INDIAN DAIRY SECTOR: OPPORTUNITIES AND CHALLENGES

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ABSTRACT

Dairy industry bestows over and above 6% to the country's GDP and affirms the livelihood of 80 million dairy farmers fuelling rural growth and economy. Approximately, 12-14% of agricultural income emanates from dairy sector. India's per capita milk consumption stands around 479 gram per day surpassing the global average of 371 gram per day. The nation accounts for 24.64% of world's milk production. Operation flood has metamorphosed Bharat from a milk deficit nation to world's largest milk producer. Albeit, India is leading global stage in milk production, it is facing numerous challenges like adulteration and food safety, unorganized nature, low productivity, supply chain issues, market volatility, environmental concerns, regulatory compliance etc. Implementation of cutting edge dairy technologies and digital dairy platforms may help us in overcoming these challenges.

KEYWORDS: milk, dairy sector, opportunity, challenge, safety concerns

INTRODUCTION

Viksit Bharat is an ambitious vision of Indian government to transform India into a developed entity by centenary of its Independence in the year 2047. With huge number of cattle population in India, dairy industry is stationed as the vanguard in spearheading India towards developed nation. Dairy industry stands at a critical juncture thus harmonizing its imperative role in nutrition, rural economy and global security. India, the global leader in terms of milk production is marching on for sustainable milk production and nutritional security through dairy industry. Dairy industry bestows over and above 6% to the country's GDP and affirms the livelihood of 80 million dairy farmers fuelling rural growth and economy. Approximately, 12-14% of agricultural income emanates from dairy sector. Dairy industry provides employment to hefty workforce explicitly and implicitly in dairy farming, processing and marketing. With Indian brands like AMUL roaring success in global markets, the sector is unfolding into a vibrant business hub. Dairy sector endows remarkably to India's GDP in tandem with market sized value at INR 18,975 billion in 2024 and anticipated to attain INR 57,001 by the year 2033. India's per capita milk consumption stands around 479 gram per day surpassing the global average of 371 gram per day. The nation accounts for 24.64% of world's milk production. This highlights the unwavering dedication, tireless efforts, potential talent and profound recognition of Indian dairy farmers in upholding the prestige and reputation of dairy sector in India

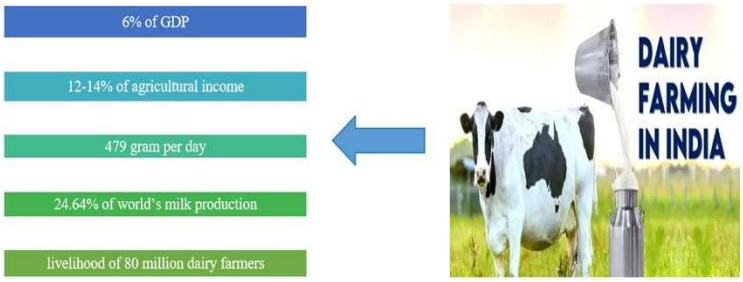

Fig. 1: Statistics of Indian Dairy Sector

OPERATION FLOOD

While boasting about the achievements of Indian dairy sector, one should not forget Dr. Verghese Kurien, the driving force behind the fruition of operation flood that has metamorphosed Bharat from a milk deficit nation to world's largest milk producer. Operation flood was launched in the year 1970 and was implemented in 3 phases. It aimed to escalate milk production, augment rural income and make milk available to consumers at a fair and affordable price. It is a national milk grid which welds milk producer across India with consumers stretching over multitudes of cities and towns, dwindling disparities in price whilst assuring that the producer gets access to fair market price in a transparent way persistently (Terhal and Doornbos, 1983).

