THEME:
Dairy for Nutrition and Livelihood

MR JEAN MARC CHAUMET
Economics Director, Centre National de l'Economie Laitière, Paris

World Dairy Situation Report and Forecasts

The new edition of the IDF World Dairy Situation Report is a thoughtful compilation of the most relevant and up-to-date information on global production, processing, trade-including prices- and consumption of milk and dairy products. This comprehensive report would not have been possible without the valuable contributions received from IDF National Committees, other national dairy organisations, IDF members and experts from more than 50 important dairy countries.

2021 was the second COVID-19 pandemic year, but again this year, this disruption had only a limited impact on the global dairy sector. The below average 2.1% growth of global milk production (for all species) reflected the difficult supply situation especially in the key exporting regions, which was caused by the sharp increase in costs of energy, animal feed and fertilizer. These rising costs were a result of strong economic recovery and disruptions to supply chains worldwide. The two main underlying growth engines remained quite consistent over the past few years: production in the milk-deficient regions, Asia in particular (+4.5% for cow's milk mainly driven by India, Pakistan and China) and buffalo milk production (growing more than 5% globally). Cow's milk accounted for 80% (749 million tonnes) and still added the biggest volume in absolute terms even with a below average growth rate.

Global cow's milk deliveries remained quite stable in 2021 (+0.5%), and were limited in the main exporting region, particularly in the second half of the year. New Zealand's deliveries (+0.1%) remained stable while Australia's dropped sharply (-3.9%), due to bad weather conditions. In the EU 27, deliveries of cow's milk slightly decreased by 0.2% for the first time in more than a decade, with many countries being affected by the sharp rise of production costs and some environment restrictions. In North America, USA milk deliveries were still on an upward trend (+1.3%), but the growth mainly occurred in the first semester.

With quite stable milk deliveries in 2021, the total output of dairy products showed a lower growth compared to the long-term trend for most of the product categories. Global output increased significantly for butter and whey, both above their respective 2010-2021 CAGR. Output only slightly increased for WMP and butter. After an increase in 2020, global liquid milk production slightly decreased by 0.4% in 2021. World skim milk powder production dwindled at 4.9 million tonnes in 2021 because processors favoured other products like cheese and WMP.

Global per capita consumption increased 1.4% over 2021 to reach 118.2 kg in milk equivalents, while population grew by 75 million people to 7.87 billion. Asia is the main consuming region (48%), where annual per capita consumption increased by 4 kg to 94 kg, far below the levels registered in Western countries. As sanitary restrictions were partially eased, some of the food services reopened gradually in the US and EU and many people reverted to their old consumption patterns, resulting in a year-on-year decline in retail sales in favour of out-of-home consumption.

Hindered by the limited availability of dairy products, especially in the 2nd half of the year, increasing price levels and rising transport costs, global trade expansion only increased by 1.3%, at about 93.3 million tonnes of milk equivalent in 2021. The share of world trade in global milk production still lies between 9 and 10%.

In 2021, prices of dairy commodities were still impacted by sanitary measures to fight COVID-19 in the 1st half of the year and were driven by the by the rapid rebound in demand, limited supply and overloaded supply chains in the 2nd half of 2021. International prices of SMP, WMP, butter and cheese all ended the year at the highest levels since 2014, except for butter.

Beginning of 2022, the conflict in Ukraine has disrupted trade and aggravated inflation for basic goods like energy, food and metals. Combined with a further decline of milk deliveries in the main exporting countries, it has led to a renewed increase in dairy commodity prices, reaching an all-time record level for many of them.

MR ROMULO ALVARADO
Project Manager, Dairy Development, Tetra Pak
Madrid, Espana

Feeding the Future - Technological Challenges and Solutions

Value of Dairy Farming in Employment Generation

- One billion people have livelihood supported by the dairy sector
- 60-65% of the income of marginal and small-scale farmers comes from dairying
- Nearly 10% of the world population directly depends on dairy farming
- Among the top five: Milk ranking as an agricultural commodity in both quantity and value terms (14% of global agriculture trade)

Main technological challenges small holder farmers are facing in various country of the world:

- Training on sustainable dairying
- Access to fodder and quality feed
- Stable market to sell milk
- Cow dung management problem
- Record keeping by farmers
- Understanding dairy economics by farmers: Farmers need to take dairy as a business.
- Basic farm management activity (shown in the Table) should be adopted by all farmers on profitable point of view.

Conclusion:

- The value of dairy farming in food security cannot be disputed, as dairy animals are a regular source of food and cash for farmers, who either consume or sell milk every day.
- Dairy development initiatives should always be market driven.
- Technological challenges must be tackled with solution that should adapt to the local condition and circumstances and ensure profitability
- When referring to smallholder dairy farming, we need to go back to the basics of farm management.
- Dairy processors need to take a leadership role in the dairy development initiatives, to secure long term supply of good quality milk.
- Creating local advisory teams with strong practical knowledge and competences is fundamental for long term success.

