plant proteins, and minimizing emissions, we need to reduce the demands we impose on nature.●



FUTURE OF SUSTAINABLE DAIRYING IN INDIA

Prof. (Dr.) G.S. Rajorhia
President, Indian Dairy Association

Milk and milk products must fulfill nutritional specifications. The dairy industry creates jobs and helps reduce poverty and hunger through natural resources like land, water, farm crop residues, soil nutrients, and energy. According to the 2019 Livestock Census, India had a livestock population of 535.82 million, of which 302.82 million were bovine. The cattle constitute 35.93%, buffalo 20.5%, goats 27.70 %, and sheep 13.8% of the livestock population. The average daily milk yield has increased to 8 kg in buffaloes and 5 kg in indigenous cattle.

Nourishing an ever growing Indian population with nutrient dense foods is a collective challenge. Sustainability is an integrated combination of development functions ensuring future generations' survival of biological systems while maintaining a healthy world without over-exploiting natural resources. Sustainable dairying is primarily aimed at ensuring food protection and global hunger besides helping people out of poverty. India supports about 17% of the world's

population on 2.3% of global land, and 4.2% of water supplies.

Sustainability also tackles food waste management problems and rising greenhouse gas emission rates. Future sustainable dairy will face many challenges in meeting the demand for milk and milk products with low arable land supply while mitigating global climate change. Demand for milk and milk products will rise nearly 70% in 2050. The country must be self-reliant by maintaining the supply chain of production using emerging technology and structural reforms to build infrastructure.

Managing livestock

The dairy sector has developed at a compound annual growth rate of 8% over the past five years. In 2014, the National Livestock Mission was launched to reduce input costs and make milk production cost competitive.

The Animal Disease Control Programme launched in 2019 will promote

537 million livestock vaccinations and label each animal with a unique ID number tracked by block chain technology. There is a need to increase the coverage of artificial insemination from the current 30% to 100% in 600 districts to ensure the use of high-rated bull semen. New entrepreneurs can plan intensive dairy farms soon. Dairy animals remain in confined facilities that are overcrowded and stressful while cow dung and urine multiply bacteria. Animals treated with antibiotics produce milk with veterinary drug residues causing food safety concerns.

Sustainable feeding

Indian dairy farming requires huge quantities of cattle feed, meal supplements, mineral mixtures, and water. A chronic shortage of cattle feed and fodder seeds constrain raising milk productivity.

Sustainable dairy feeds must be produced internally on farms or purchased locally. While dry roughage can be bought during harvesting seasons, on-farm internally green fodders should be grown. Manure and other farm wastes must be composted in pits or used for biogas production.

Energy Management

Dairy farms require electricity for farm operations like ploughing, irrigation, harvesting, and heating. Electricity being unreliable, farmers use expensive diesel generators. Biogas as a least cost and ready energy source is a sensible option. Solar power panels and cells can meet lighting, heating, and pumping requirements. . Green manuring can enhance soil organic matter and fertility.

Sustainable milk production technologies

The Indian dairy industry has grown with escalating milk and milk product demands. Consumption levels vary because of economic disparities with new production technologies evolving. Important technologies include semen sorting, embryo transfer, cloning, and genomic applications.

Technological innovations have occurred worldwide for product diversification, holding promise for dairying. Functional foods have emerged to enhance nutrition and wellbeing. Tailor-made products are optimally targeted for specific consumer groups. Functional foods are produced with antioxidants, absorbable calcium, conjugated linoleic acid, and other biologically active compounds.

New methods including membrane separation, bacto-fugation, and electric field application are on the anvil. Membrane technology will be widely used in pre-transportation raw milk concentration and to fractionate and concentrate

different functional components from milk. The differential ability to recover specific milk constituents will allow the development of a new product with desired functionalities.

Therapeutic and nutritional superiority will encourage the manufacture of different types of fermented milk products. Increased use of dairy ingredients will become the means for making ready-to-use packaged foods and formulated items with different textures and flavour. Casein will be used to produce textured and micro-structured snack foods. Improved awareness of possible food ingredient interactions will allow hybrid product developments. The health benefits of whey proteins will prompt the increased usage of whey components in functional beverage formulation, which will be tested.

Increasing amount of traditional Indian products, sweets and novelties will be produced in organized dairies continuously to enhance profitability of the dairy business while ensuring the safety and quality of popular products. For potential, alternative dairy packaging and electronic delivery systems should find broad acceptance.

New business models

Over the past decades, businesses worldwide have seen globalization and outsourcing change. The COVID-19 spread will revolutionize how business is done. Most countries will exercise protectionist measures to prop their GDPs. India shall launch its "Make in India" campaign to promote indigenous enterprises, despite stiff competition from overseas markets. Successive corona pandemic lockdowns have annihilated demand, curtailed consumption, and disrupted the dairy supply chain. There is a need to put cash in the hands of people and working capital in the hands of dairy businesses. The central government announced a series of economic reforms to improve small-scale industries. The Indian dairy industry is set to remain the world leader. ●



ROLE OF FSSAI IN ENSURING FOOD QUALITY AND SAFETY IN INDIA: EFFECT ON COMPETITIVENESS

Dr J.B. Prajapati

Principal & Dean

SMC College of Dairy Science, AAU, Anand

Food is an essential commodity warranting repeated consumption for survival. However, food should not become an agent to terminate life. Hence, a system is needed to ensure the availability of safe and quality food.