Fig. 2: Structure of a Dairy Cooperative

With the success of operation flood, dairy sector in India is viewed as an engine of development, generating income opportunities for millions of rural farmers across the nooks and corners of the nation. The bedrock of operation flood illustrates how community based models can democratize nation and its wealth. In today's world, over and above 1.9 lakh dairy cooperative societies operates on a national scale, endorsing more than 1.7 crore milk producers, myriads of whom falls into the category of small and marginal farmers (Doornbos et al., 1987)

SAFETY CONCERNS

Milk is indispensable element of Indian cuisine safeguarding food safety and nutrition for the people. Milk is a vital source of calcium and protein. Milk is deemed to be a complete food which is rich in all essential minerals and vitamins (except Vit. C and Iron). Milk and milk products put forward plethora of benefits to the consumers. It bolsters bones, augments the immune system, and accelerates growth and development. It averts deficiency diseases in man as well as in animal. It fulfils the heterogeneous requirement of the body that is requisite for executing the essential functions of the body (FAO, 2023).

Urbanisation, industrialisation and globalisation have flared up assured market for milk and its products. Albeit, owing to enormous procurement sources, dairy industry is enduring hardship in monitoring safe milk production. As, today majority of the consumers are health centric and demands wholesome milk, it is an alarm for the competent authority to dispense training to the farmers engaged in dairy sector on safe and clean milk production. Since milk has high nutritive value, it is a good medium for microbial growth. These microbes can reach consumer through consumption of unpasteurised milk and may bring about milk borne illness. And hence, extreme caution should be adopted by the dairy industry so as to bestow wholesome milk for consumption of human.

Adulteration of milk may generate multitudes of untoward consequences in man. This has paved the way for establishment of FSSAI under FSSA, 2006. It regulates rules and

guidelines pertaining to food safety and security. The act has numerous provisions that regulate the hygienic condition prevailing around manufacturing premises and assess the risk factors associated with human health. The purpose of this act is to coagulate all laws addressing food safety and quality under the same domain.

The Food Safety and Standards Authority of India (FSSAI) furnish stringent guidelines on food terms usage in order to ensure accuracy and to impede the dissemination of information that can mislead consumers. It gives specifications related with the parlance of milk production pertaining to food standards. It underscores the usage of dairy associated terms pertaining to composite milk products. It furnishes information on enrichment and fortification of milk with necessary nutrients cohering to the specified regulations (Kumar, 2022; FSSAI, 2024).

Food safety is a crucial factor that affects health of human. Milk is a highly perishable and sustaining its safety and quality is a challenge to the dairy sector. Cautions must be adopted during the process of milk production, processing, storage, sale and marketing in owing to achieve optimum safety standards for milk. Quality assurance ought to be pursued by all the stakeholders in the line (farm to fork concept). The primary focus of quality management system lies on steps to prevent outbreak of food borne illness among consumers while keeping its nutritive value intact. Quality assurance include documented systems like Good Laboratory practices (GLP), Hazard Analysis and Critical Control Point (HACCP), Food Safety Management System (FSMS) (Kumar, 2022; Doornbos, 1987)

GOVERNMENT INITIATIVES

Dairy industry is one of the corner stone of Indian economy. In order to build the legacy of operation flood which emulate AMUL model throughout the national territory of India, GoI has launched White revolution 2.0. In spite of astounding achievements of operation flood, few loopholes continue to linger within the dairy industry of India such as low export, paucity of infrastructure, all pervading influence of unorganized sector etc. In order to bridge the gap and to have access to uncovered area, government has creep up with new initiative. This step may impart a new dimension to the industry by stimulating women's participation and levering technology which conforms to poverty alleviation program of the country. In addition to it, government of India has launched several flagship visions to bolster Dairy sector in India. *Shakar se samriddhi* aspires to modernize milk procurement, processing as well as marketing systems by cooperative framework. *Rashtriya gokul* mission fixates on enhancing indigenous breeds of cattle and their milk production, National Program for dairy development reinforces infrastructure for quality testing of milk and facilities for primary chilling. Dairy entrepreneurship development scheme promotes entrepreneurship and dairy development. Animal husbandry infrastructure development fund elevates dairy farming and processing infrastructure. Handful innovations and trends in dairy sectors include Digital platforms which furnishes real time information on animal health and milk prices. Milk ATMS or Vending machines which are gaining attention in urban areas are known to dispense fresh milk.