Solution: Farm advisory should prioritize on

Record keeping	Fertility checks (at least 3 per year)
Understand costs per liter of milk	Close up cow protocol in place
Clean freshwater availability 24/7 for all animal	Fresh cow protocol in place
Control over grass grown for feed	Calf rearing and weaning protocol
Fodder storage (Silage, Hay)	Milking best practices in place
Adults' cows - group feeding (milk yield, stage of lactation)	Understand disease risk, biosecurity & Vaccination protocol

Technical Session Presentations

MR SNORRI SIDGURDSSON
Arla Foods, Nigeria

The Challenging Task - Transformation from a Dairy Farmer to Company CEO

Value of Dairy Farming in Employment Generation

- Dairy farming in the world is changing from rearing few cows to more cows.
- Chinese dairy farm number has reduced by 75% since 2007 and number of cows has reduced by nearly 20% between 2008 and 2018 but the percentage of cow on farm with more than 100 cows increased from 20% to over 60%.
- Systematic approach for farm: To make a master Standard Operating Procedure is extremely good for animal husbandry as,
  - Cows like to have everything the same at all the time like, milking, feeding and cow comfort.
- Need the right condition, right mindset of farmers and skilled advisor to make change for transformation in animal husbandry.
- Dairying is a business and farmers must make a business decision for transformation of animal husbandry practices.

SHRI AMIT VYAS
Managing Director, Kaira District Cooperative Milk Producers' Union Ltd.,
Amul Dairy, Anand

Dairying through Small Holder Systems – A Lifeline for Millions

Major challenges in dairy farm:

- Scarcity of authentic data/database
- Genetic potential of animal
- Animal feed and fodder availability
- Animal health and disease diagnosis at farm level
- Adaptation of new technology by farmers
- Education and training
- Sustainability

Solution developed/adopted by Amul:

- Mobile application for animal registration, breeding and health
- Upgradation of genetic potential by use of sorted sex semen and Embryo transfer technology
- Compound cattle feed, mineral mixture and total mixed ration
- Rapid diagnostic kit for Brucellosis, FMD and Tuberculosis in field
- Ayurvedic and homeopathic remedy as an alternative medicine
- Mastitis control programme
- IoT based intelligence system
- Use of digital thawing, digital AI gun and Pregnancy diagnosis kit
- Milk-o-bike for milking of small holder dairy farmers
- Step towards sustainability: Biogas generation, Use of solar at BMC level, Use of bio fertilizer, rainwater harvesting at farm level etc.

SHRI UPAMANYU BASU
Joint Secretary (Livestock Health, Department of Animal Husbandry & Dairying, Ministry of Fisheries, Animal Husbandry & Dairying, GOI

National Animal Disease Control Programme – A comprehensive Disease Management Model in India

India is the highest milk producer in the world, yet the animal-wise productivity is comparatively low. Further, India is also a potential hotspot for animal disease outbreaks due to the high livestock density, growing livestock population and for want of strengthening of animal disease surveillance. This impacts not only the livelihood of farmers, who rear livestock, but the ability to increase our global share in livestock products' trade. Recognising that the core capacity for animal health management in India needs to be further strengthened, our lawmakers have enabled taking up these challenges through initiatives including setting up of a separate Ministry of Fisheries, Animal Husbandry & Dairying so as to bestow the much-desired focus and impetus to the livestock sector.

National Animal Disease Control Programme (NADCP) is a visionary initiative, launched in September, 2019. It aims to vaccinate, biannually, all eligible susceptible livestock against Foot and Mouth Disease (FMD) and all female bovine calves, annually, against Brucellosis to control FMD and Brucellosis by 2025 with vaccination and envisions the eventual eradication of FMD by 2030. In fact, the foundation of the programme was laid much earlier with a strong motivation drawn from India's success in eradicating Rinderpest (cattle plague), a deadly disease, and our contribution to its global eradication.

In addition to a vaccination programme, NADCP is a stepping stone to reap benefits from this sector - identification of livestock through unique identification number, planning and formulation of a host of schemes for the sector; creating infrastructure for ensuring access and availability of quality vaccines, quality semen, feed, fodder seeds, etc. to livestock farmers for improving productivity and health of their animals. In fact, this has laid the foundation for the ambitious project of National Digital Livestock Mission, including disease diagnosis, treatment inter alia tracking of antimicrobial use, disease surveillance, disease reporting, disease forecasting modules, etc. eventually enabling disease-modelling, using big data.

Similarly, investments in cold-chain infrastructure, generating public awareness, laboratory-strengthening etc. under NADCP will have overarching benefits for other critical animal disease control programmes like Peste des Petits Ruminants (PPR) eradication and Classical Swine Fever control programme, to name a few. These efforts will also integrate with the One-Health Programme in collaboration with Word Bank, which is currently in pipeline.

DAHD was faced with various challenges immediately after the on-ground implementation of the programme with the onset of COVID-19, during the initial days, restricting the pace of the programme. Desired availability of vaccine quantity and quality issues was another temporary setback. Outbreaks of other diseases like avian influenza, lumpy skin disease etc. causes further impediments like diversion of manpower, etc. However, the resilience of veterinary services and the country's scientific community, in collaboration with both national and international departments/institutes, is enabling early-course amendments to overcome these challenges.

In addition to substantial financial and technical inputs towards strengthening of cold chain, identification of animals, strengthening of laboratories, surveillance etc., there is an equal focus on delivery of veterinary services, training of vaccinators, providing remuneration and mass-awareness amongst livestock rearers, along with feedback through sample surveys. This is likely to provide both intrinsic and extrinsic motivation to the vaccinators. Recently, another game-changing initiative has been launched through Mobile Veterinary Units, which will increase accessibility in terms of delivery of essential veterinary services to the livestock farmers' doorstep in remote areas. Motivation for adoption of suitable technology by the farmers, combined with empathy of policy-makers towards the challenges faced by frontline workers will contribute towards making this programme emerge as a comprehensive disease management model.