The Indian government had many laws in place to monitor food quality. These laws, however, lacked coordination and were flawed in their implementation. Hence, the Food Safety and Standards Act 2006 was enacted and the Food Safety and Standards Authority of India (FSSAI) established under the Ministry of Health and Family Welfare. After the enforcement of regulations in 2011, substantial changes in their philosophy and implementation have been witnessed over the past nine years. The attitude of the inspector, too, has changed to that of a facilitator.

Various initiatives taken by the FSSAI reflects its philosophy and mandate to ensure safe and high-quality consumer food and enhance competitiveness in the Indian food sector. The FSSAI has 17 scientific panels and a scientific committee of experts in different food

types to establish science-based standards and methodologies to ensure food product quality and health. Most criteria are also harmonized with Codex, making us internationally competent. This strengthens our capacity to function internationally in food products and ingredients. Programs like the FSSAI-CHIFSS (FSSAI and CII-HUL collaboration) seek to promote partnerships between Industry, the scientific community, and the Academia for Food Safety. The vast education and training program for various stakeholders helps with capacity building. Food Safety Training and Certification (FOSTAC) and Food Safety Knowledge Assimilation Network (FSKAN) promote training, research, and development that enhance our competitiveness. Doing so encourages innovations and creates new information which can help improve and enhance food safety standards consistent with international organizations.

The authority has a country-wide network of sophisticated laboratories to ensure quality and compliance. The National Accreditation Board for testing and calibration Laboratories (NABL) also

works to ensure food quality. Even at the smallest scale, there are clear-cut policies for food business operators (FBO) that help produce and distribute healthy food. The food regulatory portal provides multiple IT platforms at one level to promote the food business and reduce the clearance burden. The FSSAI regulation 2017 also offers the FBOs the opportunity to innovate with novel food, new food ingredients or processed foods using modern technology, new additives, processing aids, and enzymes.

The food industry 's true productivity increases as consumers become educated and demanding. The authority has taken several initiatives to educate consumers. Safe and Nutritious Food (SNF) at home, schools, hospitals, and the workplace, along with the Swastha Bharat Mission are some of the right steps in this direction. Being food smart, using smart buying guides along with Food Safety Connect, food fortification, organic food certification, Eat Right India, hygiene rating of FBOs, publications, videos, and educational media are some of the steps to educate us and improve our capability and competitiveness. Therefore, FSSAI's concerted efforts ensure food protection and quality in India while improving our competitiveness. ●



GLOBAL FOOD TRADE AND INDIAN DAIRY SECTOR: OPPORTUNITY AND CHALLENGES

Dr. R.S. Sodhi
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Gujarat Cooperative
Milk Marketing Federation (GCMMF)

India owns only 2.4% of the world's land area but is home to 1.38 billion people. Despite limited resources, Indian farmers produce most agricultural products and have already achieved "Aatmanirbharta".

"Milk" is the best example of how "Aatmanirbharta" is achieved by Indian farmers and is likely to play the biggest role in global dairy food trade in the years to come.

In the 70s, however, India's milk production was just one-third of USA's and one-eighth of Europe's. Today, we are double that of USA and 25% above Europe. During the 70s, much of the country did not receive remunerative returns due to the long chain of middlemen and near-nil market access. The scenario changed after the successful "Amul model" was replicated under Operation Flood thanks to the guidance of Dr. Verghese Kurien. It enabled our country to become self-sufficient in milk production, while other Asian countries remain dependent on import of milk products.

About 100 million rural households have emerged as a primary income source in the Indian dairy and animal husbandry sector, accounting for around 4.5% of GDP. Most of these households belong to landless, small,

or marginal farmers. India has been the largest milk producer country of the world for the last 22 years with current production at 189 million metric tonnes (MMT)/ year, representing approximately 21% of the global milk production. In India, milk production has increased by 4.5% in the past 20 years at the Compounded Annual Growth (CAGR) rate, compared to less than 2% of CAGR worldwide. India's per capita milk availability is around 400 gm/day/person, which is higher than the world average of less than 300 gm/ day/person.

It is important to note that over the next 40 years, India's population will increase to 1.7 billion from the current 1.38 billion, with approximately 50% of the Indian population residing in urban areas, from the current level of around 32%. Based on various parameters such as urbanization, demand of milk and milk products, and productivity of milch animals, the NITI Aayog estimates that Indians may produce around 330 MMT/year milk over 2033-34 and contribute around 31% of world milk production.

There are opportunities galore with some attendant challenges including lower milk productivity of milch animals and cheap imports from dairy developed countries like Australia, New Zealand, and USA. ●



NCDFI eMARKET: SUPPORTING COOPERATIVES DURING TESTING TIMES

Shri K.C. Supekar
Managing Director,
National Cooperative Dairy
Federation of India Ltd.

