Article

A Qualitative Account of the Perceptions and Market Determinants of Indigenous Cow Milk Sector in India

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Abstract

The conventional milk market in India has evolved in India over the last five decades post the 'Operations Flood Milk Revolution'. During the 1950s and 60s indigenous cows were cross-pollinated with foreign breeds to fulfil the shortfall in the local demand for milk. The cross-pollination of exotic with Indian breeds contaminated the purity of the lineage of Indian cow breeds which had a rich nutritive pedigree. Over the last six years, there has been a fresh stream of indigenous milk market that is slowly emerging alongside the conventional market (cross-breed milk) under the name of 'Desi Cow Milk'. This milk is marketed as an extract of pure Indian indigenous cows like Gir, Sahiwal, Tharparker, Khilar etc. The market is niche; but is available at varying price points from 90 ₹. a litre to 240 ₹. a litre. Consumers have mixed opinions about this market while others know little of this market. Ayurvedic doctors are prescribing this desi milk as a cure for several chronic diseases like diabetes, cancer, skin allergies, autism etc. Word-of-mouth publicity is a strong promotion channel and business is governed more by trust. This paper is an attempt to demystify the perceptions about the Desi cow milk market and identifies the determinants that govern its growth if it were to become a full-fledged market in future. The paper is qualitative and explores a sample size of 30 using an open-ended questionnaire.

Keywords

Indigenous milk, growth determinants, milk market, milk market perceptions

The total annual milk production in India grossed a volume of 187.7 million tons in 2019. The production volume value of milk is 33 crore litres per day. Of the total annual milk production, the small milk producers retain 50% for captive

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consumption and the remaining 50% goes to the market for distribution. In this, 10% goes towards co-operatives, 30% towards vendors and 10% to biproducts such as mava, cottage cheese etc. (Basic Animal Husbandry Statistics, DAHD&F, GoI, 2017).

The popular milk brands in India are Amul, Mother Dairy, Gokul, Warana, Heritage, Avin, Nandini etc. Certain brands have extended categories in the form of tetra packs and the premium version segregated as Gold, Premium milk, Full Cream etc.

Milk is the largest segment of dairy market in India accounting for 89.5% of the market's total value. All other biproducts contribute to the revenue to the extent of 10% (Basic Animal Husbandry Statistics, DAHD&F, GoI, 2017).

India dairy market category segmentation: $ million, 2017

Category	2017	%
Milk	16854	89.5%
Drinkable yogurt	749.4	4%
Butter & spreadable fats	458.3	2.4%
Yogurt	372.3	2.0%
Cheese	310.2	1.6%
Dairy-based & soy-based desserts	46.9	0.2%
Other	35.1	0.2%
Total	18826.9	99.9%

Source: Basic Animal Husbandry Statistics, DAHD&F (GoI, 2017).

The total milk production effectively comes from a cattle and buffalo count of nearly 30 crores. The following quanta of breeds contribute majorly to the milk market:

Total cows: 19.9 crores (16.6 crores desi govansh + 3.3 crores of jersi, holestein etc.)

Buffalo: 10 crores

Total cattle: 29.9 crores

National Dairy Development Board (2019).

During the milk revolution, the indigenous cows were cross-pollinated with foreign semen in order to increase milk production. The exclusive Indian breed of cows hence began to dwindle and resulted in a gradual cascading effect on the purity of cow milk available in the market. Slowly, it so happened that milk from other mammals such as sheep, goat and camel were also mixed with cow milk to keep pace with the increasing demand for milk in the Indian market. This trend was unquestioned for decades in India and the available milk was consumed without much scrutiny. The experts of Ayurveda and conventional wisdom suggested that indigenous cow milk, irrespective of breed, is best for brain development in children, light on digestion, improves immunity and digestion,

cures chronic diseases like ulcers and cancer, balances weight, improves lactation in mothers, illuminates the skin and nurtures positive thoughts in an individual. During ancient times, there was no evidence sought for the presence of A2 protein in cows or buffaloes. The general belief was that cow milk is less fatty and more benign on the mind and body. Indian cows and buffaloes for years have been a potent form of vitamins, energy and fat necessary for cell growth and stamina.

There was no need to promote the benefits of cow milk to establish its medicinal properties, as much of it was evidence-based.

During recent times the increase in chronic ailments like cancer, diabetes, obesity, cholesterol and skin allergies have been on the rise in India. The public at large have changed their nutrition pattern and health habits. The market observation indicates that the consumers preferring A2 indigenous milk is catching momentum.

The concept of A2 milk came into existence in New Zealand where mutations resulting from the cross-pollination of the indigenous Indian breed and foreign breed led to a decrease in the quantum of indigenous breed in India. Exotic cows, unlike Indian cows, possessed a limited ability to produce superior quality milk containing higher protein content. This trend of cross-pollination was prevalent during the milk market revolution in India to increase the quantum of milk to bridge the gap between demand and supply.

A1 and A2 are two types of beta-casein—a sub-group of casein that is the largest protein found in milk. All cows originally produced only A2 protein. However, over time, due to genetic mutation, many cows started producing both A1 and A2 proteins. Some produced only A1. As the quantum of A2 protein-based milk seemed to decrease, because cross-pollinated cows gave lesser yield of it, the milk producers in New Zealand promoted this constituent of milk with a differential exclusivity. In order to increase the market share and profit, milk producers in the Western world and New Zealand projected A2 protein as a superior health ingredient, possessing both preventive and curative properties to treat chronic ailments.

This thought has found its way to India as well. A recent observation is that the market is trending in India towards a sudden spurt in the demand for A2 *Desi* Cow Milk (*Shopkeepers and A2 milk vendors*). This opportunity is at the intersection of three factors simultaneously happening in the market environment: the promotion of A2 protein benefits by the West, the influence of incumbent government which is insisting on nurturing the indigenous cows projecting its ancient health insurance, and the Indian consumer market shifting towards health and wellness management more aggressively than ever before. The *des*i-cow milk market is gradually emerging as a competition to the conventional milk market. Indian entrepreneurs have identified this niche market as a viable potential to build a commercial business.

There are contradicting observations about A2 proteins present in cow and buffalo milk. While some maintain that both cow and buffalo milk have A2 protein, there are others who claim that A2 milk richly found in indigenous cows is far superior to A1 milk. The Government is quiet on these matters though a few administrators view that 90% of the normal milk being consumed (cow, buffalo, toned, homogenized, or cream) is rich in A2 proteins.

There are also multiple farm-based vendors and branded aggregators delivering Desi Cow Milk Market (henceforth DCMM) in the name of A2 milk. The price of such milk varies anywhere from ₹.80 a litre to ₹.150 a litre. The consumer demand is niche and supply is spread to limited locations. The Ayurvedic doctors are recommending *desi* cow milk but not the other fraternity of doctors. There is no research study conclusively claiming the benefits of A2 milk in India. The FSSAI is not certifying the *desi* cow milk. There is an evident flux in the market.

Given this, it is worthy to note that the indigenous cow population has fallen from 15.1 crores in 2012 to 14.2 crores in 2019. During the same period, the exotic cross-bred cows that have a high-yielding capacity increased from 3.97 crores to 5.13 crores (National Dairy Development Board, 2019). In a total increase of 1.59 million cattle population in 2019 as against 2012, it is observed that the proportion of exotic breeds has increased by 26.9% while the indigenous breeds have increased by -0.6%. The population proportion of milch cattle among indigenous cows in 2019 as against 2012 has changed by a meagre 0.8%. This index raises concerns about the depleting count of indigenous cows and the prospective availability of generating pure cow milk. The growing recognition of indigenous milk market (consumers) and increasing entrepreneurial fervour in this business despite depleting indigenous cattle population, demand-supply asymmetry and presence of fluxed perceptions could well be the beginning of a valid research inquiry on the future growth prospects of such an industry. This establishes the need and relevance of the present study. The present study aims to determine the factors that would influence the growth of Desi Cow Milk Market in India and demystify its perceptions.

Synoptic Review of the Debate Between A1 and A2 Milk

Year 2000: New Zealand Scientist and Founder entrepreneur of A2 Milk Company Corran McLachlan claimed that the presence of an excess of A1 protein over A2 leads to diabetes, autism, cardiovascular diseases and indigestion. Further, the release of BCM-7 an opioid peptide adversely affects the immunity and other body functioning.

Year 2003: Corran McLachlan petitioned Food Standards New Zealand to issue health warnings on A1 milk packets. This was rejected outright and A2 Corporation was asked to withdraw its claims on A2 milk also.

Year 2009: The European Food Safety Authority declared that there is no cause-and-effect relationship between BCM-7 release during intake of A1 milk and associated diseases. A2 milk in India and across the world was being sold at premium prices during this time.

Other Surveys A2 milk is preferred by experts in the Western world. A2 milk is not as much breed-specific as it is area-specific. 90% of HF cows in Germany produce A2 milk but 50%–65% of the HF cows of North America produce A1 milk (Pandey, 2021).

Dr. Ranvir Singh, Principal Scientist, Indian Veterinary Research Institute claims faith on only indigenous Indian cows which are potent claiming that

foreign breed has been a source of disease for Indian livestock. Milk from foreign breed is not rich in iron and taste as much as Indian A2 cow milk.

Review of Related Literature

While analysing an infamous case study of Sanlu milk powder in China, Chen (2009) inferred that both legal and systemic risk protection with respect to China's food safety regime is suffering. The chief causes identified were ineffective and inefficient penalty on illegal practices, unambiguous food standards, lack of unified regulatory agency, asymmetric communication, untimely and ineffective risk communication, outsourcing and independent operation between risk assessment and management. The European Food Safety Authority (2009) dismissed any cause-effect relationship between A1 beta casein and diseases followed by fatalities, however in India; this report has not been viewed seriously.

On assessing the small holder dairy farmers' access to modern milk marketing chains it was inferred that the traditional milk supply chain is still dominant in the Indian market, where less developed states like Bihar are retaining this model while in developed states like Punjab, the structure of milk marketing is heading towards commercialization. In a yield gap study, between North Eastern India and rest of India, Paul and Chandel (2010) brought out that the major factors affecting milk yield of cross bred were the technological and socio-economic practices which could be addressed by improving the management practices, better feeding practices, controlling diseases, amelioration of the socio-economic conditions of the farmers through training, education and access to funds. Kumar et al. (2013) further observe that modern milk marketing chains seem to have an inclusive structure encompassing resource-poor dairy farmers arguing that food safety issues, traceability, transportation, development of milk collection and incentive pricing will improve scalability and quality of produce. While studying the critical supply chain management issues in the Indian milk market, Rao et al. (2010), concluded that even though India is the largest milk producer in the world lags behind in value-added products despite enough technological advancements made in that area. They draw out that a better understanding of the supply chain process will facilitate easy value addition in liquid milk and emphasise the need for a Public Private Partnership to achieve higher quality and efficiency in the Indian dairy market.

The process of structural transformation of the Indian dairy sector has been closely analysed by Kumar et al. (2013) where it was found that genetic enhancement, better management of stock, and farmers' improved access to milk markets have been drivers of transformation, while the status of dairy infrastructure and delivery of veterinary services is still poor. Growth in yield of milk was a function of a shift from traditional dairy herd to cross bred cows and buffaloes. Truswell (2005) and Parashar and Saini (2015) inferred that A1 Beta casein protein present in milk does not even remotely impact the immunological process within the body nor does it lead to Type I diabetes or coronary heart disease, concluding without a doubt that A1 protein has no harmful impact on human beings. Sharma (2015) has analysed the determinants of market channel choices of small milk producers and what

impact these choices may have on farmers' income and technology adoption leading to the conclusion that traditional sector dominates despite several emerging milk marketing channels and that small dairy farmers are not excluded from the cooperatives but are excluded from the modern private sector. In studying adoption of 4Ps of marketing by small dairy farmers in Ajamgarh district of India, Mishra (2015) inferred that most of the small-scale farmers did not apply sound marketing strategies pertaining to the 4Ps for lack of awareness of the contemporary and advanced marketing techniques. Devaraju (2016) inferred that it is important to develop appropriate and adequate production, processing and marketing infrastructure that match global standards as factors that can enhance global competitiveness of the Indian dairy industry. Vendors sell indigenous cow milk of Indian breeds at a premium price claiming that their inherent A2 proteins have superior medicinal properties (Hegde, 2019). To ensure the quality, traceability and efficiency of dairy cooperatives, an innovative rule for allocating payments among dairy farmers in a coalition was initiated and a system of introducing admission fees and payments for quality of milk was modelled (Mu et al., 2019). The role of value chain in the technology adoption at dairy farm level was found to be minor, Burkitbayeva et al. (2019) while Thapa et al. (2020) brought out that food safety consciousness, awareness and following food safety norms impacts consumer's choice for purchasing safer milk products and is imperative to tap the higher potential of dairy industry. Upon review of perishable food supply chains, Kumar et al. (2020) concluded that lack of horizontal integration of farmers, poor pre-harvest management, lack of government support and regulations are the most critical challenges of PFSCs (Challenges in Perishable Food Supply Chains in Sustainability Management: A Developing Economy Perspective, 2020).