MS ANNA STYGAR
Research Scientist
Natural Resources Institute Finland (Luke)

Technological Advances in Dairy Health and Welfare Management

Research groups and companies around the world have been engaged in developing different sensors for dairy monitoring. Already now, according to Product Watch Report published by European Commission, the livestock monitoring market is estimated to be worth USD 1.6 billions and is projected to grow substantially. In a recently conducted market review on available dairy sensors, 129 technologies from 67 different providers located in 21 countries were identified. The United Kingdom, the Netherlands, and the United States, were the leaders for providing technologies with potential use for animal-based health and welfare assessment. Accelerometer and scale-based technologies were the most popular solution on the market and constituted 57% of all found tools. Commercially available accelerometers were offered with different animal attachment option. The collar was the most popular solution (65%), while leg (30%), ear (14%), and halter (3%) were less frequent. All reviewed products based on accelerometers offered health alerts. Only one accelerometer-based product was dedicated for calves, the remaining products were advertised for cows or heifers. Systems based on load cells in combination with RFID were most often used for managing and tracking the feeding program of individual animals. Also, few systems were used for body weight monitoring. The market review identified 14 boluses and 10 products using vision-based monitoring.

Boluses were advertised as tools for measuring body temperature, pH, and rumen activity as well as for animal identification. Among cameras, seven were dedicated for body temperature monitoring (thermal cameras), two were used for body condition scoring, and one camera for feeding monitoring. Regarding milk quality, 25 sensor technologies for health monitoring were identified (including 13 milking robot products). GPS sensors were used in eight different products offering the possibility to locate animal position. Additionally, two systems using microphone, as well as one mobile app for body condition scoring were identified.

Even though the dairy monitoring sensors seems to be well-established on markets, still relatively little is known about the performance of tools. According to literature review, in total, only 18 currently retailed dairy sensors have been externally validated (14%). The highest validation rate was found for systems based on accelerometers (30% of tools available on the market have validation records), while the lower rates were obtained for cameras (10%), load cells (8%), miscellaneous milk sensors (8%), and boluses (7%). Therefore, future actions should concentrate on increasing actors trust in technologies by providing knowledge from validation trials.

Farms and processors are already collecting a vast amount of sensor data in an automated manner. Integration of this data can bring benefits for the whole value chain. However, to strengthen the application of data-driven solution in the markets, we need to be more knowledgeable about the socio-economic implications of technology use in animal production. For instance, on how the application of sensor technologies could affect the economic results and animal welfare on a farm, or how farmers/consumers can utilize data from different sources in making informative decisions in herd management/purchase.

Already now ongoing research projects are aiming to demonstrate the potential of sensor data to estimate complex traits such as animal welfare or resilience rank of cows. It seems that the key to success for above mentioned projects as well as in further straitening the use of sensor technology is the cooperation between actors holding the data, namely between farmers associations, farm advisers, and technology providers.

MS MARIA KARLSSON
Milk Quality Expert, LRF Dairy
Sweden

Ecosystem Services Provided by the Dairy Sector

Ecosystem services may be defined as the benefits to humans from nature or, direct and indirect contributions of ecosystems to human wellbeing. Generally, ecosystem services can be categorized into four groups (provisioning, regulating, cultural and supporting), and globally all are equally important. But regionally, or locally some ecosystem services could be of higher relevance for that area.

Promoting the benefits and services of the dairy sector for the environment can give a more balanced perspective of the impacts of the dairy sector. Here ecosystem services are important. It is important to raise awareness and knowledge of ecosystem services provided by the dairy sector, so farmers can continue to produce them going forward. Not only for themselves, but also for society us who depends on agriculture systems.

A recent Swedish study has shown that carbon sequestration is higher on Swedish dairy farms compared to other farm types. Small changes in the large stock of soil organic carbon (SOC) can have a substantial influence on the climate impact of agriculture. The mean SOC stock increase on dairy farms corresponded to an approximately 5% annual increase over a 10-year period. Transition from cropland to grassland and increased frequency of perennial forage crops are generally expected to increase SOC stocks. However, the magnitude of actual SOC sequestration achieved depends on both management and site characteristics and can therefore vary considerably between farms. Overall, the results in this case study indicate that it is important to account for SOC changes when assessing the climate impact of dairy production, and that the climate impact of SOC increases on dairy farms may be larger than estimated in previous studies.

When we have gathered the essential data, we come to the challenge of explaining to the public and politicians what the results mean for society.

Three things to keep in mind:

- Keep it simple. Don´t try to explain every single ecosystem service to emphasize the importance of the dairy sector - you will lose people´s attention.

- Try to relate to something people like and have a good feeling about. In our case we chose to talk about that delicious combination of a cold glass of milk and a freshly baked cinnamon roll that so many Swedes are familiar with, and flowers, birds and cows grazing which is a great part of the Swedish people's love of nature.

- Don´t give up. When you have heard yourself saying the same thing a thousand times, people might have started to listen!

DR PRAVEEN MALIK
Animal Husbandry Commissioner, Govt. of India

India's Initiative in Strengthening One-Health

During the last two decades, India had experienced the emergence and re-emergence of many infectious diseases of zoonotic and non-zoonotic nature. These diseases have proved to be of high economic significance and have posed threat to food and nutritional security, national economy, and livelihood of rural people.