Milk, which is highly perishable, must normally be consumed daily in the market due to its daily production or should be well preserved for future use. While milk production has continued in its normal pace, the supply chain couldn't position itself strongly enough in the nationwide lockdown against the backdrop of the Covid-19 pandemic which posed many operational challenges for the dairy industry stakeholders. Since the central issue was not so much the supply and demand for milk and milk products as that of logistics, the unprecedented situation had placed the largely unorganized Indian dairy sector in some degree of stress in the beginning.

However, the robust model of dairy cooperatives envisaged by the great visionary Dr. Verghese Kurien came to the rescue of more than 16.3 million Indian dairy farmers and increased the supply of milk during the lockdown period, even though the demand for liquid milk had decreased by almost 5 million litres per day in April compared to January 2020 due to the closure of the HoReCa sector. Gradual relaxation by the

authorities and improved conversion of liquid milk to SMP, butter and other value-added dairy products by various dairy cooperatives have led to a reduction in parity and a stabilization of around 10-15 per cent.

In an effort to strike a balance between public health and economic activities, the Government has also announced a number of constructive measures including financial support for the sector in the form of Interest Subvention Scheme, Animal Husbandry Infrastructure Development Fund, and National Animal Disease Control Program etc. (to the tune of Rs.33,000 crores). The cumulative measures are expected to enhance the overall capacity in the Indian organized dairy industry by 50% from 100-110 million litres to 150-160 million litres.

As an apex body of dairy cooperatives, the NCDFI has also made all-out and consistent efforts to support dairy cooperatives in meeting operational challenges by providing the services of the electronic trading platform 'NCDFI eMarket' with the best possible means of

providing transparent, fair, and economic transactions to various dairy cooperatives. The NCDFI eMarket has successfully supported member cooperatives in the seamless and market-oriented supply of dairy commodities, cattle feed ingredients, packaging material, sugar, silage, and chemicals besides concluding service contracts including transport, labour, storage, and milk conversion. Despite the lockdown, the NCDFI eMarket concluded contracts worth Rs.105 crores during April 2020. Therefore, conforming to the vision of our former Chairman, Dr. Verghese Kurien, the NCDFI is committed to supporting the business continuity of its members and encouraging the development of an efficient and reliable business environment. Transacting on the NCDFI eMarket reduces the workload of member organizations that need to function with reduced manpower during times of social distancing. It is time to migrate the cooperatives to new platforms like the NCDFI eMarket so that business transactions are smooth in these testing times. ●



WHAT THE NEW LIVESTOCK CENSUS HAS TO SAY ON INDIAN DAIRYING?

Shri Abhishek Rajan
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The bovine headcount from the recently released 20th Livestock Census in 2019 provides strong evidence for the greater orientation towards dairying in India's livestock economy. While the total bovine population has remained steady from the previous census in 2012, marginally increased by 1%, the female bovine population has jumped by 15 %, from 215 million in 2012 to 246 million in 2019. Larger proportion of female bovines in the herd indicates growing inclination towards dairying and the dwindling worth of male bovines due to rapid diffusion of mechanisation in agriculture. Of the female bovines, the population of in-milk bovines has a greater significance. Higher the ratio of in-milk bovines to the total bovine population, more intensive and efficient is the dairy production. During 2012-2019, the milking bovine population increased by 10 million - from 80.5 in 2012 to 90.4 million in 2019 – taking their proportion from 27% to 30% in the overall bovine population.

Increasing number of milking bovines of indigenous breeds is another silver lining from this census data. Of the increment in 10 million in-milk bovines, crossbreed cattle accounts for 6 million, followed by 2.5 million from indigenous breeds and 1.5 million from buffaloes. The lion's share

of crossbreed cattle holds no surprises as the high-yielding species remains the preferred choice of dairy farmers. The numbers of crossbreed cattle has risen by 27% to 51 million during 2012-19. However, the noteworthy change in last seven years has been the farmers reposing faith in the milk producing ability of indigenous cattle. During the 2007-12 period, the population of in-milk indigenous cattle declined by 3.5%; but their numbers climbed by 8% in 2012-19 suggesting greater farmer investment in breeding, feeding and management of zebu cattle as well as local breeds of cows. This trend reversal could be farmers' response to the recent government policy of improving productivity of indigenous breeds through Rashtriya Gokul Mission programme.

The census data also shows a significant geographical shift in bovine demography towards eastern India. Together, The eastern states of Bihar, West Bengal and Jharkhand account for more than 40% of the newly added population of in-milk bovine and female bovine in last seven years, reflecting the growing status of dairying as a specialized bovine function in the region - which is a positive sign for the smallholder livelihoods. ●



SCOPE OF NOVEL PACKAGING TECHNOLOGIES IN DAIRY INDUSTRY

Dr. Pankaj Parmar

Research Fellow, VKCoE, IRMA, Anand

The rising demand for minimally processed food, changes in the retail distribution network, growth of e-commerce, and the advent of milk vending machines have contributed to the packaging advancements of the dairy industry. Dairy firms have been investing in intelligent, nano, active, antimicrobial, and controlled and modified atmospheric packaging. Experts and researchers predict that, in the next decade, glass packaging will return to the market due to its excellent recyclability.