The literature establishes that the subject 'desi (indigenous) cow milk market in India' is a less travelled path and deserves more attention. Studies specifically focussing on determinants of growth of indigenous cow milk market in India and the perceptions engulfing it are limited. Exploratory Approach is least found. This is the focus of the present study.

Research Questions

In the background given above, I posit the following research questions:

1. To identify the determinants of growth of the indigenous Desi cow milk market in India.
2. To demystify the perceptions of indigenous cow milk market in India.

Research Methodology

The present study is exploratory and qualitative in nature. Qualitative research methods like open-ended, semi-structured, in-depth interviews were conducted. Farm survey was done in the local regions of Pune, Nasik and Aurangabad. Around 17 semi-structured questions were asked keeping the broad constructs in mind. In-depth interviews have the benefit of '[using] open, direct, verbal

questions that elicit stories and case-oriented narratives' (Miller & Crabtree, 1999). In-depth interviews require careful and diligent listening of a seamless flow of emotional thoughts, narration of events, incidents and personal experiences. A semi-structured interview is considered to be the most appropriate, as it allows a broad tentative flow of relevant questions with a 'tighter' more closely focused discussion to take place (Robson, 1993). Following Brynman (1989) and Keats (2000) a schedule of pertinent themes was drawn up but it was recognised that departures from this were probable. This type of interviewing is beneficial as it '(encourages) respondents to express experiences, attitudes, needs and ideas' (Wright, 1996, 59).

Responses were collected from businessmen owning farms with a cattle size of 400–500, aggregators who collected milk from small farmers and resold them again under their brand name, local milk farmers (Hindi equivalent: *Doodhiya*) owning a small number of cows like a herd of 15–25 and selling them to aggregators, and milk producers making by-products of cow milk. The researcher personally conducted the interview. In addition, regulatory authorities certifying the purity indigenous milk and originality of the breed were also considered as samples. The popular breeds of cows in India as of today are Sahiwal, Tharparkar, Khilar and Gir. The widely available milk belongs to the indigenous breed Gir. In all 30 interviews were conducted comprising of four regulators, 13 big farm owners, eight mid-size aggregators and five small local milk farmers. Interviews were conducted in English, Hindi and Marathi. Each interview spanned over two to three hours as the respondents were given a free hand to communicate their views and perceptions. Each interview was recorded with the permission of the respondent, and later decoded diligently in an Excel format with the name and profile of the respondent. The originality of words and expressions has been retained in the original Excel sheet. A subsequent Excel was created with all the decoded responses of respondents in English. Few words did not find the exact equivalents and hence were decoded keeping the intention of the respondent in mind. The address, contact details, name of the big farmhouses, brand under which the milk is sold with the location of farmhouse were collected and codified in a separate Excel sheet. Appointments with each respondent were fixed well in advance and connected at a time of their convenience. All responses in Hindi and Marathi were decoded into English. People spend abundantly on health, wellness and personal care. Milk is considered a health stimulant by the people of the state. Since the cost of indigenous milk is much higher than normal milk the general affordability level of a state was a considered factor. Content analysis technique was used to analyse data, which entailed the identification of key themes and the illustration of these through selected excerpts, expressions and quotations. The exact sources of these quotations are available in the Excel File data sheet appended via case numbers while preserving anonymity. Data were 'revisited' on subsequent occasions post the initial analysis, in order to gain a further in-depth picture of the themes and topics (Robson & Hedges, 1993).

Operationalizing Variables

The broad factors identified for semi-structured interview were:

1. Profile of the Vendors
2. Milk Characteristics
3. Nutritional Diet of the Cattle
4. Training and Development of Farmers
5. Awareness and Perception of the Desi cow Milk
6. Reasons for Customer Preference
7. Extended bi-products of Cow Milk Market
8. Research Focus
9. Use of Technology
10. Supply Chain and Storage
11. Adoption of Safety Practices
12. Competition
13. Regulatory Architecture
14. Government Support
15. Government Certifications
16. Future Prospects of the Indigenous Cow Market
17. Computation of Cost, Margins, Profits and Quantum of breeds

On content analysis, it was found that there were iterative responses within variables. There was no clear demarcation possible, of the responses, against one single unique variable. The pattern emerging was that the responses could be attributed to two or more variables. Such related responses against aforesaid variables were merged and brought under one broad theme. After merging the related variables based on echoing responses the following six relevant variables were derived.

1. Profile of the vendors
2. Knowledge repository on Indigenous Cow Milk Market
3. Indigenous dairy bi-product/allied market
4. Research focus
5. Technological interventions
6. Regulatory architecture
7. Computation of cost, margins, profits and quantum of breeds

Rationale of the Operationalised Variables

The profile of the vendors is a key to understanding the educational levels, age, family owned businesses and passion of the dairy vendors/entrepreneurs. The variable was selected to know to know the interests the selling community, short or long term, while engaging in the dairy business and the background of these respondents gave an indication of the drivers that propelled them to be in this business: whether commercial, emotional or family driven values. Milk business is a loss leader venture. The idea of making a commercial and business sense of this business is challenging. Yet, the interviews revealed that even first-generation

entrepreneurs have entered the market so have start-up ventures. The qualification of the vendors was important to know from which genre they belonged—technical, managerial, social sciences or by only experience. Moreover, exposure, business skill and acumen were crucial factors in determining the growth prospects of the DCMM in future.

Knowledge Repository on Indigenous Cow Milk Market

There were responses collected on variables such as milk characteristics, a nutritional diet of the cattle, training and development of farmers, awareness and perception of the dairy DCM, reasons for consumer preference. There were related responses present in all these variables. Hence they were merged into a broader theme 'Knowledge repository on cow maintenance'. The growth of the present DCMM is dependent on perceptions, myths and realities. The old and young health freaks are mesmerised by its stated health properties. However, conflicting reports, media articles and even political figureheads have not endorsed this view completely with stray contradictions here and there. Often the farmers are ill-equipped with the latest information to protect, nurture and maintain the health of cattle. Training is important for updating knowledge on new mechanisms, machines and technology that can help wellness of cows and improve quality yield. Lampe and Sharp (2015) resonate these relationships among the variables with utmost importance for explaining the

> higher total factor productivity (more and wider use of technology) of 'modern farms', the *system* variable is key, which they consider to be a measure of the modernity (technology) and professionalization of the farm, the educational level of the farmer, or at least his openness to new ideas and methods. This is in line with their previous work which also finds the education of the farmer to be of prime importance for the efficiency of milk production. (Lampe & Sharp, 2015)

These affect the quality of milk and its characteristics.

Consumer preferences are driven by quality, taste and positive health benefits which are fundamental to the growth of this industry. The nutrition intake of cows affects the quality of milk yield. Lampe and Sharp (2015) resonate these imply lesser dependence on traditional summer grass feeding and grassland per cow, which on the other hand implies more use of barn-feeding to increase nutrition and productivity among Danish cows.

Indigenous Dairy Bi-products and Allied Market

The dairy bi-product market has commercial potential in products like ghee, cheese, khoya, mawa, butter, cream, buttermilk, ice cream etc. According to Rabobank, from fiscal year 2012–2013 to 2019–2020, the market for value-added dairy products in the country, is estimated to grow from 21% to 31%. With a growing, more affluent population, demanding more diversified milk and dairy products,

India's processed dairy segment has grown. Sources believe that continued growth will largely depend on an enabling business environment, consistent supplies of high-quality fluid milk, and an improved cold chain (Dairy Industries International, Bell Publishing Ltd, 2015). At times the primary product may be a loss leader but its allied products may have a better product penetration potential to help the industry grow. This thought has been highlighted as an area of concern by Rao et al. (2010), who observe that nearly 70% of milk is consumed as liquid milk whereas the conversion of milk into various value-added products like butter, ghee, flavoured milk beverages, ice cream, *dahi*, condensed milk, canned *gulabjamun*, canned *rasogolla*, etc. is to a very limited extent, especially in the organised sector. In contrast, the unorganised sector has been focussing on three main semi-finished products: *paneer, khoa* and *chhana*. This study extends this thought that indigenous milk market has potential to generate all these bi-products and many more like fertilisers, bricks, cow urine, bio-fuel etc. as value additions. These products have a better export and profit potential than milk itself which can fill the market.

Research Focus

Rao et al. (2010), aligned with the thought that value addition to milk in the organised sector still remains at a very low rate even though sustained Research and Development (R&D) inputs for improving the quality and shelf life of milk products and designing appropriate and cost-effective equipment have been made throughout the country.

Private and public-sponsored research, research papers and projects of Indian and foreign universities, student research papers are indicative of the direction in which the dairy market is heading. It is the research outcome that has suggested the presence of beta-casein A2 protein in milk indicating that A1 has negative health consequences on human system. This is contradicted by research proclaiming that there is no difference between A1 milk and A2 milk. This has been mentioned openly by the concerned minister in the House of Lok Sabha while discussing Dairy research in 2020. Since these myths and realities had to be demystified this theme was found relevant. The quantum of research establishing the larger health benefits of indigenous cow milk has not been sufficiently showcased or brought to public domain. Hence the ambiguity remains.

Technological Interventions

Any industry of contemporary times is market relevant for profit only if adopts latest tools and techniques across all its functional areas not limited to production, operations, demand management, promotion, customer connectivity or price structuring, finance, logistics, supply chain, procurement, storage etc. Maintaining the desired or ideal quality of perishable agri-food such as milk and milk products is governed by several factors in the supply chain (Rao et al., 2010).

Hence, a well-organised supply chain is critical for the success of any dairy enterprise. Use of technology, competition, supply chain and storage and adoption

of safety practices were interrelated variables linked to technology use and hence were merged into one broad theme 'Technological Interventions'. Lampe and Sharp (2015) identify the contribution of modernization through the use of specific new technologies and practices in Danish dairy farms to improve TFP (TFP growth is a combination between the use of more productive available technologies and the wider and more efficient use of these). Mu et al. (2014, 2016) relay the importance of quality enhancement in the milk supply chain under a non-cooperative setting, where farmers sell their milk produce individually to privately owned intermediaries. Specifically, Mu et al. (2016) exploit competition between the intermediaries to obtain a scheme, which is based on the intermediaries employing a testing-standard differential that improves the quality of milk. The indigenous cow market at present is unable to serve milk to consumers at even price points (preliminary market survey). A peripheral inquiry from consumers in different pockets of Mumbai revealed that supply was not uniform and service required a bare minimum cluster of consumers so as to justify the milk price for delivery at the doorstep. While addressing inefficiencies in milk marketing in Connecticut (USA), Bresseler and Macleod (1947) examine the problem of excessive delivery mileage in milk marketing with respect to density of delivery and consider various solutions.

> It is a truism that delivery distances for individual dealers are high because of the relatively few quarts of milk delivered per mile of route, and that any program that increases the delivery density for an individual dealer will reduce the distances that his trucks travel, with some resulting decrease in costs. (Bresseler & Macleod, 1947)

The intervention of technology could be possible at several points in the value chain beginning from cow maintenance and milking up to door step delivery thus assisting in building effectiveness and efficiency leading to quicker growth in the market. This is in synchronization with and compares favourably to the total factor productivity computations by Henriksen and O'Rourke (2005) for all of Danish agriculture in the periods 1875–1895 and 1895–1910. She attributes much of this overall increase to the shift from crop to dairy production, the adoption of modern practices spread to family farms by cooperatives, and the stronger relation between agricultural practice and science.