For enhancing productivity of livestock through health interventions, Department of Animal Husbandry and Dairying (DAHD), Ministry of Fisheries, Animal Husbandry, and Dairying, GoI has initiated many programmes; some of these include vaccination under National Animal Disease Control Programme (NADCP) and Livestock Health and Disease Control (LH & DC) programme against the following:

- Foot-and- mouth disease (FMD)
- Peste des petits ruminants (PPR)
- Brucellosis
- Classical swine fever (CSF)

Establishment and Strengthening of Veterinary Hospitals & Dispensaries – Mobile Veterinary Unit (ESVHD-MVU), developing an exhaustive digital architecture for livestock sector under National Digital Livestock Mission (NDLM), and implementation of One Health schemes were initiated.

Amongst various initiatives taken by DAHD, One Health India is one of the most important initiatives that has started with a vision of designing an effective framework for achieving One Health in the entire nation with clear focus on actions, responses, and consequences at the animal-human-ecosystems interfaces.

The project is operating with six major interventions, which includes institutionalizing coordination among various sectors, enabling better disease reporting through creation and strengthening the one heath laboratory network, and integrating it with the National Digital Livestock Mission, capacity building through customizing new training modules and improving the old ones for health professionals, creating awareness amongst the stakeholders for enhancing their active participation by preparation of IEC material, and finally strengthening of biosafety and biosecurity measures for livestock farmers at the farm level.

All these interventions will help in efficient surveillance, early prediction, detection, and diagnosis of zoonotic diseases leading to improved livestock and human health, ensuring food safety and nutritional security, managing livestock-human-wildlife interface, better livelihood opportunities to meet SDGs and reduce human diseases and antimicrobial burden.

MR STEPHAN HUBERTUS
Senior Agricultural Policy Analyst, OECD, France

Dairy in Global Agricultural Commodities Markets under Uncertainty

Dairy is deeply integrated into global agricultural commodity markets. It competes with alternative commodities in contributing to the healthy diets of the growing world population, especially in the provision of proteins and other nutrients. In the production process, dairy uses pastures, other roughage and compound feed. Notably, compound feed is produced from cereals, protein meal and other crops, which then in turn, directly links dairy to crop market developments.

In the last four years, three major disruptions affected global agricultural commodity markets: the outbreak of African Swine Fever (ASF) in East Asia, the global COVID-19 pandemic and Russia's war against Ukraine. This have limited direct impact on dairy but still placed constraints on global markets, e.g. ASF shifted global trade of meat and feed grains, COVID-19 reduced income and temporarily changed consumption behaviour, Russia's war against Ukraine increased crop, energy and fertiliser prices.

The OECD-FAO Agricultural Outlook report assesses the global agricultural commodity balances in the coming decade. We conclude that the dairy market is likely to be one of the strongest growing markets. This is largely due to population growth but also because of the positive economic growth prospects of India and Pakistan, where dairy is the most important animal protein in the diet. Dairy is an important provider of protein and other nutrients needed to maintain a healthy diet but the intake of it is still low in Sub-Saharan Africa - a region with the highest share of food insecure people. As dairy is considerably less traded than other agricultural commodities, it implies that production often occurs at and near the place of consumption. Additionally, the productivity per cow is often lower in the countries where consumption growth is the largest which in turn increases the challenge to reduce direct greenhouse gas emissions from the global dairy sector. Many efforts, especially those promoted by the International Dairy Federation, work to reduce emissions but these practices must be widely disseminated to all dairy producers to effectively and significantly reduce global emissions.

Dairy has shown resilience to several recent global challenges as production and consumption are closely linked. Nevertheless, several additional uncertainties are on the horizon in the coming decade:

- How will global markets recover from the COVID-19 pandemic and Russia's war against Ukraine?
- What is the future for plant-based replacements on the global dairy market?
- How will environmental legislation shape dairy production?
- Could there be a disruptive animal disease in dairy?
- Dairy trade is treated often specially in trade agreements. Will that shape major trade flows?

PROF RAKESH MOHAN JOSHI
Director, IIPM, Bangalore and Professor, IIFT, New Delhi

Emerging Challenges to Dairy Industry

Dairying is the fastest growing agri-food commodity in the world during the next decade and India continues to be the world's largest consumer and importer. As prices in real terms for most dairy commodities like butter and whole milk powder are hardly expected to rise, the focus of the dairy industry should be on improving cost competitiveness, value addition, innovation and branding.

International dairy industry must come together and collaborate to fight unitedly against unethical competitive practices from the rising veganism and plant based milk substitutes. There is an emergent need for the world dairy industry to come together and identify synergies to collaborate and innovate and make dairying sustainable for environment and livelihood.

MR LAWRENCE HADDAD
Executive Director, The Global Alliance for Improved Nutrition (GAIN)

Sustainable Food Systems for Nutritious and Affordable Food: Why they Matter and How to Get them

Food systems are currently undermining human health and planetary health. Diets are the main drivers of poor health and premature mortality in India and in nearly all countries. Animal sourced foods such as dairy are an important part of a healthy diet for those who are consuming very low levels. Those who are consuming high levels of animal sourced foods as defined by the country's food based dietary guidelines should reduce their intake for their health. As far and the environment is concerned, animal sourced foods have a heavy footprint in greenhouse gas emissions, but that is not the case with all environmental dimensions. In high income contexts, animal sourced food production systems tend to be efficient, while in low income contexts there are many opportunities for these production systems to become more efficient and therefore less environmentally damaging.