In 2018, milk packaging revenues amounted to USD 37.1 billion and were expected to increase as the consumption of milk and milk products increased. The Asia Pacific is expected to grow with rising milk consumption, particularly in India and China. Milk consumption has a vital role to play in enhancing the economy of farmers and tackling malnutrition. In addition, dairy figures among the top three commodities with respect to the gross value generated.

Key players of the global dairy packaging include Huhtamaki; Berry Global Group, Inc., Bemis Company Inc., Amcor Limited,

Ball Corporation, Tetra Pak International S.A., Sealed Air Corporation, WestRock Company, the Mondi Group, and Nampak Ltd. These players emphasize new product development, which helps them grab a significant share of the global market. The initial product launch helps maintain consumer interest leading to increased product preference. It also helps maintain product sustainability in the market. In February 2018, Bemis Company Inc. launched the "Encore-ultra-clear recyclable film," which includes a readily recyclable material technology with a shelf-like appeal alongside sustainable business objectives. Furthermore, in June 2018, the Huhtamaki Group acquired Ajanta Packaging in India for USD 15.5 million, which helped the former gain its market position. Recent launches of innovative dairy packaging are as follows.

1. Recyclable Pulp Fibres: In November 2017, the Arta Industrial Group launched a new paperboard cup under the brand name "FiberCup" for packaging dairy products. The company uses recyclable pulp fibers and recycled PET plastic resins as raw materials to

manufacture FiberCup.

2. **Transparent Packaging for Fermented Milk:** In May 2019, the Brazil-based AGRINDUS adopted transparent PET bottles for the packaging of fermented milk brand, Letti. Amcor Packaging supplies packaging materials for these products. These transparent PET bottles have thick walls to prevent deformation, excellent drop resistance, and eliminate the need for a foil seal barrier.
3. **Recyclable Mono Material:** Constantia Flexibles has recently introduced the "EcoLamPlus" packaging for meat, cheese, and dairy products. It comprises layers of only P.E. lamination, giving it a mono-material structure. This packaging reduces carbon footprint by almost 32% and ensures high levels of moisture and oxygen barrier.
4. **Packaging for Distribution Efficiency:** Tetra Pak launched the "Tetra Classic Aseptic Cube" for dairy, juice, and liquid food in December 2018. Six packages were grouped to form a cube, saving 40% of the transportation space. This one-of-a-kind structural innovation is cost-effective for manufacturers while being environmentally sustainable at the same time.
5. **Biodegradable Dairy Bottles:** An Austrian company "Naku – Made of Natural Plastic" has launched a bioplastic container for dairy items. It comprises lactic acid from vegetable sugar and starch. The packaging is free of synthetic plasticizers, twenty times lighter than glass, and ten times cheaper than plastic. It's entirely biodegradable.

Rising demand for longer or extended shelf life products, convenience, and a broader scope of distribution are the cornerstones of innovation in dairy packaging. Environmental sustainability will always be the primary concern of packaging material manufacturers. Researchers and experts predict the future widespread use of bioplastics and active packaging for a range of dairy products.



DAIRY SECTOR OVERVIEW: ROLE IN ECONOMIC DEVELOPMENT

Shri Yashobanta Parida
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Ms. Deepika Yadav
Junior Research Fellow, VKCoE, IRMA, Anand

According to the FAO 2018 report, more than 500 million impoverished people depend mainly on livestock, many of whom are small and marginal dairy farmers. Dairy development helps fuel rural economic growth and empowering rural women. Moreover, 160 million children worldwide receive milk benefits through school feeding programmes (Bulletin of the International Dairy Federation, 2020). The dairy sector plays a vital role in achieving the Sustainable Development Goals (SDGs), especially SDG 1- No Poverty, SDG 3- Good Health, SDG 5- Gender Equality, SDG 8- Good Jobs & Economic Growth and SDG 10 - Reduced Inequalities.

The agricultural and allied sector is one of the most crucial sectors of the Indian economy, which not only provides employment to the rural workforce but also contributes significantly to the national economy. It also helps to reduce rural poverty, inequity, and ensure food security for millions of rural households. Annually, 8.4 million farmers depend on the dairy sector for their livelihoods, 71% of whom are women (Agriculture Skill Council of India). Furthermore, in a year, crop production employs the rural workforce for 90 to 120 days, but dairy provides alternative employment opportunities throughout the year. Regarding the benefits to dairy farmers, around 60% of consumer price from milk goes back to them, the highest among major milk-producing countries (International Farm Comparison Network, Dairy Report, 2018).

India was a milk-deficit nation in the 1950s and 1960s, depending mostly on imports. In 1965, the Government of India formed the National Dairy Development Board to direct India's dairy sector development. In 1970, the government of India launched Operation Flood (OF), the world's largest dairy development program to boost the country's milk production. By 1998, India overtook the US as the largest milk producer in the world, contributing 22% of the global milk production in 2018. Between 1991 and 2018, the per capita milk supply increased from 178 (gms/day) to 394 (gms/day). During this period, milk production in India increased from 55.6 million tonnes to 187.7 million tonnes and is growing at 4% compounded annually.