Regulatory Architecture

The larger procurement literature examines ideas to improve supplier quality under a non-cooperative setting, such as warranty contracts (e.g., Balachandran & Radhakrishnan, 2005), deferred payments (e.g., Babich & Tang 2012), shared recall costs (e.g., Chao et al., 2009), and certification programs (e.g., Hwang et al., 2006). The milk market is India is a giant business, process-driven, with its own systemic culture of working. The milk revolution changed the status of the industry from an unorganised exploited market to a co-operative structure with farmers becoming owners in a whole large unified aggregate, sharing profits based on quality of milk and quantity supplied. However, in the Amul cooperative, one of the world's largest,

farmers are paid based on a relatively quick, but incomplete test of quality; specifically, only the fat content is tested (Ajwani, 2015). Because the true quality of milk is dependent on several other factors (e.g., protein, solids-not-fat, etc.) that are harder to measure, the incomplete test does not correctly reward a farmer for true quality. As a result, there is both the potential for free-riding and adulteration (Sayyed, 2014). An essential aspect of contamination is also the cross-breeding of exotic breeds with indigenous breed milk that has affected the quality of pure A2–A2 indigenous milk. It is today looked at as a grave decision of the erstwhile, milk revolution, as it has destroyed the highly potent Indian breed. Imam et al. (2011) concur that for producing quality and safe dairy products, a comprehensive strategy with suitable legal backup should be formulated. Government policy has undoubtedly played an important role in achieving this magnificent success at the aggregate level, but all these have occurred under the regulated trade regime. This support gives strength to collate regulatory framework, government support and certification as a single theme for this study.

Findings and Discussion

1. Profile of the vendors

> Case said - '42 years education - software engg, MBA finance Madhya Pradesh. Now Hyderabad. Only food habits and desi cow products changed by health condition'.

> Case said - Sugatho - 36 years, Mumbai. 'have a Bachelor in Mass Media. "Was in a job in advertisement and Media Company as analysis planner for 12 year. MBA when I was 30 years old…." when i was 30 years old, 1 month bed ridden due to slip disk. …admitted in Ayurvedic hospital. Got fully treated…. Here the motivation began…then saw a very young girl child joined yoga…when my wife was pregnant, I wanted desi ghee. I wanted to give her good milk, organic milk but then got to know that there is something called A1 and A2. Dr. Navnath in Mumbai was active in gomutra and gober products. My wife was healed of pregnancy complications…. I got attracted to Naturopathy course. It was a learning point that lifestyle goes into disaster if Ayurvedic and Naturopathy is ignored…I started a company of my own leaving all things behind….

> Case said Yogesh Rajput - panchgavya community - her wife got cured from throat cancer due to gomutra treatment. He is motivating farmers how can we use gober, gomutra, jeevamrut, gandul khat and on local level how can you produce international level products instead of using milk as the prime product. I met him and he said i can give you milk upto certain quantity uptil thane and I started to procure milk. Since then it is 4 years…. i am distributor of milk but with no promotion. At Bramha Muhurt (4.30 am auspicious time of Lords) I do raw milk distribution…. 130 litres daily…. gouseva, bull breeding, pure breeding.

The profiles of all the vendors were of the age group between 28 and 45 years. The conventional vendors like the *Dudhiyaas* and small milk vendors were around 45 years of age and above. These were family-managed businesses. Surprisingly,

many case respondents were well-qualified. Cases were excited being the first generation entrepreneurs working on a start-up model to make the DCMM business a huge success. The entrepreneurs were Doctorate in Livestock Management, qualified engineers, Agri-tech Masters, and some were MBAs in Rural Management. Most entrepreneurs had a Naturopathy degree and knowledge of Ayurveda, Yoga and conventional wisdom. I conclude that the industry is a non-domain specific and accommodates educated individuals in all arenas from medicine to engineering to Doctorates to MBAs to Family managed businesses. This can holistically enrich the industry as educated minds from all domains can collectively look at the growth of the industry with a global vision and standards of operation be it competition, technology or product supply chain.

> Started a company in 2015 – 'Aarogya Sukh'…motive was modern medicine has swindled me at some time, thus to tell people that without medicine you can be cured with right food and right lifestyle and organic food chain. Being desi is a pride…have 400+ dealers and desi cow's panchgavya utpadan…own 100 cows and under 72–73 goshala and sell their products according to my system. Milk and ghee are very less. Gober (cow dung), panchagavya (5-ingredient mixture of the cow) and Goumutra are favourite….

> Case 3 Qualification - Mechanical Diploma, 1st Generation Business since last 2 years (partnership business between 2–3 people in Indapur, Pune). Farming background. The partnership was sought because the minimum quantity required for pasteurization was 200–300 litres. had choice to go for goat farming or cow farming, chose cow faming because of cow's affection and family sanskar. Quit the high-paying job abroad only to choose cow farming business. Number of cows – 127, Cattle breed – 99% is Gir cows and 2–3 Sahiwal cows. Annual income – 10 –12 lakh per year.

> Case 2 From Solapur district Maharashtra, 28 years of age, intending to do dairy farming. 'Spent 6 months each in Rajasthan and Gujrat. Understood the business.... Dairy observer/consultant. Implemented and set the business through the help of friends. It is a 1st generation business for me and I, grazed animals myself, studied behavioural structure, utility and their actual function 'At Satara I set up the plant with my friend." with only Sahiwal cows...Centralised in Pune and we make majorly ghee.... "…Milk is supplied to Pune, nearby Pune area, Nasik farms, I have a total herd size of 500–600 cows…Collection of milk is about 2500 litre per day and varies from season to season". Annual income – 25+ lakh with a consumer base of more than 750 people spread around Pune, Mumbai, Bangalore. Some doctors are recommending our products.

> Case 1 – Age 46, Qualification - Masters in IT University of Arizona Pheonix, Concluding stage of PhD thesis, 1st generation Entrepreneur, Annual turnover –100 cr, Owner of $$$$ Ltd. Started business with 7–8 cows and now cattle of 1000+ cows in 2017, Farm is in Pune, Indapur….

> Case 12 - Age 60, Electrical Engineer from VJTI, was doing electrical contracting etc. then came into this business ; just started this business, I am distributor of $$$$$ Co. and not selling any other product, ***Foods is my proprietary concern….

> Case 14: $$$ Pvt ltd, business from 2012, age – 34 years,1st generation business, annual turnover – 2 Crores per annum, type of breed in the plant – Gir, Number of cows – 512

> Case 13 Age - 40 years, I have total 60 cows in my cattle, They belong to 4 different breeds, namely, Gir, Sahiwal, Rathi and Concrage. Earlier I was working on jewellery design in Andheri. From last 7 years I am working in this field. My wife suffered through thyroid cancer with 6 tumours. She got operated in Leelavati Hospital under Dr. P. ****, who is doctor of Sachin Tendulkar, Amitabh Bachchan as well. This operation was carried out with the help/recommendation from my office. But 6 months after the operation, again tumour was detected, so again re-operated it. Radiation and chemotherapy was suggested. But I researched on the cancer, according to that, cancer patient does not die because of cancer, but patient dies because of cancer treatment. Because of chemotherapy and radiation, even good patients also die Actually I have done diploma in 'Panchgavya' from Chennai, Tamil Nadu. So I did know about it. Thus I took my wife to Chennai. In Chennai, we started to use panchgavya (gomutra (Cow urine), gober, milk, yogurt and ghee) based medicines, which are useful to cure every disease. In addition to this we started a diet based on organic food. I do organic farming also. There are Genetically Modified (GM) seeds available in the market. But we use desi-organic seeds. We started to give this food to her. It was necessary that her body should get in alkaline mode because her body was acidic at that time. I studied what all should be done to convert her body into alkaline mode i.e. what should she eat, how much to eat, at what time should she eat etc. I applied this to my wife and eventually after 7 months she was cured. After this I developed an interest in cows and started to work on cows as my full time passion… First got 2 cows. …'Converted some farmers who were keeping Jersy cows or buffalos to desi cow business. So now I help to purchase the cows to the farmers and even I purchase cow milk from them. I have developed 5 centres near Kalyan. 'Annual income from A2 milk business - 10–12 lakh per annum.

The cattle sizes were varying: While some owned huge cattle beyond 100–750–1000 cows, there were also distributors collecting milk from small-sized farmers and doing a forward selling to entrepreneurs and companies. The business of DCM is a harmonious combination of large-scale, medium and small-scale owners, vendors and distributors. The milk aggregators are the very small *dudhiyas* having less than 40 cows which dilute the quality of milk as all of them may not generate a uniform quality at the same time/day. The income earned by these vendors varies according to the cattle size and is more or less linear in nature.

> We are not majorly into commercial business and we are satisfied with whatever sale and profit is coming out of milk, milk products and bi-products. We are team of about 60 people and we manage the gaushala by personally contributing from our own pocket. This is mostly loss-making business for us but we have left that to the grace of Datta Krupa. The charitable offering from devotees is accepted and used for cattle maintenance.

Start-ups with passion: This industry does not follow the normal rules of the game. The name of the game is *evidence-driven passion*. This industry is not

motivated by profit as much as it is driven by passion, internal peace and psychological satisfaction. The profit potential of some entrepreneurs does not exceed 7–13 lakhs per annum, but their effort involved in cattle management is mammoth. These entrepreneurs are also effectively educating the farmers to switch to indigenous milk production instead of exotic rearing. Experiences narrated are convincing to conclude that *evidence-based medicine* has kindled the passion, *not profit,* to promote this business, as entrepreneurs had experienced recovery from fatal possibilities that altered their entire course of life. Finally, desi cows were quoted to be highly humanistic in their tendencies and were valued as collaborators in the DCMM initiative rather than a capital resource. These were indeed surprising aspects of this study. This passion based on evidence—case study, emerged as a key determinant of growth contributing to the growth of this industry.

2. Knowledge Repository on Indigenous Cow Milk Market

Milk Characteristics

> We should not use word A1 and A2. A2 word is A2 milk Corporation Company from New Zealand which first time found out why their country is not ill. Desi humped cow milk is the correct nomenclature. The cows which have no hump, long neck should not be called cow. Shrimad Bhagwat has defined cow….
>
> When these breeds of cows migrate from their state of origin to another state then their yield decreases. Cost of a Tharparkar is ₹.72000 per cow, Cost of a Gir is ₹.45000–50000 per cow, Cost of a Khilar is ₹.20000–25000 per cow, Patient can eat upto death if he/she consumes goumutra ark, if the hump of the cow is exposed to solar light, the quality of milk, gober and goumutra increases because the hump is the main carrier of Vitamin D.
>
> Colour of milk is slightly pale yellow and taste is sweet and perishability is same as A1 milk and requires immediate cooling which is the case in all the milk….depends on storage condition. If the process of cooling is delayed, bacteria count increases and shelf life decreases. A2 cow milk is thinner than A1 or buffalo milk. A2 milk is easy on digestion, light on weight and sorts out constipation problems.
>
> A2 milk is thinner because it does not contain melamine. Normal market milk has 3.5% fat and it is thicker because it contains jersey milk which yields about 50–60 litre/day daily 3 times. The taste of jersey is bad. Odour is like cow dung….. like gobur,…, sound of jersey is not good kakarsh while desi sound is sweet. Gir is a lovable cow…,
>
> Indigenous cows have a hump which acts as a solar panel this is a differentiating factor between A2 and A1. Cows of the west do not have this hump... this makes our milk quality superior.... indigenous Desi milk is golden yellow Taste, colour and thickness - Cow milk for tea is not suitable as the perception is that it should be white or bright Hence we teach our consumers that this should not be a constraint.... and that they should go with the property of milk and not its taste, colour or density.

> The regular A1 milk is bright white A2 milk is light white - sweeter even without adding sugar, Desi cows have a hump that absorbs solar energy; it penetrates into the milk and so people and children are more active. 70–80 degree for boiling and 4 degree cooling, a process of normal pasteurization...80–90 - high pasteurization... beyond this ultra-pasteurization....perishability is same across milk

> A2 is type of protein casein - beta casein morphine. Beta casein morphine is a constituent of protein which increases immunity system when it gets entered in the body. 'Beta casein morphine A2 type' is present only in desi humped cows whereas 'Beta casein morphine A1 type' is found to be present in Jersey cows. A1 type protein causes diseases like A1-type diabetes, arthritis etc. A2 type protein is found in desi humped cows. Perishability of the processed milk is 2–3 days if you keep it in the freezer. But out milk is raw milk, so it has to get warmed in 2–3 hrs. Thus I work in 10–20 km radius only. I live in Ulhasnagar, so I deliver only till kalyan-dombivali. If I want to increase my area, then I will not choose pasteurization. But I will go for chilling. It will increase its life to 4 hrs. Benefits of milk will be intact.