Transformations such as this to food systems require a range of things to happen: there are no silver bullets. For transformations to occur governments need to make this a priority, demand patterns need to shift, producing and processing incentives need to be directed towards more nutritious foods, finance needs to be guided towards businesses producing more nutritious foods, and data need to be available and easy to use to track food systems transformations and guide course corrections.

DR A.K. DATTA
Emeritus Professor, Agricultural and Food Engineering Department, IIT Kharagpur, India

Market Milk - Innovations in Processing and Packaging

A laboratory model indirect type helical tube ultra-high -temperature (UHT) milk sterilizer was designed and tested. The helical triple tube heat exchanger modeling and simulation was carried out for heating milk from 85°C to 145°C in the annulus of the triple tube with steam being supplied to the innermost tube and the outermost annulus.

The holding section was designed on the basis of Arrhenius model to reduce *B. stearothermophilus* microorganisms in the milk by 9 log cycles at a sterilization temperature of 145°C with a residence time of 12.37 s, followed by holding time of 2 s and cooling time of 2.8 s. The helical double tube cooling section modeling and simulation was carried out to cool milk from 145°C to 85°C by using tap water.

The lengths of the heating, holding and cooling sections were found to be 2.28, 1.0 and 2.08 m, respectively. An aseptic packaging machine was fabricated based on form-fill-seal machine design and tested along with the sterilizer for 9 log cycle destruction and shelf-life studies for such sterilised millk was found to be yielding safe storage period of two months. The sterilizer was run on milk flow rate of 135 L/h. Both *B. stearothermophilus* and *B. subtillis* were completely inactivated for an overall batch size of 1,000 L, meaning a continuous operation of 7.4 h. The sealing of the packages was completed by the form-fill-seal machine operating in semi continuous mode with one operator coming near the set up.

The quality attributes (*i.e.* color and viscosity) of the processed milk were tested over a period of fifteen days and no significant variation was found. The packaging machine was designed on the basis of hydrogen peroxide solution dipping, followed by sterilized air drying of the package material (HDPE). The sealing device was tested for DC voltage varying from 14 to 30 Volts and generating 3 to 12 W power to ensure just the optimum bondage between the adjoining package layers to avoid inadequate sealing or/and melting. No recontamination was evidenced in pouches.

MR TOM HEILANDT
Secretary, FAO/WHO Codex Alimentarius Commission, Rome, Italy

Importance of International and Local Regulations in Food Safety

The presentation will reflect on the upcoming anniversaries of Codex and IDF and the continued importance of close cooperation in a changing world.

As Codex is nearing its 60th anniversary and IDF its 120th our cooperation that has lasted Codex whole lifespan is as important as ever. Codex mandate is to protect the health of consumers and ensure fair practices in the food trade. IDF represents the dairy sector internationally providing a global source of scientific expertise and knowledge in support of the development and promotion of quality milk and milk products so as to deliver consumers with nutrition, health and wellbeing.

Codex/IDF successful cooperation has not only brought forward important food safety texts like Code of Hygienic Practice for Milk and Milk Products but also many product standards and other important general texts. One general text of particular importance today is the Codex General Standard on the Use of Dairy Terms regulating amongst other what can be called milk and what not. The text was written long before the internet and todays' chaos of information and misinformation flooding the minds of consumers. Avoiding misleading consumers is one of the main principles of Codex work in nutrition and food labelling. Wrong or misleading information has both economic and health aspects and the name of a product is important in that respect.

As sociocultural norms and expectations are changing, new food sources and production systems appear, and we are striving towards more sustainable and inclusive food systems, we will need to work together continuing to make sure that food is safe, provides the needed nutrition to the consumer and offers a fair income to those producing it. Beyond that, we will need to look at sustainability and a concept of health as seen by WHO being "not merely the absence of disease" but "a state of complete physical, mental and social well-being". In this we will have to continue basing ourselves on the scientific method that is open-ended and dependent on empirical verification and falsification. The sciences we need to look at may expand but the rigor we use to verify results must remain as strong as must the will for international harmonization, exchange and cooperation.

SHRI SUNIL BAKSHI
Head (Regulations), Food Safety and Standards Authority of India, New Delhi

Evolution of Food Safety and Quality Regulations for Milk and Milk Products in India

The globalization of food production and trade in the last couple of decades has caught the attention of all the relevant stakeholders including regulators, food businesses, scientific community and consumers.

From regulators' perspective, strengthening of national food control system has become imperative to ensure food safety and fair practices in food trade. Doing away with archaic food laws, out of sync food standards and multitude of administering agencies has been witnessed in recent times in many countries. In Indiatoo, multiplicity of food laws and their administration by different government ministries/departments was not only a major challenge for growth and competitiveness of food industry, it also shackled the regulatory ecosystem being unable to respond to the emerging food safety scenario. Appropriate corrective measures had to be, and were, undertaken. The journey of improvement continues.