Data shows that only ten Indian states produce 81% of total milk. The remainder of the states and union territories generate 19%. Similarly, only nine states have achieved milk availability per capita at national level. The Government of India needs to devise a suitable dairy development policy to improve milk production in potential districts and states.

The Finance Minister recently announced an outlay of Rs. 15,000 crore for Animal Husbandry Infrastructure Development Fund, which can be used for strengthening cooperative milk business across milk deficit regions. This will help generate alternative employment opportunities, especially for women and economically disadvantaged communities. A flourishing dairy sector will help rural India become self-reliant and also help double farmers' incomes.●



COVID-19 AND RESPONSIVE DAIRY COOPERATIVE SUPPLY CHAIN: INDIAN EXPERIENCE

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The Coronavirus (COVID-19) pandemic, which forced countries across the world into a lockdown, has caused disruptions of supply chains dealing with essential commodities including dairy. The dairy supply chain was disrupted because farmers across the key milk-producing regions – Australia, New Zealand, the United States, United Kingdom and countries in European Union (EU) – faced challenges in connecting to markets. Sharp fall in demand for dairy products forced farmers to dump milk in many cases.

In India, when the countrywide lock-down was announced on March 24, the dairy cooperatives' network continued its key operations (as part of essential services) of milk procurement from farmers, processing and distribution of milk and dairy products to millions of consumers.

The National Dairy Development Board (NDDB) sent an advisory to dairy cooperatives suggesting measures to combat the spread of the COVID-19 virus. These measures included adoption of clean and hygienic practices, the prevention of physical contact, the holding of meetings via video conferencing, entry restrictions, visitor screening, social distancing, the organization of quarantine and testing facilities for suspected, among other things.

Cooperatives like Amul, Nandini, Aavin, Verka Parag, and other state dairy federations and milk producer companies modified their supply chain to ensure uninterrupted supply of milk to consumers as well as to ensure a variety of steps including social distancing at the procurement, transportation, processing, and retail points.

Cooperatives also had to ensure procurement from those farmers who previously supplied milk to both private and unorganized players. The private and un-organized players stopped or reduced procurement due to the lock-down leading to reduced consumer demand in hotels, restaurants, and the catering segment. As a result, the cooperatives' milk procurement rose sharply against consumption during March 15-May 15, 2020, despite the commencement of the 'lean' summer season.

The cooperatives converted excess milk to Skimmed Milk Powder (SMP). The production of SMP doubled over the same period (see tables 1 and 2).

The government announced interest subvention on working capital loans taken from banks by cooperatives and milk producer companies during the current fiscal, which is expected to help cooperatives in stocking SMP.

A senior official with the leading dairy cooperatives aptly stated that “this lock-down situation has created lots of trust amongst the farmers for the cooperatives. We have not also reduced prices given to farmers. In coming months (post-COVID19 phase), cooperatives are going to get more milk as they stood by the farmers, when needed”.

Table 1: Dairy cooperatives: milk procurement & sales

Period	Milk Procured (LLPD)	Liquid Milk Sale (LLPD)	Liquid milk sale as % of procurement
February, 2020	529.1	384.4	72.6
1-15 March, 2020	534.2	386.9	72.4
16-31 March, 2020	509.6	320.2	62.8
1-07 April, 2020	508.3	324.1	63.8
8-14 April, 2020	514.2	327.2	63.6
1-15, May, 2020	510	339.8	66.6

Source: NDDDB, Lakh Litre Per Day (LLPD)

Table 2: Skimmed Milk Powder Stocks with cooperatives (in lakh tonne)

March, 15, 2020	0.7
April 15, 2020	1.34
May 15, 2020	1.45

Source: NDDDB



OPTIMIZING MILK SUPPLY AND DEMAND AMIDST LOCKDOWN

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Following the COVID-19 lockdown, the lean season of India's milk supply has been witnessing a paradoxical situation in which the dairy cooperatives are saturated with excess milk supplies. The decline in bulk liquid milk demand from private dairies, milk vendors, and the HORECA (**H**otels, **R**estaurants, **C**afes) industry is one of the main reasons for excess milk supplies to dairy cooperatives.

This onslaught has led to challenges for the dairy cooperatives, such as creating additional capacity and reducing the turnaround time for milk procurement, processing, and distribution. It has also created a need for dairy cooperatives to use more working capital loans to purchase additional milk.

If the situation of fewer buyers and lower demand persists into the flush season (starting around October), a severe glut in the dairy market is to be expected, leading to a significant drop in procurement prices. The procurement price in Bengaluru and Mysore unions has decreased by INR 1.5 and INR 2.5 respectively per litre. In such a situation,

the dairy farmers, in effect, will try to lower their costs by compromising on input costs such as feed, fodder, and veterinary services, leading to a drop in milk productivity and hence, milk production. Dairy farmers across the country have already resorted to distress sales of owing to the paucity of buyers. An impending flush season with few takers for the farmers' milk could lead to severe agrarian distress and affect dairy livelihoods.