The hump on the cow is a solar panel that absorbs Vitamin D from the solar race and hence Ayurvedic doctors are prescribing Cow ghee, milk and sweets made of DCM instead of prescribing tablets. The pale yellow colour and thin texture without odour indicate purity. Shelf life of cow milk, the cases said was just four hours post extraction hence needed pasteurization, homogenization or cold storage to increase its shelf life. Respondent said that 'the composite consumption of having milk, ghee, curd, and goumotra urine as a health regimen is preferable for best health benefits'. It cannot be used for coffee or tea. The raw milk form is best. Cases were unequivocal that they had experienced the cure of Arthritis, obesity, diabetes and cancer, skin allergies and autism due to consumption of DCM. Another respondent said that melamine is a banned product but is still used in conventional milk as a permissible product. Many respondents echoed that if the native geographic location is altered the productivity of the cow depletes by 40%. The Gir produces best in Gujarat, Tharparkar best in Rajasthan, Sahiwal in Punjab, Khilar in Maharashtra etc. They are acclimatised to the local conditions weather, water etc. Another case stated: whatever the cow consumes is what it delivers the next day, all days the density of milk is not uniform. Hence nutrition dictates the milk output.

Nutrition

> Ideal nutritional diet for pregnant cow - 2–4 kg - energy giving seeds, 100 gm – shatawari, 500 gm – ajwain, 500 gm - methi daana,300 gm - mineral mixture (50 gm per day for normal cow), 100 gm – hing, 100 gm - sweet oil,300 gm – daliya.

> Every cow should be given 30–50 gm salt per day in its diet, else it will reduce blood pressure and the yield will reduce. The ideal weight of the cows should

> be 600 kg, but now the weight has become 400 kg because they are losing 5 kg per year systematically because of inadequate salt intake. Farmers plan the diet of the cow based on its weight and the reduction in such intake will affect further quality and quality of the milk. Farmers need to work on highly nutritional, balanced home-made diet. From very first month of pregnancy if the farmer is willing to spend ₹4000 on prescribed composite nutrition as mentioned above, frequency of pregnancy and quality and quantity of milk can be increased.
>
> There is likely chance developing calcium deficiency during and after pregnancy. In order to make up for this deficiency the cow is fed with jaggery and calcium powder in water. If the cow has calcium deficiency it may even stop eating food. In normal we follow mukt gotha paddhati which is the process of keeping fodder and grass within the compound of cattle shed and allowing the cows to free graze. We have a dedicated land space to grow the grass which we feed to the cows. We also feed the cows with 'shalu and maka (Jawar and corn)'.
>
> Cow has to be fed upto 10–15% of its body weight. As the time lapses we can increase it up to 20% of her body weight. Location is most important for cow yield and nutrition.
>
> Many people don't even know what should be fed to the cows. For that we work on their field management only. We take our cows to freely graze in jungle in rainy season and observe which type of grass she is eating. This consumption includes safed musali, grass which is there in rains - it comes in mid-grass pedigree.

Cases mentioned that there is no difference in the nutrition and pregnancy care protocols between a human mother and a desi cow. Shatavari is best for both to address milking needs and calcium deficiency. They substantiated why desi cow milk is given to mothers during/after pregnancy and to infants in case of non-lactating mothers. However small farmers are unable to spend ₹4000 a month on home-made nutrition due to poor economic conditions and hence cows lost weight and energy. Milk is indeed a loss-making business, widely agreed by cases. Many respondents emphasised the importance of free grazing or *Mukta Gotha Padathi* for maximising yield. Since they did not own so much land, feeding was within the shed limits. Cases were concerned that many dairy farmers have no knowledge of field and nutrition management even today. They keep following routine faulty methods that affect the cow's health and productivity.

I find that the economic condition of the small vendors is weak to adopt new methods in nutrition planning and yield management. The lack of both theoretical and practical knowledge of farmers is a grey shade that needs to be addressed for sectoral and consumer growth in DCMM. There is a need for robust, sincere and focused training and development in the farmer's community.

Training and Development

> No focus on management of cattle, focus is more on disease management because the veterinary mind-set is prevailing over management of cattle, veterinary disease management should be only 4-8% of total cattle management, focus should shift from veterinary, disease management to management of cattle, management of cattle include nutritional food, balanced diet, quality of intake, this can increase the yield in 6 months.

> Role of veterinary science in dairy industry is almost zero. Veterinarians are not actively engaged in tutoring the farmers about the seriousness of tuberculosis disease in cows. Doctors should educate the farmers…..Veterinarians don't train farmers regarding this at all……Veterinarians don't utter a single world without consent of their superiors or animal husbandry even if it is a science. All the work related to livestock disease management is done by livestock supervisors and not by the veterinary doctors themselves. Even the top notch health body such as OIE wing of WHO doesn't want to disclose that cattle can be infected with tuberculosis

> …..academic research papers can be beneficial to the academic community but if the farmers have to improve their yield, quality and quantity of the production, it is important that they are trained on the ground level in the field. It has been found that training and development make significant difference on the mindset of farmers and the milk yield has gone up from 2 kgs to 8 kgs because of nutritional training and other areas.

The respondents were critical that cattle TB is a serious disease that can infect the milk too. The consumption of milk from an infected cow can lead to transmission of the disease into human body.

> [This chain was started during British Raj when they owned desi cows and extracted milk in their backyard. But on being detected TB positive they would sell it to Indian farmers. Since then Indian farmers are not doing a medical check- up of cows on their purchase or disposal]

'Another case said, Veterinary doctors are the real people who should educate farmers on disease-information and treatment protocols but this job is left to livestock supervisors who themselves are partially equipped with information'. Doctors are science-driven and can educate the farmers on disease prediction, prevention and cure in a lucid manner than supervisors.

Consumer Awareness and Reasons for Preference of DCM

> Research papers and books are of no use as much as popular awakening and mass arising makes the difference. Books give knowledge but they are not of much use because people have to be aware through mass spread of knowledge. Books and research papers are of limited use.

> People have bad perception for this business. I had done a survey. People feel shy to collect cow dung and everything. They want a luxurious safe life. No risk.

> No consumer awareness, in spite of having vendor literacy… he can't do training…. Vendors are doing business only. How the consumer and vendor perception gap will be reduced? We can do it. Willingness should be there. Mission based work has to be there. I took an oath with my son that i will promote desi cow milk with premium rates.

> Children, infants and old people in the family consume A2 milk on doctor advice to increase the calcium intake during which time the demand of milk goes upto 3 litres per household….Customers give surprise visit to the farms to get to know the quality of the milk which is not the case with aggregators. Aggregators often mislead the consumers saying that they own farm. There is no side effect complained by the consumers for our A2 milk. The beneficial effects stated are that our A2 milk has been a substitute for mother's milk which even a new born babies can take and it is very effective in treating lose motions

> We take quarterly reviews of what they want….Mainly for drinking and mainly for kids…ghee is used for all age groups. For other purposes this- price point is more. Business is Price based and customers based on statistics we received

> People are now aware that the milk that we get in the market is all fake and adulterated. Thus consumer requires trustworthy people now. Consumers require family farmer who can give vegetables, milk, and ghee.

Cases have clearly refereed that consumers visit their farms without prior information, spend time with cows, meditate and take a brief vacation. 'We encourage face-to-face validation'. The money muscled entrepreneurs having scale of production work on this model to make the consumers aware about the DCM and its medicinal properties. They take consumer feedback and reviews… '[There are no side effects reported]'…Cases belonging to this class of vendors is tech savvy having mobile Apps for feedback, ordering, paying and cancellations. Another case said: '[Aggregators do not own farms so they are not reliable…since this business is trust driven even certifications are useless.]' Contradicting this, some few aggregators commented that ['big entrepreneurs may show they are credible but what if they contaminate the milk after you leave…? You are not here every day…So trust us…!]' Small vendors probably do not know that Desi cow milk is being sold as premium milk in cities as Desi A2 milk. Their knowledge is poor on commercials and trade benefits.

From the exploratory extract, I infer that the industry is driven by trust and belief of the consumer on the vendor; regardless of the price point and certification. There are three classes of vendors: wealthy entrepreneurs, small aggregators and mid-sized distributors but consumers are not oriented fully by any of them. Consumer awareness is limited and perceptions are mixed. The existing users seem to be convinced by doctors' advice for health compulsions. Non-users do

not find a strong reason to switch their milk type. Those finding the price high, ₹90–110 per litre, are consuming in smaller quantities but continuing intake. The distinctiveness of DCMM is percolating very slowly in the audience. The educated vendors/aggregators/entrepreneurs are knowledgeable but are not purpose-driven to create a mass awakening in the consumers. The vendor-consumer gap has to be simultaneously addressed.

A unique finding of this study is that DCMM is driven by both consumer and vendor's belief in the sanctity of Ayurvedic and ancient forms of nutritional intake. The milk is promoted as a health stimulant. The business works on trust. There can be no trust-gap between the two. There can also be no knowledge-gap between the consumers and vendors on the cyclic pattern of the working of this industry. The consumer has to have an end to end knowledge about the biological, chemical, physical properties of the cow, shelf life, breed types and cost and their milking capacity, their product lifecycle, progeny, health, nutrition and yield including their emotional aspects without which their perception about desi cows cannot change. I infer that consumer perception will change after long-drawn efforts, if they succeed in understanding the philosophy behind *desi -cows* better than the *desi-cow milk*. Such a perception change would be permanent.

> Demand has been increased by 80% in these 4 years. I work in 20 km radius, but there are demands from 100 km distance. Initially I was supplying 50 litres of milk. Now it has become 300 litre. I have demand for 550 litre. I have 250 people on waiting list.

> Growth rate observed from 2012 - 20-30% per year last year - 50% increase, I have spread from Mumbai and Pune to Hyderabad and Bangalore

Despite a gradual awareness spread, there is a steady growth in demand for DCM; there is little that can be said about consumer's preference for this milk unless a survey is administered to them. Word-of-mouth publicity seems to be strong agent for now. With measures mentioned in the aforesaid portions, this growth can be further strengthened.

3. Indigenous Dairy Bi-product/Allied Market

'*The price of a cow is dependent on the chronology of generation it is in and yield of milk it produces. "Dharoshna"(Raw) milk has several health benefits. "Gomutra ark is beneficial for cancer, based on real life case study"*'. Organically drawn pure desi cow ghee according to Ayurveda says it can stay for 100 years.... the method used is important.... Whether it has undergone shelf-life testing If it is stored in earthen pot and stored underground then it can stay intact for 100 years... according to Ayurveda experts

> We are into only ghee production now Gir Breed ghee price is @ ₹.2000 per kg, and khilar ghee @ ₹4000 per kg, it is highly potent. The energy of khilar cow percolates into the milk making the individuals drinking it as strong as the Khilar…

There are seven biproducts of our A2 milk - milk, ghee, paneer, butter milk, curd, yogurt, lassi. Ghee is produced using bilona method. It can follow machine or

Hand churn process. There is another method for ghee production which is cream separation based, which we do not follow.

We are majorly into making value-added products from the biproducts of the cow. These include making of shampoos, soaps, panchagavya ghrut (fivefold divine nutrition liquid butter) and jeevamrut for land. These biproducts are made with goumutra (cow urine), gober (cow dung) and some Ayurvedic ingredients.

> ….it is more important to save cows than selling milk. NGOs and other organizations should be newly instituted, who will go home to home and tell the importance of gober and goumutra based products and Vedic plaster.……..if Modiji says for 4 days desi cow desi cow in spite of corona, everyone would get convinced……. it is not expected because our AYUSH ministry is just for the namesake……if Modi would have wanted to promote Ayurveda, then it would have gone worldwide…. but he does not want it…..

> Otherwise, Ayurveda says if you put lemon juice in warm water, you can cure corona. ….without gober and goumutra application, you can't build a sustainable business…. my monthly turnover is 1–2 cr, 70% sale is from organic food and gober, goumutra and based products. milk contribution is just 20–30%. …in Sanatana dead bodies are fired with wood but we can build the system to fire the gober, If govt . passes the bill, if someone wants to fire gober then we have gober bricks available… in Jaipur it is already happening on a huge scale…..