CHALLENGES IN DAIRY SECTOR

The dairy sector in India encounters umpteen challenges. Low productivity and milk yield of Indigenous breed is triggered by ineffective breeding program, traditional feeding practices and limited availability of feed and fodder. Many rural settings in India have inadequate access to veterinary service and scientific animal rearing practices. Fluctuating weather patterns and its associated ecological changes are affecting animal health and feed production. Sustainable dairy husbandry demands practices for effective management of green house gas emission, water usage and manure utilization (Schelhaas, 1999). Many dairy farmers in various regions struggle to secure fair prices for milk and its products which impact their profitability. The dairy sector is highly susceptible to market fluctuations, making it difficult to plan and invest. Adhering to quality and safety standards of milk during the process of storage and transportation is crucial. Lack of infrastructure for cold chain system may render milk to spoil by degrading its quality. This may further be fuelled by adulterating milk with hazardous substance to fetch better return. Dairy processing demands high energy requirement, making it strenuous to minimize the industry's carbon footprint. Waste

generated from farm as well as industry raises environmental concerns (Sarkar and Dutta, 2020).

Fig. 3: Challenges in Dairy Sector

RECENT ADVANCEMENT

Indian dairy sector, long acknowledged as the backbone of agrarian economy is enduring a reformative transition propelled by innovative drive. As the country toil to fulfill the burgeoning demand for milk and its products, novel innovations and trends are setting the stage for unprecedented growth and success. Automation has redefined the dairy sector by upgrading hygiene, efficiency and consistency. Automated milking system ascertains hassle free and hygienic milking. Automation of pasteurization assists in maintaining persistent temperature of heating and cooling. AI based quality check diminishes risk of contamination and human errors. Robotic packaging solution amplifies accuracy and speed in product handling. The amalgamation of AI with IoT (Internet of things) in dairy processing is revamping the sector. It reinforces the sector by AI driven system for monitoring cattle health. Automated quality checks utilize computer vision for contamination and spoilage determination. Smart sensors trace humidity and temperature during the process of milk storage. Real time monitoring of milk tank levels is performed to impede spillage. Investment in modern cold chain system, and temperature controlled logistics are revamping dairy preservation. Solar powered system furnishes sustainable facilities for cold storage in remote areas. IoT connected cold storage units helps us in monitoring temperature fluctuations. Block chain technology for supply chain transparency ascertain that storage and transportation of milk is done at optimal conditions. High pressure processing (HPP) is being used in dairy industry to lengthen the shelf life of milk and its products without the aid of heat. Perks of HPP in dairy sector comprise retention of nutritional value while wiping out pathogenic bacteria, boosts flavor and texture in dairy products; minimize reliance on chemical preservatives and producing healthier products. With escalating fear over waste management and energy consumption, dairy plants are drawing near to sustainable processing solutions. Sustainability innovativeness in dairy consists of biogas plants that transform dairy waste into energy, water recycling system to dwindle processing wastewater and renewable energy powered dairy plants to trim operational cost. Sophisticated processing techniques enable dairy business to explore fermentation technologies for dairy products rich in probiotic, ultra filtration technologies to generate milk products rich in protein and fortify it with vitamin and minerals (Tamime, 2009; Walstra et al., 2006).

Fig, 4: State-of-the-art technologies in Dairy Sector

WAY FORWARD

Dairy sector in India are a mandarin of equity, social cohesion and empowerment which resonates collective ownership for accomplishment of food safety and community resilience by empowering rural youth. As today the world is heading for climate resilient agriculture coupled with sustainable food system, Indian dairy sector should inculcate green practices in production of milk, digitally facilitated quality testing of milk and export of Indian dairy products and capacity building of women and youth in dairy industry.

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