In view of the impending flush situation, it is imperative to have a national plan to optimize milk supply and demand to minimize losses of all the stakeholders in the dairy ecosystem.

Several milk unions across the country have used surplus dairy products for transformation into skimmed milk powder and UHT milk with a longer shelf life. On the flip side, not all unions have conversion plants, and they resort to unions of neighbouring states for conversion. The Kerala Co-operative Milk Marketing Federation (Milma) relies on the Tamil Nadu Co-operative Milk Producers' Union (Aavin), which has two

conversion plants, for converting its excess milk into milk powder. Despite this conversion to Skimmed Milk Powder (SMP), demand creation seems a long-haul due to the closure of the ice-cream industry. The lack of domestic demand and the current global scenario, in which the SMP prices have dropped from USD 2747 to USD 2373, Per metric tone has caused a 13% decline. The upcoming flush season will not only witness a reduced demand but will also hamper SMP's export potential.

In addition to the cooperative ecosystem, state governments need to stimulate demand by creating an enabling business environment for newer dairy cooperatives, private milk buyers, and the HORECA segment. An integrated approach to optimizing milk supply and demand for cooperatives is an imperative. The creation of milk grids at state, regional, and national levels for the transfer of milk from surplus to deficient regions, as envisaged during Operation Flood, could be the way forward.●



IMPACT OF COVID-19 ON GLOBAL DAIRY PRODUCTS PRICES

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Globally speaking, Covid-19 entombed the year 2020, disrupting the world's economic, social, financial, and political structure of. This pandemic has severely affected the global economy while influencing global food prices. Food prices have, therefore, declined worldwide. A recent report on FAO Food Price Index (FFPI) by Food Agricultural Organisation (FAO) has shown a drop of 11.2% in food prices. In January, the FFPI recorded a high of 184 points. This FFPI decline is specifically correlated with the global pandemic.

This article attempts to explain global market shifts in dairy product prices. The FAO April 2020 report indicates an 8.8% decrease in the dairy food price index. Global dairy prices have been adversely affected by lower demand for products during the lockdown. Closing restaurants, offices, hotels, schools, and coffee shops during the lockdown has affected dairy product trade locally and globally.

The international dairy industry faces grave challenges like limited logistics, sluggish retail demand, limited

workforce in processing industries, and the rise in milk production in northern hemisphere countries.

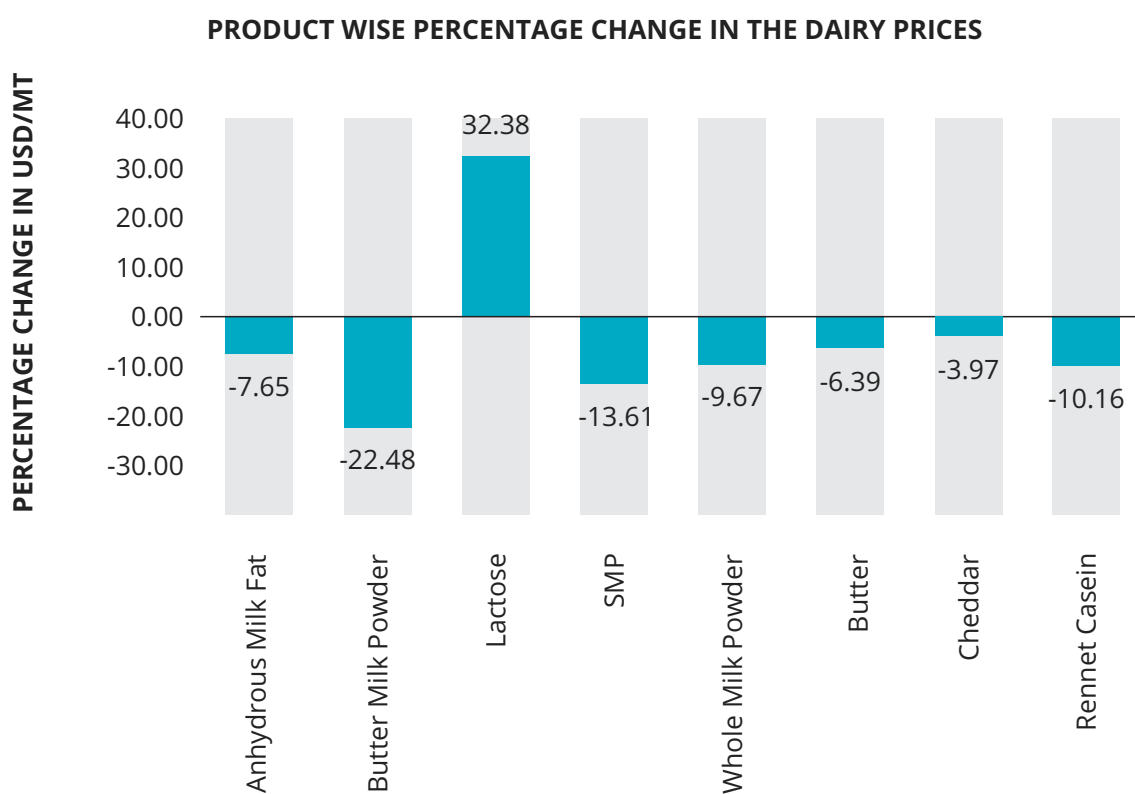
After the WHO declared COVID-19 a "Global Pandemic" on 11th March, dairy product prices began to decline worldwide. A bearish trend was witnessed thereon. In the global context, skim milk powder, anhydrous milk fat, buttermilk powder, whole milk powder, butter, cheddar, rennet casein, and lactose are the leading dairy products. In the recently announced Global Dairy Trade (GDT) auction, prices dropped for all dairy products except lactose, which has recorded a growth of 32.38%. The buttermilk powder prices fared worst, with a drop of 22.5%. Compared to last year's trade, the volume of dairy products dropped by nearly 55%. Extending lockdowns in different countries may further damage global dairy trade.