> Gober and Gomutra products - Gober lights, bricks, plaster, paints, gober gas plants…… We are doing farming, keeping cows, making ghee, making 40 products out of gober and goumutra such as lights, dantmanjan (toothpaste), agarbatti, utensil washing powder (rakh) etc….radiation free cancer resistant vedic plaster…… Vedic plaster comprised of gober, gypsum, aloe vera and lemon. Harmful radiation can't penetrate these gober DNA) will be safe. We can survive against these radiations. We are making fertilizer out of gober. When we do farming, there should be production of organic carbon. We produce 4 types of fertilizers out of gober - gandul khat, vermi khat etc. … We produce our ghee according to traditional charak samhita. We have set churning machine frequency (RPM) to hand churning frequency. It is similar to getting butter by hand. At night we produce yogurt and before sunrise we make butter. At last, we make ghee on low heat. This ghee contains HDL (High-Density Lipoproteins). If you give this ghee to a patient having 99% heart blockages, his good cholesterol will increase and bad cholesterol will decline. We have given to many patients till date.

(Refer Annexure for Profit Workings for Bi-products of Desi Cow Milk)

According to a case, the sale of bi-product market has earned him revenue of 1–2 crores annually. Cases mentioned that most of them are into ghee business where margins are high as the selling price ranges anywhere between 1600 and ₹.6000 a Kg. depending upon the breed and generation of the cow. These are being used by affluent sections of the society like bureaucrats, politicians, film stars and upper middle class. Health has become top priority for people. Other cases mentioned that the real *value adding edible products* in the chain are buttermilk/ Chaas (Ahmedabad multi crore business), curd, cow urine, goumotra arka,

sweetmeats, paneer, cheese, panchagavya ghrut (fivefold divine nutrition liquid butter, jeevamrut. Here the margins are high according to them.

Cases said 'In the *value adding non-edible* category the margins are even higher to make a sustainable business model'. Bio-gas, bio-fuel, gobur gas plants, antifungal ointments, shampoos, soaps, cow dung (gobur), vedic plaster (gober, gypsum, aloe vera and lemon), fertilizers out of gobur powder ['Chhattisgarh Govt. is purchasing gober at ₹2kg. in our state and a Kranti is happening!!'] gobur bricks ['Haryana, Hyderabad, Jaipur is a major user'], firewood (Sanathana community, Hyderabad wherever crematoriums are in private hands, for example, of Agrawal, Toshniwal community), gobur lights, bricks, incandescent sticks (agarbatti), dishwash powder, toothpaste, plaster, paints etc.

The aforesaid exploratory extract of respondent interviews leads us to believe that the primary product of commercialization need not essentially be desi milk; instead, the focus could even be towards commercializing its organic bi-products. There was a strong fervour within the respondents to convince me that the diversified edible and non-edible products have strong potential to make good margins.

Considering the decoded extract I infer that a reverse engineering model would work better in this niche sector. Probably the long-term benefits suggested by the use of edible and non-edible categories of bi-products would more convincingly auto-promote the use of primary product, that is, desi cow milk. I deduce this because milk has a lower potential to cover costs and also that *desi bi-product-edibles* would have a quicker impact on the body on consumption. The cycle time to prove benefits would be faster. The AYUSH ministry can make an earnest effort in this regard. It would be worth exploring an export potential to the entire bi-product market as a niche, with research testimonials, under the Make in India Initiative of the Government of India.

4. Research Focus

Extracts Favouring Research:

> Research work is basically going on 2–3 breeds which have been subsidised by Govt. of India now. They are Gir from Gujrat, Hardaker from Rajasthan, Khilar from Maharashtra, Sahiwal from Punjab, Hariyanwi from Haryana….. In all, there are 39 varieties of indigenous breeds….36 are existing and 2–3 breeds have become extinct…. In Maharashtra, research work on Lal Kandhari is going on aggressively with a Maharashtrian ego/self-esteem with the goal of increasing the quantum of local breeds. 98 times research has been done, results are same that A1 milk contains 6 types of toxins viz as BCM-7, Hysterin, toxic casein protein etc. There is no dearth for research.

> In Junagadh University - patented gold was extracted from gomutra. All the cows were initially A2, no research was required. 20-25 years back cows were cross bred. BCM -7 based researches is abundantly available.

> 'Based on real life case study comprising of 1000 people, it was inferred that the consumption of A1 milk leads to various of kinds of diseases such as constipation, fatigue, Alzheimer and Parkinson whereas chances of such diseases reduces to

only 2% among people consuming A2 milk. A2 milk is easy on digestion, light on weight and sorts out constipation problems. 'Up to the 67th level of DNA, A1 and A2 milk exhibit similar properties. However beyond that the properties begin to change. My wife is a genetic doctor who told me that if the breakage does not happen properly then it can result in a collapse of the digestive system.'

A1 has BCM -7 chain, A2 does not have this...Conclusion is that A1 can lead to type 1 diabetes ...there is a chronological impact on the body due to BCM 7 impact. Always A2 is good for digesting as it is light in fat content and far purer'…..

…..at the age of 32 I had diabetes, BP, arthritis, 120 kg weight and by leaving wrong dairy products i have had a lot of benefits…. whether govt. approves or not science approves or not, we will follow this….we are live case studies…'

Gomutra has the curative power to treat 48 diseases. Goumutra is an antibiotic with an US 6410059 patent, and cures cancer 100%. ...

Breast cancer, I recall got fully treated without chemotherapy among a set of patients consuming Gaumoothra (cow urine) while, with patients taking chemo no one could survive I can recall that a Marwadi mother suffering from cancer for 15 years and consumed 1 glass of goumutra every day and got treated completely at a time when doctors had lost all hope on her.

'Research by Anuj Shrivastava MD, Cardiologist has inferred that other than skin problems, there are 13 diseases that get completely cured due to consumption of A2 milk . A2 ghee is one of the best! It is best for energy hence we say Maa, milk and then ghee for curative powers!!' Rajysabha MLA comment…. leave it... they are no one, no scientist backing..., no study…. will have no effect on business lot of research has happened from the times of ancient rishi muni only (Knowledgeable teachers of ancient Indian civilization) this will only sustain…

Extracts Critiquing Research

No one is ready to do research on classification of milk. Don't have that much will. In agricultural colleges they only teach what is going on globally and there is no word about research for A2 milk research. To promote the milk, first research is required to be done by authentic labs. ICMR does not believe in the promotion at this point of time, it is not its work. But ICMR should promote their scientists to work on the research on this issue. In response to the minister's comment in the assembly that there is no difference between A1 and A2 milk this is what the respondent said

Minister said in the parliament that the data that we have received from ICMR claims that there is no difference between A1 and A2 milk. This statement will have an effect on the milk market in India. The customers who are on border line may role over to normal milk. But those who have already experienced health benefits of A2 milk they will remain constant.

No Research, No one, has been done to say A2 is better than A1 in India, how will fssai approve? I opened mithai shop, went to NDRI Karnal, I wanted to certify/ test

the ingredients in milk and wanted to print on the packet Dr. Dey was shocked… he said you are the first to ask for such a test….Scientist Anil singh was shocked everyone is afraid of testing … NDRI said we have never done any such testing, on quoting ICMR they said they have no authentic research, I asked you are the top body should you not research.. they replied we do what our superiors instruct us to do I asked in NDRI on what basis minister is saying when research has not happened at all.

…report of ICAR you have to publish the paper to say that both the milks are same. They can't do that; they don't do research work. If they have done the work, I would not have to give the lecture to them!! Politicians are power and money hugry…. Lot of research has to be done!!

"Agro research is very limited. Research mind is regressive otherwise there is no shortage of funds from Govt authorities. University research is driven by Vice Chancellor and professor's mindset and myopic vision. They see their own benefits of promotion…Every research needs money. No medical college has studied on the contamination of milk. There is no research evidence to prove that consumption of A1 milk results in serious diseases such as autism, diabetes. Unless reputed research bodies such as ICMR and NIN do not publish evidences of the superiority of A2 milk over A1 milk the Government will not certify the A2 milk.

Research in this particular field is both tedious and slow. Several unpublished researches are available at NDRI, Karnal. There is no shortage of grant allocations for research, fellowships or projects. Research guides and mentors are not promoting research in this direction. Quality of research has deteriorated over years because of poor research guides and mentors. There is lot of bias and prejudice in the minds of superiors and they restrict either directly or indirectly the other academicians from working on such funding-based project. Research mindset has become regressive otherwise there is no shortage of funds from Govt authorities. The research in India is copied version of works done abroad. No self-driven research in India ….Our target is that even if 5% of the people are benefitted by changing their mindset then we consider our research experiment to be successful. We see that Technology growth is slow in this direction but the 5% of the people who have changed their mindset will influence the rest of the population based on the performance. (Snowball research)". "My vice chancellor put all kinds of audits, curbs and restrictions on my research project which was to the tune of ₹.3 cr from the Govt. He went to the extent of stopping my increments and slapped me with the inquiries and thus let me to abruptly stop my work. Tell me who will do a committed research if such pressures are there

There is requirement of funding for the research. I am working on this subject of milk, ghee. Some doctors should get connected with these products so that good research will be performed. Studies should be conducted on field management, ghee production, ghee contents etc. Even in foreign countries A1 and A2 types milk are sold separately. Thus, we can't say that there is no research.

I decode the excerpts in crux. The DCMM follows a mixed opinion on research focus. While many cases were aggressive research attributable to DCM for people

has to be more experiential, case study driven and evidence-based rather than textual evidence. Other cases critiqued that willful and deliberate attempts were made to keep research findings off the public domain by supervisors and that the government was diverting funds to areas of research other than desi milk. The common contention of cases was that research is being done but either its process or outcome is being stalled much because of political resistance. The mindset, myopic vision, power play and sub-optimal role played by top research-based institutions of India (ICMR, NDRI, ICAR, Agro–university) have been projected in poor light.

Two clear classes of respondents emerged: *one* class which trusted the self-evidenced-experiential case study approach who did not find the need for any print matter on research, *the other* class of cases who found the need for published research and funded projects. The experiential cases were mid-sized and established entrepreneurs already gaining commercial from DCM business while the critiquing cases were regulators, officials of private certifying bodies, retired academicians, university researchers and government officials. Obviously, the entrepreneurs had little to do with academic research as they had mapped a long-term commercial potential in this stream of business, while the critiquing class appeared to be more genuine aspiring to promote the concept of desi cow milk within the society without any commercial interests.

I infer, based on qualitative interviews that DCMM is a more action-oriented, experimental and evidence-based terrain comprising real-life case studies which consumers may want to tread themselves before forming any perception. However, the cases insisting on credible laboratory and published research evidence are right in setting the tone for the long-term growth of the industry. Such research publications in acclaimed journals can be beneficial to the academic community who can subsequently begin clinical research with some valid questions in mind. I could not infer the under-served areas of research since it came out that no research work is being reported. A descriptive follow-up research is suggested. On decoding, the inferences were both puzzling and surprising. Cases were divided and emotional in their standpoints. This parameter at this point does not appear to be influencing consumer perception as other factors are contributing to it, and market growth is at a steady pace between 8% and 50% (vendors claimed in this study) whether or not published research is available.

Technological Interventions

Supply chain

> Many customers demand pasteurized milk, but i share the videos and tell them that when you have already shifted to pure one why to add processed in it…. 5 lakh machines, health conscious consumers. reason for chilling within 4 hours of extraction is that the micro culture in the milk gets disturbed, and becomes undrinkable as per the dairy guidelines. hence it is necessary to deliver the milk within 1 hour of extraction which is impossible hence we could cater to a very few

areas in Pune, 1 lakh distribution potential at this time but we could not fulfill the commitment.

Perishability of the processed milk is 2–3 days if you keep it in the freezer. But cow milk is raw milk, so it has to get warmed in 2–3 hrs. Thus I work in 10–20 km radius only. I live in Ulhasnagar, so I deliver only till kalyan-dombivali. If I want to increase my area, then I will not choose pasteurization. But I will go for chilling. It will increase its life to 4 hrs. Benefits of milk will be intact.

Distribution is self-owned.. I am searching for distributor because I want to do expand the business…, the full year went into loss we have our own distributor channel across India. it is handled by minimum and known people so that any tampering we check the distribution….. 126 distributors at this time….if distribution is not established in that area, then price @90 is not affordable, transport cost becomes ₹250 … people need to subscribe for at least one month mandatorily…. when they first taste the milk their order increases and so the cost can be covered. Farmers give milk in varying quantities; sometimes a farmer only gives 5 liters it is not viable to sell to customers for one or two days…… it can't cover the cost…… there is lot of capital investment… we own some cows in the farm, some farmers come to us and we go to collect from few farmers,all collection is accumulated in the company and then pasteurization happens,… pack and sell it….. we sell it to distributors and individual folks and they sell it to consumers.

Marketing and consumer outreach

We are promoting our milk, milk products and biproducts majorly through WhatsApp platform and word of mouth publicity.