For the country, it has been a long journey to witness the change in the national food regulatory system with the enactment of Food Safety and Standards Act, 2006 that integrated all the food laws and provided a much deliberated shift in the focus from merely addressing issues of 'adulteration' to ensuring 'food safety' comprehensively; and a systematic and scientific reorientation of food processing and manufacturing industry from 'being regulated' to working towards 'self-compliance'. In this backdrop, the food regulatory dispensation is now reforming at a very fast pace while taking into consideration the ever-evolving information on food safety and risk analysis, advances in food technology, global best practices, nuances of emerging food trade (*e.g.* e-commerce) etc.

The revision of the domestic food regulations, including those pertaining to milk and milk products, is increasingly relying on an integrated system-approach to food safety with a focus on food additives, chemical contaminants (heavy metals, mycotoxins, pesticides and veterinary drugs residues etc.) and microbiological contaminants in foods. The approach is that not only the finished products conform to the stipulated safety parameters but also that measures are taken to control and minimize contamination in the entire food value chain.

Further, comprehensive revision of the milk and milk product identity standards taken up from the erstwhile 'Prevention of Food Adulteration' regulatory regime; formulation of new standards for value- added dairy products; development of new regulations on nutraceuticals, food supplements, foods for special dietary uses, foods for special medical purposes, probiotic/prebiotic foods, organic foods and fortified foods; revision of food additives and proprietary foods' provisions; addressing labelling of milk products and analogues in the dairy context to facilitate informed choice; increased emphasis on traceability and recall; all put together have paved way for innovation, manufacture and fair trade of a whole new generation of safe dairy products and other dairy-based foods.

MR ALLEN SAYLER
Managing Director, Centre for Food Safety and Regulatory Solution, Virginia

PROF. SEEMA PURI
Professor, Department of Food & Nutrition, Institute of Home Economics, University of Delhi, New Delhi, India

Key Hygienic Elements for Exporting Safe Dairy Products - International Recommendations Including the Codex Code of Hygienic Practice for Milk and Milk Products

The highly perishable characteristics of milk and dairy products made from milk create special food safety challenges for the dairy industry at all points in the supply chain (farm to fork). This is particularly true if these dairy products are intended for export. While governments have regulations and laws to reduce or eliminate these food safety challenges, exported dairy products must meet the requirements of the importing country. The food safety laws and regulations of the exporting and importing countries do not always align, creating the potential for blockage of dairy products from one country to another. It is important that dairy exporting countries and companies understand and recognize broader food safety recommendations established by international organizations such as Codex, ISO, OIE, FAO and the WHO as many importing countries utilize these recommendations as the basis for accepting dairy product imports.

This presentation will provide details on food safety recommendations from various international organizations, using the Codex "Code of Hygienic Practice for Milk and Milk Products" as one example to identify specific food safety and hygiene recommendations with the intention of increasing the understanding, importance and awareness of these international food safety recommendations for the entire dairy sector.

School based Nutritional Intervention Programs: Experiences from India

India has a long history of school based nutrition programs since the early 1970s. The initial programs focused on bridging the gap in nutrient intakes among young children mainly calories and proteins. A few prophylaxis programs were also in operation which included prophylaxis for iron, and folic acid, vitamin A and iodine, through community based interventions. Since 1995, India has a large Midday Meal program in schools operationalized countrywide. The program now known as PM-POSHAN (Pradhan Mantri Poshan Shakti Nirman) Scheme, supplies hot cooked meals on working days for children in primary and upper primary classes in government, government aided, local body, and alternate innovative education centres. Serving 118 million children in 1.12 million schools, the Midday Meal Scheme is the largest of its kind in the world.

Several innovative approaches have also been implemented by different State governments to improve the food served in the schools including provision of milk, banana, and egg besides the usual midday meal. School based nutrition programs also focus on imparting nutrition and health education, through reinforcement of simple hygiene and diet messages.

The Eat Right Movement launched by the Food Safety and Standards Authority of India has also launched several programs targeting school children including the SNF@School and Eat right Campaign which focus on orienting school children to healthy and safe eating practices through a series of fun activities like games, puppet shows, competitions, quizzes etc. Promotion of school gardens is another area which the government is promoting actively to inculcate not only good nutritious practices but also sustainable environment awareness.

MR KENICHIRO TOYOFUKU
Director, (Corporate Planning), Maruti Suzuki India Ltd.

Biogas Vehicle Fuel for Rural Development and Net-zero

- MSIL is a leader in factory-fitted CNG vehicles and currently has 10 CNG models in its portfolio.
- From FY10-11 till date, MSIL has sold 1.13 million CNG vehicles.
- MSIL's market share in passenger and commercial CNG vehicles ~ 80%, and 42.4% respectively.
- CNG vehicle can be run using compressed biogas (CBG).
- Promotion of biogas can yield both direct and indirect benefits to rural persons and contribute to rural development.
- Direct benefits of biogas to rural people include income from selling cow-dung, use of bio-manure for farming and employment generation in biogas value chain.
- Based on secondary research, almost 52.6% rural people In India have no means to travel outside of their villages due to lack of affordable mobility solutions.
- Biogas based mobility can provide indirect benefits for rural people, as biogas can be locally available in areas where CNG is not available and can be cheaper than petrol/ diesel.
- Biogas is a carbon negative fuel on Well-to-wheel basis. Well-to-Wheel (WTW) emissions consist of (a) Well-to-Tank (WTT) emissions due to fuel extraction, processing, transportation and storage, and (b) Tank-to-Wheel (TTW) emission in vehicles.
- WTW emission of biogas from cow dung is -747 $kgCO_2$/km (calculated based on California Air Resources Board data).
- In comparison WTW emission of petrol, CNG and EV are 142, 125 and 62 respectively (calculated on basis of various publicly available emission factors).
- Biogas avoids methane from getting released from waste such as cow dung. Methane has 28 times more Global Warming Potential than CO_2. Methane avoidance contributes most to negative WTW emission of biogas (-747 gCO_2/KM).
- Though EV has no tailpipe emissions, EV has positive WTW emissions (62 gCO_2/KM). The reason is electricity used to charge EV is coal-based which leads to CO_2 emissions.
- Approx. 10% of cow-dung available in India can run nearly 3 million CNG vehicles annually. Therefore, biogas from cow-dung has great potential for transportation sector in India.
- The key challenges for promotion of biogas are financial viability of biogas plant, improvement crop yield due to use of bio-manure, and quality of biogas for vehicle application.