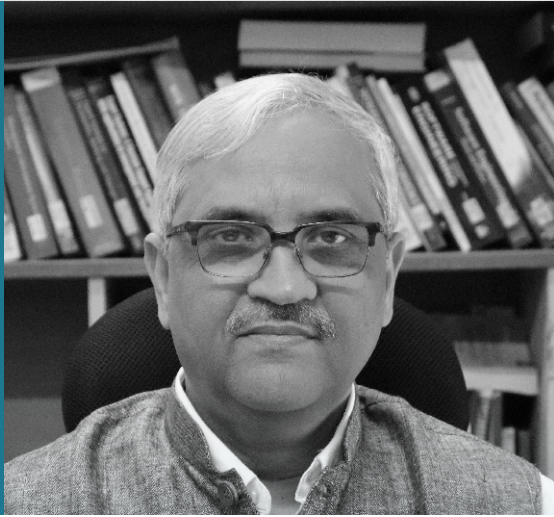
Table 1 offers a brief overview of global dairy product prices in pre- and post-pandemic situations and percentage change.

Table 1: Comparison of Global Dairy Product Prices

Prices (USD/MT)	Pre-Pandemic (as on 3-Mar-2020)	Post-Pandemic (as on 5-May-2020)	Percentage Change
Anhydrous Milk Fat	4302	3973	-7.65
Butter Milk Powder	2718	2107	-22.48
Lactose	871	1153	32.38
SMP	2747	2373	-13.61
Whole Milk Powder	3039	2745	-9.67
Butter	4131	3867	-6.39
Cheddar	4285	4115	-3.97
Rennet Casein	9897	8891	-10.16

Source: Global Dairy Trade, <https://www.globaldairytrade.info/en/product-results/>





WEB 4.0 AND INDUSTRY 4.0: IS THE INDIAN DAIRY SECTOR LIKELY TO BENEFIT?

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The Web 4.0 looks beyond the benefits of Web 3.0 and helps link physical devices to networks seamlessly through the Internet of Things (IoT) without human intervention. By 2020, over 30 billion devices are estimated to be interconnected directly over the network. The emergence of Web 4.0 has also led to a very powerful transition known as Industry 4.0. The big shift, under the Industry 4.0 scenario, involves the way in which goods and services are produced, distributed, and delivered. This includes use of smart machines, the predictive and lean supply chains, raw material inventories, work-in-process, and finished goods, production, manufacturing and, above all, cost and time optimization with no human interventions. Today, this is possible because of cloud computing, enterprise resource planning (ERP), and IoT integration. Web 4.0 and Industry 4.0 are also designed to provide benefits through artificial intelligence (AI), machine learning (ML), virtual reality (VR), and augmented reality (AR). The Industry 4.0 market has been growing rapidly and is expected to reach USD 156.6 billion by 2024, at a CAGR of 16.9% from 2019 to

2024. According to sources in FICCI and NASSCOM, India's IoT market base is USD 4.9 billion with a market share of 8% in agriculture, 9% in retail, 13% in logistics, and 18% in manufacturing among other sectors. India has in place the National Digital Communication Policy, 2018 and the IoT Policy, 2016. The 2015 Smart Cities Mission also addresses IoT use in India.

According to OECD estimates, India is one of the fastest growing countries among G20 economies today. Dependence on agriculture and food production and the related supply chain will remain a central issue in India. This means that India needs to review ways to infuse policy-level innovations to improve farm productivity and sustainable value chains. The dependence of Indian framers on dairy and livestock value chain is high. Besides, India is the world's largest milk producer. However, there is scope for the dairy sector to improve entrepreneurship, supply chain, interconnected interorganizational resource planning, smart and ecologically sensitive logistics, storage, production, and processing.

The global FMCG sector, including the dairy sector, has been experiencing massive disruption in its distribution and retail sector. Siemens Financial Services (SFS) forecasts that the dairy products' sector will receive an annual gain of £399m through digital transformation by 2025. By 2030, India's retail estimates are expected to double and reach USD\$ 1.5 trillion, according to Nielson. E-commerce retail is likely to grow. The disruption concerns the e-commerce model click-n-collect and modern trade in Tier-1, Tier 2, and Tier 3 cities. The Indian dairy industry needs a cold chain throughout its forward supply chain and testing infrastructure. The market value of dairy testing is forecast at 7.8% for 2019-2025, with USD 4.5 billion in 2018. According to the FSSAI, 68% of dairy products have scope to meet the standards. With IoT and Industry 4.0 in place, the Indian dairy industry could benefit from cloud-based testing and data based predictive analytics. This could help reduce the amount of milk and SMP adulteration during pooling, animal feed, production, packing, transport, and distribution.