……social media posts – promoting, newspapers scarcely print something…most of the customers tests first and then purchase it. People have to be connected to farming.

"We promote and educate the customers via social media - Facebook, Instagram, YouTube channels and our website [*****] by posting in doctor's comments on our cow milk, ghee, and the views of celebrities,…. stickers passed on through WhatsApp, IndiaMart marketing channels to get in touch with genuine customers. Stickers have more information in just a small patch….We have workshops, trainings etc. and we have a plan for that.... this is not possible online. …. every year we have farm visit program, people come for vacation here …… Desi milk promotion is based on wellnes management ….we conduct few shows along with doctors also. …These are self-driven activities lot of people are engaged to increase employment opportunities.

follows B-B and B-C models of selling A2 milk. We introduced app for order placement. For promotion of our products, we use digital marketing via Facebook, Instagram, YouTube. In addition to this we conduct society campaigns, engage with rotary, give presentations in such clubs and visit officers of Government of India such as the navy in which we promote the benefits of consumption of A2 cow milk

Promotions are done through word-of-mouth publicity, person to person,..o vacations on farming. We do society campaigns. and give away samples of 50gm

> ghee. Online ordering of milk by the way of Apps....we don't use social media.... input cost reduces. profit margin increases. Promotion as desi/indigenous cow milk and not as A2, because when you name the milk as A2; the perception and expectations of farmers and customers increase and become high fandub which is why we sell our ghee as desi cow ghee. If we expand further, we want to do it legally otherwise, we are happy with whatever customer base we have now. Distribution of purely extracted milk is possible only when farmers are within a 10 km radius of their customers. else at a temperature of 4 degree Celsius, within a minimum time of 2 hrs. the delivery of milk should be done at the doorstep of the consumer.

The cases mentioned that shelf life of cow milk is a mere four hours from extraction, it needs super-fast distribution. If distribution limits are beyond 8–10 km chilling, pasteurization and homogenization machines are the only solution. The delivery vans are state of art with preservation and hygiene standards. Packaging technology costs are high as they are made tamper-proof. Cases are well equipped with robust technology and sophisticated treatment machines in the delivery and supply chain function. Distribution to Mumbai is done from Nasik, Sangli, and Pune etc. Cases mentioned that in order to cover cost of transportation, an alternate-day-delivery model by mapping the demand clusters at specific locations is followed.

There is a huge demand-supply mismatch in this sector for two reasons: non-availability of reliable distributors and excessive transportation costs; despite demand being high. This is because consumer demand is widely dispersed across locations but in very few numbers. It is unviable to cater to individual demand across far-spread geographies because it escalates transportation costs thereby pushing milk prices to ₹250 a litre. In addition, the delivery of milk is distributor-dependent but even more on his credibility. Milk at any stage during transportation can be contaminated which dissolves the entire purpose of buying and selling desi milk. Due to lack of a trustworthy distributor network in the DCMM, a large segment of consumers are under-served. These are the untapped potential of the market. Hence business expansion is dependent on a credible distributor networking system which is resulting in a retarded growth of the DCMM.

The cases also made the researcher infer that the use of technology is more compatible with bigger investors aspiring for substantial margins in this business. For marginalised dudhiyaas, these technologies were unaffordable who claimed that they were struggling with small pieces of land and nuclear families.

Cases are using B2B and B2C models of marketing to promote the products. Cases were robust in the use of digital marketing technologies for promoting, ordering, cancellation, feedback, payment and information dissemination. The widely used technologies are social media platforms like WhatsApp, Instagram, Facebook, YouTube and IndiaMart as channel partners to connect with new credible customers.

However, the other cases who did not want to increase too much of their input costs used only WhatsApp as a promotional tool. A case said 'India Mart connected us with to customers but charged us heavily and their initial deposit was also very high. The malls charged us heavily for the shelf space hence I am OK with the modest WA circulation'. Cases have devised downloadable Apps for ordering.

I infer that in marketing and supply chain functions, technology is adequately put to use. It is in fact reflecting a 10%–15% growth annually as cases referred. Cases are in fact unable to cater to the increasing demand for reasons mentioned in the aforesaid paragraph.

I infer another interesting observation that desi milk vendors are not in so much a hurry to expand the consumer base as much as they are interested in creating awareness among consumers. This is rather surprising to the tenets of a commercial business. Most vendors are promoting desi milk with passion. For this, they are into conducting workshops, doctor's seminars, lectures in social service organizations, organizing farm vacations and visits, social campaigns and distribution of free samples and digital notifications about the history, culture and philosophy of Desi cows and ancient medicine.

Safety Practices and Reproduction and Training

> In Punjab NDDB/NDRI have worked a lot on feeding system… every house has its own cow my friends are there, they tell us that green fodder and all other feeding management is set....., Medication related and other matters is all set and people with required knowledge are there with expertise ..... I have done self-learning Feeding management is the biggest challenge in Maharashtra. While in other states the NDDB and local bodies also conduct training to farmers, attach/connecting with them to explain the feeding system, so as to minimise the cost and maximise the profit...we don't have a single person like this in Maharashtra there is nothing like this in Maharashtra. ....it should be there

> Right now, we are using hand milking only. It is observed that in desi breeds milking machine is not suitable, it is not impossible. We are planning to shift to milking machine. But right now, it is hand milking only. New born calf after first lactation has to habituate itself to machine lactation. If the cow has already had 2 lactations, for them if we immediately shift to milking machine, it does not work.

> I use the following technologies which is FDA approved: Two shades better than the approval, gold cleaning machine to desterilise, chemical approved by FDA, use of jet spray to clean the cows.

> While purchasing a cow we test if it has transacted Brucella or TB prior to which we test the cow whether it is A1 or A2. This is one of the top most safety standards that we follow. We follow safety standards by frequently checking if the cow fodder intake is hygienic. All these parameters affect the quality of milk. We pasteurise the milk in such a manner that not even a single point changes in the quality of milk. Quality of milk may change due to homogenization: high pressure agitation mixing, unification and homogenization of fat globules, this results in depletion of vitamin D content as it is volatile. Pasteurization of milk would keep the vitamins and nutrients intact similar to just as in raw milk. Pasteurization is very safe process without compromising on nutrients and the spoilage bacteria is also kept under control.

> We test cows for Brucella, TB before buying them. We make health certificate before bringing it to the farm. We give vaccines after every 3 months. Before everything, we test the cow for A2 casein from Chhattisgarh lab. They perform DNA

> test. One can do insurance; it is I think 2–3% of price has to be given. But to be frank in last 5 years, not a single cow has been dead. No accidents are happened. Desi cow is very capable to sustain herself. It can sustain in temperature ranges.
>
> Technology to detect and treat of tuberculosis in cows is required. Technology should be used to train the farmers for occurrence of tuberculosis in cows, infertility caused due to TB in cattle and Tuberculosis treatment. Technology can play (used in Brazil) a role in the most efficient way.
>
> Technology is not at all being used to the desired extent in detecting and treating the tuberculosis among Indian cattle. Unlike technologically advanced nations like Brazil, we are not using technology for disease detection, artificial insemination, pregnancy diagnosis, estrus synchronization, selective breeding etc. Detection of pregnancy can be done on the 18th day itself by testing milk sample or urine sample if the technology is in place. Such kind of technological training both in terms of its availability, access and usage is not being provided to the farmers.
>
> There is technology named embryo transfer like surrogate mother. If you want to get female calf only, then the semen is also available. We have used such technology in 5 cows.
>
> We do not administer artificial insemination, injections or vaccinations on the cattle. We follow natural mating processes in cattle maintenance.

I infer from the qualitative interview excerpts that TB detection while purchasing the cow is the starting point of adopting safety practices in cattle management. While farmers with good turnover are certifying the cows from the veterinary diagnostic laboratory at Chhattisgarh, before purchase, but not all vendors have full knowledge on how TB in cows is to be diagnosed, prevented, protected and cured. Farmers are not being trained enough to make them realise the deadly consequences of this disease. The milk extracted is unsafe to drink and if the TB is not treated it transmits to the successive generation.

I find that technology is under-utilised to train and inform vendors, in areas pertaining to cattle insurance, TB diagnosis, prevention, cure, infertility caused therefrom, artificial insemination, pregnancy detection, estrus synchronization, selective breeding, embryo transfer, surrogacy, mechanised extraction and lactation of milk and vaccination protocols. Major cases were clear while saying 'Such kind of technological training both in terms of its availability, access and usage is not being provided to the farmers'.

Health, Nutrition, Grazing

> Technology is minimally used while monitoring the diet of the cow, how much of intake consumption, grass intake it is not tracked across the industry... reasons for differential milk yield in cow breeds like 8-10 liters in some while 10–12 liters milk in others is not tracked yet.... reasons of protein deficiency and mechanisms to treat it in different breeds is not tracked yet diet and quantity & quality are not correlated and digital records are not available. At individual level we are tracking some

> innovate mechanism.... it is hard to track…. . they are freely grazed... this is the hardest part we can't say how much grass intake has been has eaten we check weight per day and guess the consumption. Milk extraction is manual.

> When cows are allowed to freely graze in the jungles, we observe which type of grass does she eats. Because of this free grazing fat content in the milk went up to 6–7% which is the fat range of buffalo. We use Google scanner to understand the feeding of the cows in jungle. We take that plant under the Google scanner; we get all the information about that plant. It was observed that cows eat safed musali, fulanwa grass, leafs of drumstick, tulsi. We evaluated proteins of all these herbs in jungle. For most of these herbs there is no research available. But by eating all these things, cow becomes healthy and not prone to disease.

From the interviews I could gather that cases experienced better yield and quality milk on free grazing but expressed regret that an organised digital directory was not available that could be correspondingly linked to the history, daily nutrition intake, vitamin and protein deficiency, differential milk yields, reasons thereof, weight management and intake adequacy. '[Several progeny and health-related decisions could be mapped to such information using algorithmic tools…]' The case wanted to use machine learning and predictive tools to analyse case registries of cows with all their clinical data including their genes and pedigree. Another case mentioned that ...'[there is no provision to maintain such intense records in the ministerial departments and realistically speaking each cow is to be uniquely identified with a registration number in the government records. But this is done only to claim false subsidies by providing misinformation]'.

Another case said in contradiction that technology tools like Google scanners are available to track the intake of cows while grazing… ['We subsequently analyze the leaves and herbs consumed]'. It gave a sense to the case, [on the herbs and shrubs that gave strength and energy to the grazing cows].

Predictive Technologies and Artificial Intelligence

> From birth all the records should be maintained. It helps in identifying child and mother. Digital technology plays vital role in maintaining registries on birth, breeding, death and relationship records. Breeding structure could be scheduled other body statistics and case records, medical history etc. like weight of the cow after delivery, protein deficiency, medical health condition and ailments etc Digital record of milk pasteurization, consumer delivery and consumption record maintenance, which batch is delivered and who is drinking that directly from company to consumer etc. here technology is extensively used.

> Technology diffusion is very slow in this sector. Technology requirement of farmers is not being mapped properly. Farmers are not inclined to do dairy farming because they are nuclear families now and the number of cows, they have at home are very less and their educated children do not want to follow this lineage. Since the joint families have become disintegrated, the portion of the land and the number of the cows has also declined. This makes technology usage unviable. Hence customised

> technology is required for these small farmers. Dairy driven technology should now focus on predictive intelligence models that can predict the disease before its arrival, develop a single vaccine that addresses multiple diseases in cows and make a calf biologically potent to become pregnant after 2 years of its birth and similar solutions. However, there is no collective decision making in this regard.
>
> Embryo Transfer Technology (ETT) is very expensive and unaffordable for the farmers in India. Each embryo transfer takes ₹35000 because it is done by branded companies in association with commission touts. However actual cost should not go beyond ₹5000. Hence technology should be adopted to bring down these escalating costs. It is also important that technology training is provided to make it more affordable and accessible to the farmer. Dairy contributes to 7–8% of GDP and 3 crore families are dependent on this income. Hence technology adoption, penetration and its accessibility should be within the reach of the farmers. In the event of uncertain monsoon, it is this dairy milk business that helps the rural farmers to earn their livelihood.
>
> I send my lectures, seminars, workshops on mail and WhatsApp to the public for their knowledge. Live videos of making nutritive cow food at home that I also send over WhatsApp.