MS ARLENE MITCHELL
Executive Director,
Global Child Nutrition Foundation (GCNF)

School Milk Programmes for Long-term Food and Nutrition Security

Global Food and Nutrition Security :

COVID-19 was a factor in the dramatic worsening of world hunger in 2020; the conflict in Ukraine made the situation worse in 2022; and prices will likely stay at historically high levels through 2024. As for nutrition, our diets are increasingly harming both our own health and that of the planet. The world is off course to meet 5 out of 6 targets for the nutrition of mothers, infants, and young children, and for meeting all targets for diet-related non-communicable disease, salt intake, raised blood pressure, adult obesity, and diabetes.

Only 27 percent of school-age children worldwide received school meals in the school year that began in 2020 and-despite gains in Africa-coverage is still lowest in low-income countries (LICs), where school nutrition is most needed. This is according to GCNF's 2021 Global Survey of School Meal Programs© that elicited responses from 139 countries, providing new data for 183 large-scale programmes in 125 countries (the remaining 14 countries reported that they had no large-scale programmes in 2020/21).

The data shows significant potential for increasing the use of dairy in schools: particularly in LICs (in the Middle East, North Africa, and sub-Saharan Africa): Only 35 percent of school meal programmes in LICs reported using dairy products, while 94 percent of programmes in high-income countries include dairy.

There are challenges to achieving improved food and nutrition security, however, and most are man- made or man-influenced (climate change; civil strife; agriculture's negative impact on the environment; prioritization and marketing of high-calorie foods; loss of biodiversity/ reliance on four major food crops; population growth; the aging of agriculturalists; and high fuel, fertilizer and transport costs). School meal programmes face challenges of capacity, funding, and the political will required for sustainability.

Impediments to the use of more dairy in schools include: The cost of product, packaging, and transport; the impact of dairy production, packaging and transport on the environment; food safety issues; lactose intolerance; low levels of dairy production in low-income countries; changing tastes; and concerns about the health implications of flavouring and sweetening in dairy products.

The proposal for addressing the challenges is to combine successful past approaches with new/different approaches. Successful approaches include use of UHT milk; fortification; partnerships with willing governments and implementors; honesty about the challenges; a long-term view; and producing a range of healthy dairy products. Other approaches revolve around: Reducing costs, developing solutions to the environmental issues; bio fortification; avoiding sweetened, flavoured products; new/different partnerships; new/flexible business models; ensuring local economic development opportunities, introducing healthy dairy products at young ages (i.e., preschool); establishing local partnerships, processing, and handling facilities in LICs; offering new, nutritious, shelf-stable, and affordable dairy products appropriate to local tastes and conditions; credibly addressing the concerns of "dairy naysayers"; improving the public image of dairy; and sticking with it-it will take time and trust to succeed in LICs, especially in the current environment.

MS MARY LEDMAN
Rabobank Dairy Strategist

Over the Next Decade and Beyond, Changing Global Demographics will Drive Dairy Market Opportunities

According to the UN, from 2020 to 2030, an additional 750m people will share our planet. Over 35% of the population growth will occur in Africa, followed by India with 16%, Pakistan with 5.6%, Indonesia with 3.4%, China with 3.3%, and the US with 2.5%. India and Pakistan will continue their quests to be self-sufficient.

Africa remains a net - and growing - dairy importer, largely importing from international players. Still, there will be pockets of flourishing regional domestic production growth, such as in East Africa, based on the availability of natural resources and social, economic, and political stability.

By 2030, India will be the most populous country in the world with its population growing by nearly 125 million people during the decade, topping 1.5 billion. Rabobank expects India to continue to strive for self-sufficiency in milk production and dairy product consumption. However, this could prove challenging if climatic conditions become more variable.

Barring any geopolitical fallout, China will continue to reign as the world's largest dairy importer in 2030. Rather than being dominated by the infant nutrition market of the past two decades, China's dairy sector will find growth in the 'Active Silvers' (i.e. people over 50 years old) market. China's population is projected to grow by about 25m during the decade, but the demographic changes are significant. The number of people less than four years of age is forecast to decline by nearly 13m, while the number of people over 50 years old will increase by 100m.

Mexico and Indonesia remain key dairy import markets due to their growing populations and rising per capita dairy consumption driven by increased purchasing power. Nearly 75% of Indonesia's population is under 50 years old in 2030, and real per capita GDP is forecast to increase by 4.2% CAGR, supporting demand growth.