The Indian dairy sector has been inclusive of the Industry 4.0 compliant service providers. Some of them are: Stellaps, Aakashganga, Reil, miRobot, GEA, Milc Group, MilkManApps and Trinetra Wireless, among many others. The broad scope for the implementation of Industry 4.0 includes a) Milching machines, b) Automatic Milk collection units (AMCUs), d) Bulk Milk Chilling Units (BMCUs), e) Milk Tankers, f) Chilling Units, g) Milk pooling and receiving platforms, h) Processing involving machine maintenance and work-in-process (AI, ML, VR and AR), i) inventory storage and stacking, j) Packing, and k) Logistics for finished goods transport, distribution, retailing, returns,

and traceability. IoT can also help track consumer behaviour across retail outlets through modern trading techniques. Another important use of IoT is monitoring cattle health (some attempts do exist through drones, GPS, GPRS) and expert service provisioning.

Industry 4.0 is expected to give way to the widespread use of technologies using big data analytics and VR and AR techniques with the help of expert systems and decision support systems. This requires converged efforts in India, in line with the National Dairy Plan, through infrastructure development funds to develop strong digital networks, commonly deployed cloud ERP, and cloud-based services so that the lean supply chain evens out seasonal milk supply through a network of installed capacities in a national grid involving lean/shared infrastructure use and optimized operations cost, while improved quality services on demand to reach the primary producers and consumers. The dairy sector needs a special policy vehicle to induce technology-enabled cloud, software as a service (SaaS), infrastructure as a service (IaaS), platform as a service (PaaS), networked ERP solution grid, and fog computing for primary dairy producers and retailers via consumers.

The Indian dairy sector is likely to face internal and international competition in its market. In order to remain sustainable in the international dairy market, India's dairy industry should remain competitive with the adoption of disruptive technologies as a necessary pre-condition. Looking forward, the market is expected to reach INR 25,491 billion by 2025, with a CAGR of around 16% by 2020-2025 along with the potential use of Industry 4.0. The Indian dairy sector needs to take note of this advancement while ensuring more primary producers join the organized sector. ●



Interview Series



In the context of the COVID-19 pandemic, Verghese Kurien Centre of Excellence (VKCoE), set up at IRMA, has been conducting series of interviews with key stakeholders associated with the dairy sector. Through this series, VKCoE aims to get insights from leaders of the cooperative dairy sector in India on the effect of the COVID-19 pandemic on the cooperative dairy sector.

Presented are *excerpts* of interactions with two key thought Leaders – **Dr. R.S. Sodhi**, Managing Director, Gujarat Cooperative Milk Marketing Federation (GCMMF) and **Shri Balu Iyer**, Regional Director, International Cooperative Alliance – Asia & Pacific.



Dr. R. S. Sodhi

Overall, this lockdown situation has created lots of trust amongst the farmers for the Cooperatives. We have not also reduced prices given to farmers. In coming months, Cooperatives are going to get more milk as they stood by the farmers when needed. In the post COVID-19 phase, US and EU would put lot of pressure on India to import dairy products. However, there is opportunity for the dairy cooperative sector to expand building on trust generated during this lockdown period. The administration at States and Centre also provided a lot of help to dairy sector. But milk which used to be purchased (from farmers) and sold by small vendors, private operators, they stopped the procurement and sale of milk during the lockdown as majority of them were supplying to Hotel-Restaurant-Catering (HoReCa) segment and sweet shops. The surplus milk started to come to Cooperatives. Cooperatives do not have strong presence in all the states.

The web link of the interview
[https://www.youtube.com/
watch?v=O6TD3t3e8FQ](https://www.youtube.com/watch?v=O6TD3t3e8FQ)



Shri Balu Iyer

This pandemic also taught the cooperatives that we can't be working in silos. We need to create an eco-system where agricultural and consumer Cooperatives work together. We need to adopt new technologies in the absence of physical meeting and contacts. We need to look at health access as well as basic incomes, we need to adopt new technologies.

As the Indian government has allowed direct purchase of agricultural commodities from the farmers, Cooperatives must play a critical role in organizing farmers for ensuring better bargaining power for the farmers. Many countries Cooperatives are looked at enterprises, in India we are yet to look at this aspect. Young people are interested in 'start ups' where cooperatives are missing.

The web link of the interview
[https://www.youtube.com/
watch?v=CQpynZWjunM](https://www.youtube.com/watch?v=CQpynZWjunM)

Remembering Dr. Verghese Kurien

I trust, in a humble way - dairying is such an instrument of change: an instrument not only of technical change, but also of economic and social change. It is to such instruments that we must look to build the India of tomorrow.

- Dr. Verghese Kurien





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