The. highest form of technology application in recent times is the use of artificial intelligence and machine learning in all aspects of social and business life. It is inferred in the previous section that adoption and use of technology tools to provide training is not sufficient in nutrition, disease, and safety and reproduction management. It was also concerning the cases that the critical need of the hour for this industry is to extend the lineage of each indigenous breed and prevent them from becoming extinct. The industry depends on the expansion of desi cows in numbers. This is fundamental to the growth of DCMM business. The industry depends on the expansion of desi cows in numbers.

A case mentioned that….['Each embryo transfer takes ₹35000 because it is done by branded companies in association with commission touts. However actual cost should not go beyond ₹5000']… In this regard most cases were unequivocal that technology absorption is slow in the DCMM sector with respect to how technology can reduce the costs of expensive processes and procedures like Embryo Transfer Technology (ETT) and how can it assist in making procedures more accessible, affordable and understandable to the vendors. Other cases mentioned the need for predictive intelligence in disease prediction, developing one single vaccine offering multiple solutions, building early reproductive cycle capacity in calves, for which mass data on cattle registries pertaining to DNA, body statistics, breeding structure, relationship and health details etc. are required.

I infer that adoption of technology for improving lineage, DNA studies, and maintaining linked clinical registries is contributing to de-growth of this sector.

Competition

> …..hence it is necessary to deliver the milk within 1 hour of extraction which is impossible hence we could cater to a very few areas in Pune, 1 lakh distribution potential at this time but we could not fulfill the commitment.

> I do not use any social media platform for promotion. I am not able to cater to current demand too.

> I don't think we have any competitors or rivalry. We are aware of our consumers and about the wellness regimen…. I don't have competitors. We have USP. It is not monopoly. We have certification. People have accepted it and we have 2000 doctors who back up us.

> There is no competition at all. Demand is so huge that if if 100 people like me stands out, there will be no problem of competition. More the people will do this business, our team will increase. We can work in such volume. We can purchase gross medicines, cultivate crops together. We have now become senior, people take consultation from us One person called Bendre who is 65 years old, who has retired from international logistic business. He has 150 acre of land in Neral. I have consulted to purchase him 10 cows and gave all field management training. His costing has become half now. He is very happy and said why have I wasted 65 years, this is a fantastic business

I infer that business is based on Unique selling proposition of vendors and on trust. Consumers are not changing their vendors as it is the trust quotient which matters. Competition has not emerged to be a variable that dictates growth. Competition is also not influencing quality or price however both are influenced by trust, dependence and credibility. Competition is assumed to be an oligopoly with a few 25 big players…is not a major determinant influencing growth of the industry. This can contradict earlier findings.

5. Regulatory Architecture

Certifications

Any lab of India n Govt which is FSSAI approved has an authority to give testing in certification form. They can test all the chemistry of milk we need regulatory body to reduce price of testing per batch Each cow is certified… random samples of milk are selected and then tested for A2 accredited beta casein protein. in US and Canada, it is cheaper testing mechanism, 12 dollar per sample

> Certification is not necessary and important because I don't want to spend 2–3 lakhs on certifying my cows. This is unproductive for me so did not do it There is equivalent lab in Pune that tests purity and milk type based on milk/blood samples. A2 Milk Research Corporation may have taken the trademark for the name. It charges ₹1500 per cow. Instead, I ask customers to test the milk in Thane APX lab, NABL approved, reputed lab. I have done various testing over there for Vitamin A, vitamin D, fats etc. APX lab is licensed and charges separately for testing vitamin A, vitamin D, fat and

calcium..... only my milk bag is saying vitamin A, vitamin D.... costed me ₹10000, nobody else says this because I know its importance. While working abroad my vit. D decreased and I suffered through lot of pain for 3 months. No need of tablets vitamin D is 91.6 IU per 100 ml of desi cow, which satisfies human daily requirement. I don't know whether A2 milk cows give more Vit D or not because I have not tested A1 milk. Whichever cow is exposed to sun light, vitamin D in its milk is more. Vit D can be raised either because of sun rays or green fodder.

In the last 2–3 years, there are seven labs in Mumbai which are certified by FSSAI, NDRI and NIN who give certification based on milk quality. PCR method of testing A1 and A2 milk has been developed by NDRI. There is no Government of India certification body that certifies the quality of milk the way organic food is certified. There are 2 big certified farms in Maharashtra including us. The DNA testing on the cows can be done through blood, hair or milk. All our cows are DNA tested using blood and hair sample because the accuracy is more than that of milk-based testing. This why we mention 'certified A2' during our milk packaging. Rest of the 99% brands claim that they are A2 milk but when customers ask them for a valid certification they say that we do not have the certification because they never tested their milk. Testing is very costly and amounts to ₹3000 per cow which small farmers cannot afford. When milk-based testing is done the PCR test cost ₹1500 per cow. At times milk-based testing is not reliable because the milk of 2 cows might be mixed while giving it for testing which is difficult to differentiate. Customers also take their milk to the lab and get it test randomly for A1 and A2.

….we don't believe in certification…. I was in the ghee business. I spent ₹4 lakh so that I could understand the parameters that would decide this is a1 or a2….I gave same sample in 4 labs; 4 separate reports were generated. I do have question on modern science, it is not science. A2 lab at Raipur has taken a2 milk corporation certificate New Zealand….our society is all illusion…. if we get out of this illusion, we will be sorted. A1 A2 identification can't be done in labs but by sense organs by smell, taste. science can't understand all ancient science aura, satvikta, chakra…. lab is not available to gauge all these…..- modern science is not science….. own theories get argued and contradicted ……whereas our ancient science studied by rishi muni, if they write, it is line on the rock….. if we go with modern science to find truth it is based on false arguments.. it is a total failure.

BCM - 7 based test is not there in India as of now… Whoever is saying this ask him where is it is published. If there is problem for A2 milk as name we can certify as desi cow milk…. No problem for copyright issue in India. They will talk with Govt first. No need to give money.

I need labs and doctors so that some research would happen. A2 testing labs are available, one is in Chhattisgarh. Cost for testing is ₹1500 per cow.

when a cow's DNA is tested by Govt. authority or by veterinary doctor their A2 potency is checked.. DNA is registered as an A2... because A1 cows generate BCM-7 in the food chain and A2 does not generate BCM-7. The hallmarking feature of particular brand is A2 certification that should be published on the milk pouch this will give validity to customers that it is certified…. Customers should cross check for certification link and milk adulteration.

> Very selective breeders now have pure indigenous breeds left with them. There is a breeder near Sangli who has a khilar breed which gives 6-8 litre per day however if it even gives 4 litres, we are at cloud nine!! they have male and female cows and now we are trying to preserve that blood line we have even applied to the Govt. to preserve the semen of that cow, since this preservation system is available in Indi so that even if it dies, the lineage will not end.

From the gist of observations that came from the cases, I can infer that the certifications are expensive in this system ranging anywhere between ₹1500 for milk testing to ₹3000 for DNA testing and upwards for Vitamin characterizations. I gather that small farmers do not have the money muscle to pay this kind of amount. [In the last 2–3 years, there are seven labs in Mumbai which are certified by FSSAI, NDRI and NIN who give certification based on milk quality. PCR method of testing A1 and A2 milk has been developed by NDRI. There is no Government of India certification body that certifies the quality of milk the way organic food is certified].

Government is not vocal in following a similar approach as it did for organic product certification. The excerpts clearly indicate that the need for certification is felt by a few cases who are into commercial business. Certifications can create a differential advantage in the eyes of the consumers. Regulators are making money out of the certification business. There are conventional vendors who do not attach any importance to certifications as they go by Ayurvedic and Vedic wisdom. […A1 A2 identification can't be done in labs but by sense organs by smell, taste. science can't understand all ancient science aura, satvikta, chakra…. lab is not available to gauge all these …] Another case [Certification is not necessary and important because I don't want to spend 2–3 lakhs on certifying my cows. This is unproductive for me so did not do

it….]. Another case said. [BCM - 7 based test is not there in India as of now… Whoever is saying this ask him where is it is published. If there is problem for A2 milk as name we can certify as desi cow milk…] There have been cases who have got conflicting results from the labs on testing for milk purity. […we don't believe in certification…. I was in the ghee business. I spent ₹4 lakh so that I could understand the parameters that would decide this is a1 or a2 gave same sample in 4

labs; 4 separate reports were generated. I do have question on modern science, it is not science.A2 lab at Raipur has taken a2 milk corporation certificate New Zealand…. our society is all illusion. if we could go out of this illusion, we will be sorted.]

I infer that certification is a marketing gimmick without adequate backing about its authenticity. The testing lab in Raipur has a valid certification license and trade mark from A2 Milk Research Corporation, but a similar lab in Pune approved by NABL gives reliable certifications. The presence of so many labs, each claiming superiority of their licence over the other, and conflicting views of the respondents create ambiguity on the validity of these agencies and their reports. While one case mentioned that their milk is BCM-7 characterised and that his farm has only BCM-certified cows, the other vendor is fully opposed to commenting that there is no BCM-7 testing done anywhere in India. Besides, the cost of testing and mode of testing is also not standardised.

> [No big players are not involved in A2 milk market yet. The people who are doing this business are working on smaller level such as someone is keeping 10 cows, some 20 cows. This cow gives lesser milk - 8–10 times per milking. Thus, there is no enough volume so that these players could go for labeling, ISI certification and spend the money.
>
> So, all the customers are there with me have already came to my farm, saw it. This is the way they have become my customers. If we want to take this business on bigger levels at that time all these things of labelling, posting, ISI certification come into picture.]

The DCMM is not proportionally big enough nor are big players involved. Competition is scarce. Hence the players are less and handful agro startups are in the game. Labelling, licensing and certifications involve considerable expenditure the first time and on renewals. Should the market size, competition and volume of yield increase, the Govt. may find the need for policy interventions.

I conclude that this variable needs deeper inquiry before it can be designated as an influencing variable on the growth of the industry. Certifications are in a state of flux be it for vendors, regulators or government. Growth in the market is happening despite the lack of any seal, stamp or certification on the desi cow milk delivered packets. A qualifying statement from the consumer's end would further validate if certified milk delivered at doorstep is better or not, compared to non-certified milk. Hence a follow-on research in this direction is prescribed.

Regulatory Architecture

'There is not yet a governing body that can undertake research responsibility. So individual vendors are doing the research…

> …..but the Indian Govt will not consider the results of other countries as valid and legitimate until research agencies of Indian government will not research on the matter and find the genuine difference between desi cow milk and other milk……
>
> Kamdhenu Ayog is Govt. organization. It is formed with the dedicated intention to increase, improve and motivate indigenous breeds. If there was no difference between A1 and A2 then Kamdhenu Ayog would not have been formed. Indian breeds would not have got subsidies separately article has been written with the intention to push the government or to point that desi cow is a matter that needs focus, to insist on doing research studies, legalize it and build its market...., is my understanding it is not for demotivating but kam ko lagane ke liye.. (To put the govt. at work)…

The government architecture is supporting the protection of indigenous cows by allocating funds for creating cow protection sheds, subsidies and pension plans etc. However, it does not give any vocal valid statement or research evidence on the established difference between desi cow milk and normal milk. Hence, I infer that the regulatory architecture is supportive in tacit manner than active.

[Data with the Govt /regulatory bodies is wrong….they say 18–20 crores of desi breeds are there, Ramdev baba says this …biproducts data does not match milk production….I told the Govt that if pashudhan is in so much quantity, then what should be the quantity of milk generated to get paneer, ghee, butter etc. but there is no data to match or find the missing links….. they don't club. …there is no data about why Govt. is giving a 100 crores order business to soya milk suppliers … no data with ICAR, ICAR makes guidelines…. no research is available.. soya is protein but has lot of side effects…Govt. should give such amounts to desi cow sector…

Pre milk production phase is handled by NDRI and IVRI, Post milk production phase is handled by NDDB, however, technology impression should be there between pre milk and post milk phases.]'

FSSAI stand A report from WHO says that in India, there is a production of 85 lakh litres of milk but the population is 1.30 crores… hence there is huge amount of fake milk. NITI Aayog has to answer the disproportionate population: yield ratio. ….they may interrogate with numbers…….. What is your planning on milk production, desi cow breeding, their quantum etc ? System is also helpless and can't say that you we need to work on purity System is such that no one considers this problem.

The excerpts are evident that unresponsiveness of the government is attributable to information asymmetry in public record keeping and ineffectual reporting on data pertaining to desi cows. These are missing links of the regulatory system. Moreover, the data of the pre and post milk production phase need data integration for data integrity. In the earlier sections, I inferred that predictive intelligence and artificial intelligence are necessary for decision-making across disease protection, prevention, cure and reproduction. I extend the same here to infer that in our regulatory architecture, voluminous coherent and comparable data sets must be accessible from Dairy, Veterinary and Animal Husbandry departments so that meaningful policies favouring the growth of the sector can be devised.