The US population is forecast to grow by 18.6m people, reaching nearly 350m. It will be an aging and affluent market that attracts innovation and competition. The EU-27 market - with a consumer base near 450m people in 2030 - will also be aging and affluent but only 2.3m larger than in 2020. As a result, European dairy companies will face limited growth in their domestic consumer markets.

Over the next decade and beyond, evolving environmental, sustainability, and governance requirements will impact milk production growth in the key exporting regions. As a result, the EU-27 and Oceania are expected to have less exportable surplus growth during this decade than in the previous decade. In contrast, the US is well position to grow its milk supply by 1.5% CAGR, and increase its share of the global dairy markets.

SHRI NIRANJAN KARADE
Team Leader (Innovation and Project Management Cell)
National Dairy Development Board, Anand, India

Manure Management for Increasing Income from Dairying - The Indian Experience

India continues to be the largest milk producer in the world with 309 million bovines. While producing about 210 Million Metric Tonnes of Milk, these animals are estimated to produce about 1600 million metric of dung also. Even after adjusting these estimate against the dung lost in grazing, the bovine dung produced in India, if efficiently utilized through anaerobic digestion can replace approximately 50% of India's LPG requirement or can suffice energy needs of almost all rural households in the country. The bio slurry produced through anaerobic digestion of this dung can address about 40% of India's Nitrogen, Phosphorus and Potassium (NPK) needs.

To harness this potential of cattle dung, National Dairy Development Board (NDDB), evolved a model of manure management focusing on small holder dairy farmers who own about 85% of India's Bovines. Household Biogas plants provided to the women dairy farmers in a cluster of village's satisfy these farmers' cooking energy needs. The biogas slurry produced from these plants is primarily used by these farmers in their own fields and surplus slurry is sold to their own cooperative based on the defined quality parameters. The aggregated surplus slurry is processed to manufacture slurry based organic fertilizer which are made available to farmers at reasonable rates.

The model while accruing the significant savings on cooking fuel has also ensured sustained additional income for biogas owner farmers from dung and even from non milking bovines. It is helping in reducing the carbon footprint by arresting the methane emissions. The slurry based organic fertilizers rich in organic matter, microbial content and enriched with required nutrient and micronutrient are improving the crop yield and soil health.

Going ahead, while replicating this model across the country, NDDB is also developing another model wherein bovine dung aggregated from the farmers shall be utilized in large capacity biogas plant to produce biogas which shall satisfy energy needs of a dairy processing plant. NDDB has also helped setup a cattle dung based biogas grid model to supply piped gas to rural households who have constraints to install Household level biogas plants.

While the first model of manure management of NDDB is full established and getting rapidly replicated, the results of other two models shall be available in next one year. All the three models which take in to account slurry based fertilizer also as key component and not just biogas produced from the cow dung. These Manure Management models are surely going to remain reference to the dairy sector in India to convert the once considered Waste *i.e.* bovine dung in to the Wealth.

MR ISRAEL FLAMENBAUM
CEO, Cow Cooling Solution Ltd, Israel Cowcooling Flamenbaum & Seddon Ltd, Brazil

Managing Heat Stress in Dairy Cows

Heat stress is currently one of the biggest causes of economic losses to the global dairy industry and this is expected to worsen in the coming years. Two factors come together to address this situation. Global warming, and the increase in the frequency of extreme heat events, and the constant increase in cow's milk yield, a result of genetic, nutritional and farm management improvements, meaning that cows have to dissipate more heat to the environment.

High yielding cows generate higher amounts of heat than they can dissipate. The failure to dissipate heat impair cows' production, health and fertility, causing an increase in the cost of milk production, economic losses to farmers, seasonality in milk supply to the markets, impair cow's welfare and increase greenhouse gases emission.

In recent decades, researchers, mostly in warm regions, have been developing means to help cows dissipate heat, among them the "direct cooling", through combinations of wetting and forced ventilation, and the "indirect cooling", trough evaporation of water inside closed barns, particularly effective in dry climates. The "direct cooling", is the most common cooling method, being suitable for any type of climate, inexpensive and easy to apply. Cooling can be provided in different farm sites, as waiting yard and feed manger. Fans and sprinklers are activated automatically, providing short periods of wetting, followed by forced ventilation.

A recent study carried out in Israel showed that cooling the cows for six cumulative hours per day allowed cows in warm regions maintain normal body temperatures along the day and almost eliminate summer decline in cows' milk production and fertility. A study carried out in US 20 years ago, showed an annual loss of near 1.5 billion US$ for the US dairy industry due to heat stress (an average of 170 US$ per cow). These losses could be reduced by 40% to 900 million, if properly implementing cooling means. The cost effectiveness of implementing intensive cooling to the cows has been studied in last decade, in different parts of the world, and indicate that the investment may be repaid in short time, reducing cost of milk production and make cooling the cows, one of the most worthwhile investments in world dairy industry.

Applying the current knowledge, while adapting it to the farm and climate conditions in different parts of the world, is the task facing a special committee, set up last year by the IDF and in which I serve as one of its heads. The committee is due to submit its recommendations towards the end of 2023 and we expect that it will help world's dairy farmers increase cow's annual yield, allowing reduce number of cows required for its production. By this, farmers will be able to produce milk more efficiently, reduce significantly the cost of production and increase their farm profitability. In same time, farmers will improve cow's welfare and reduce cow's greenhouse gases emissions to the atmosphere.

Courtesy : Compendium of abstracts (Technical Papers) of IDF World Dairy Summit 2022.