Government should do research and present its findings openly. I was part of Govt system and I think this is not going to happen in next 50 years. I worked in agricultural dept. I was region officer. The Govt will not give any such statement of this kind because the A1 milk market architecture will completely collapse. This will eventually affect dairy farms, companies and employment. Ultimately entire milk market infrastructure will collapse.

I think it is the same reason behind A2 promotion not being done by Govt because A1 system is all set-in terms of machinery and employment. It might be the reason! White revolution, Varghese Kurien based Amul brand cooperatives took 50 years to establish, the Govt. would not want this to collapse right away.

The statement of ICMR and NDRI is contradictory with respect to A1 and A2 milk. The government does not want to take an independent stand on this matter by releasing its own statement about its observations on the equivalence (or not) of A1

> and A2 milk. ICMR is not the governing body for dairy milk instead it is the Government which has the right to say such a statement.
>
> Govt should compel the certification of A2 milk as desi milk similar to certification that is available for organic food product sale.

The regulatory architecture at present is not likely to support the DCMM. The conventional milk market is stable, structured and controlled. It has gone through a slow process of evolution over the past five decades. The government would be reluctant to demolish this status quo all of a sudden which can create unwarranted tremors in the sector. It can affect the market equilibrium with respect to income, output, employment, consumer demand and profits.

Govt. Support

NABARD provides. Interest-free subsidy of 25% on purchase of every 10 cows. Discount on setting up Gober gas plant. Two lakhs of discounts on setting up a cow dairy project worth seven lakhs; These are incremental steps but are not enough to make an impact.

> [to expand the business, employ the people, train the farmers, give good milk for more people, first problem arises is the Funding and second is space. This land has been usurped by big business people, sarpanch of villages etc. There is no land available for grazing. Govt should hand over the gochar bhumi to gopalak like us who know about cattle maintenance, their grazing, breeding etc. We can cultivate crops in that gochar bhumi and decrease the cost of production.]
>
> 'Second help can be from banking. Loans should be given. As I said earlier there is initial investment of ₹7 lac for cattle purchase (10 cows) and there is additional investment of ₹5 lac for building a shade, it will be enough for 10–20 cows. So, we require investment of 12–15 lac investment to start the business. Then 100 liter per day production would get started with 10 cows. We can easily pay EMIs and clear the debts. But banks don't support at all……'
>
> 'We are farmers, love cows, we have knowledge about fodder, breeding. But we lack in funding I am keeping these 60 cows, I am doing it by taking debts…. If we get good funding's, loans then we can work in really good manner. But system has been made such that we can't get loans on cows. We don't get support. I am working in this field when I was 35 years old, now I am 40. The people who are working on field, who are maintaining the cows are in the age group of 20–30 years. Young generation wishes to work in this field because they can see the future.

I infer from the extract of interviewees that funding through banks via loans for cattle purchase, breeding and maintenance and grazing space for cows is concerning the vendors deeply.

> Government should look into the subsidy on the price of indigenous cows; 25–50% percentage subsidy is available now. up to 90% subsidy should be given to farmers so that he can reach up to end customer.'
>
> ' there are subsidies for cow breeding but it is not accessible.'
>
> '….Govt. intervention is expected at cattle level/ cattle raising. feeding /grass supply to local farms…. price of SCM will fall in the form of subsidy…. cow maintenance level help is expected. 90% subsidy….when Govt declares subsidy then bank would come to the farmers, now the farmers are chasing the banks….investment will rise, per capita for banks will increase.,. Suicides will decrease. Banks will become agents.

I further infer that subsidies are not being given for those purposes for which farmers actually require them. Most farmers are looking at non-milking cows as a saddle on their back as the pressure of already being in debt is choking them economically. Cases were firm that subsidy band must be extended up to 90% for cattle management: rearing, feeding, nutrition, health etc. and to reduce the purchase price of the desi cow.

> For every farmer, 100 customers should be assigned then and then only desi milk will reach up to the customer. As you decentralise the system A2 will reach every home with real value, if you centralise it then it will go with unreal value. Govt. should give enormous freedom to farmers and help them to connect directly with the customers. Every farmer can have 100 customers and every farmer almost has family of 5 members, so he can cater to 100 customers to sustain. Now individual milk suppliers are giving milk to the companies @ 23 per litre but the cost of production is ₹50–60 per litre'.
>
> Subsidy is a wrong practice. You are making the farmers lazy is my understanding. We don't want subsidy. Giving permission for direct marketing and decentralization of milk market would help. A monthly income of ₹1.5–2 lakhs can be earned by working this model out. No middlemen required!!
>
> 'Govt. is not supposed to assign customers but to train the farmers. One of the biggest drawbacks of our milking system is that small aggregators supply milk to dairy cooperatives. We are planning to work on a 100-farm, training program for dairy farmers on the importance and commercial benefits of decentralization of milk with zero investment from farmers, which they can further snowball to other farmers and the referral network goes on.
>
> 'While companies like Amul, Gokul etc. do not own a single cow, because they know production cost, they are willing to give loans to farmers but not to purchase a single cow.

I captured that there were *big player* cases who suggested new business models such as assigning a fixed number of consumers for each farmer, a farm-to-folk

philosophy of directly marketing to the consumers without the intervention of middlemen to jump the profits. Most of the cases wanted decentralization to be substituted for cooperative farming as cooperative model always left the small aggregators in perpetual debt and poverty.'

> Govt. support is required for breeding, semen collection, distribution and preserving good bulls. Only 6–7 breeding stations currently exist in India which is very less. A good nutrition mix like almond, kaju mixture is good for bulls is good in Sabarmati Ashram.

> India has total 57 type of desi breeds out of which 37 are available. Out of them we now get only gir breed's milk Brazil has highest number of gir - gir lando, 60 lakh Gir cows; they yield 72 liters per day per cow. Even bull was imported from India named Krishna

> If Govt gives subsidy, I can increase the number of cows, hence productivity; natural breeding should be done, injections should be decreased…

> Govt is not doing anything to increase the breed size.

I deciphered from the extract that govt. support is limited in encouraging and providing support on infrastructure facilities like semen protection, collection, distribution and increasing breed size. The crying call of the vendors was that subsidy is not percolating to their level as most times the disbursement is either caste driven or acquaintances based for which false records are created to avail the subsidy.

> No Government subsidy on dairy is percolating at the grassroots' level to us…..... Only high contact people get that 30% on loan is available. It is based on caste system as well...data. 25% subsidy is given but not for milk business. it is for gaushala maintenance and protection, and not for business.'

> Subsidy is not available for overall dairy sector. However, subsidy is not required. The benefit from Direct Beneficiary Transfer (DBT) is also not available to the farmers. NDDB schemes are credit linked that don't give more than 10%.

Subsidies are given more for goushala management and not for the dairy business as a whole. The cases were discouraged due to this.

> Slaughtering of the cows should be permitted by Government of India. The non-reproductive cows are not only occupying land space, additional man power, putting a pressure on fodder but also contaminating the pure reproductive breed of cows. The Government's Gokul mission budget should focus on reproductive and milking cows and not on unproductive cows. At present the Gokul Mission is consuming 50% of the total budget allocated. However ideally it should consume only 10% of the budget so that the resources are diverted towards the productive cows. The way the present government is pampering and protecting the unproductive cows is the cause of serious concern because most of the farmers drive away the unproductive

cows and these stray cows contaminate the pure breed. We are compelled to shelter such unproductive cows without slaughtering which actually raises our personal cost of maintenance and also the cost of the Government. '….if cost of production is 40–50 then how would farmer will sell at 27? villagers are less educated; they don't understand legalities. Legalities should be communicated very well up to bottom of the pyramid….

Farmers need the support of officials to decode the govt. policies and the benefits offered for dairy management in a lucid manner. Most times cases said they are ignorant about loans offered, funding policies etc. The cases were emotional about cows but could not afford to feed them till death due to their impoverished condition. Their concern was the pure breed contamination due to the unproductive cows that were driven away. Cases mentioned that more than 10% allocation in the budget for goushala management in the Gokul Mission is a drain on exchequer and demanded 40% diversion towards dairy development as government support.

The regulatory architecture is not supporting the growth of the sector. Robust engagement of the Govt. and its policies is preferred to enable consistent growth in this sector.

6. Computation of Cost, Margins, Profits and Quantum of Breeds (Refer to the Annexure)

Quantum of breeds

16.6 crores - desi govansh

3.3 crores - jersey, holestein etc 10 crores - buffalo

29.9 crores - Total cattle

Input Costs

The composition is 10 kg - dry matter

20-30 kg - green matter concentrate /mineral mixture

when you extract milk, heavy amount of calcium depletes in the cows and so mineral mixture is mandatory.....

If the concentrate is not given, cost remains at ₹80 ...

while some farmers feed chuna, saindha namak (rock salt) which raises the cost between ₹80–120 shwagandha, shatavari

etc. are fed as intake to cow after the pregnancy, for better milk yield for the calf and also as medication I learnt this from a old lady.

> Selling price – ₹80 per litre delivered at Mumbai and Pune Cost of production – ₹60 per litre including delivery cost

> We are not majorly into commercial business and we are satisfied with whatever sale and profit is coming out of milk, milk products and bi-products. We are team of about 60 people and we manage the goushala by personally contributing from our own pocket.

I infer that price of the milk between ₹80 and ₹120 per litre is reasonable considering the input costs. However, the local farmer sells his milk at the rate of ₹23 while his cost sometimes is nearly ₹40 per litre. He is thus a loss leader. The escalation in price is due to transportation costs, lack of dependable distributors and packaging costs. Besides, the demand is dispersed, and milk orders are not stable. This also catapults the price of milk per litre. Input costs are almost similar for large and small vendors. Most consumers are not worried about the price as it is consumed as a health drink. For those to whom price matters, they reduce the order size and frequency of purchase. For now, it is relatively price-inelastic. The growth and perception of the industry do not appear to be majorly influenced by the price factor.

7. Future Prospect of Growth

> Demand of A2 milk is increasing 100%. You will see in 3 years where it will go. Future is very bright…..

> Future is very bright. …many industries are coming into Desi farms. 200% more up to 2022**…** still work is in progress across the globe…..Future is expected to be moderate because people are not still aware about desi cows…. there should be joint ventures to promote indigenous cows irrespective what any government of the world says anything….

> Future is absolutely possible with direct marketing. ….Most important is to educate and train... and priority should be to increase the pedigree for indigenous breeds..... increase quantity of cows. 80% of the milk market is A1; and 20% is A2 protein milk. It is not possible to cater to the market if all switched to A2 milk next day. We require 10 years to breed desi cows that can cater to the required quantity of Desi milk for our 1.4 billion population In 1947, 30 Crore animal population catered to 40 Crores of human population while now 1.4 billion people are being catered to by 13 Cr mammals including camels, donkey, sheep, goat, cows etc. Before exotic arrival, we had excess milk.

> It will be good. If I do good marketing, income will increase. I should find 1000 health-conscious people, try to prove efficacy on cancer patients. According to Food and Drugs Department, in 2011, 69% of milk samples failed to pass the test for purity. …Awareness needs to be created, Government. subsidy is required....25 competitors in all…..Export of desi cow milk is difficult..., requires seal, barcode etc not possible while packaging..... Sale is unpredictable...if 3 days business is good then it is followed by 1.5 days sale..... then loss. Malls charge me 27% commission, ₹88 for extra transport, plus bottle packaging, ₹120 for flight, which will shoot up the milk price to ₹300 per litre.

> Awareness is increasing among customers to change their priority towards healthy living, healthy eating nutritious food. There is an inclination among consumers to shift towards drinking pure milk….
>
> Focus on organic farming with pure gobur and bi-products of cow as fertilizers etc…... when money is earned through gobur sale, worth of milk will shoot up spontaneously, people will love cows …… desi semen is available, but Govt. has limited desire to work on it as their bosses don't permit ….. it is impossible to get actions from Govt ……. promote desi than A2. …the people who are working in social media, breeding, gaushala management should be motivated to make 10 cows out of 1 cow else, this last generation will die. Currently we are copying gaushala management from Europe. ..we are destroying our traditional gaushala management desi cow milk means least use of machines …i.e. untouched by machine and everything is done by human hands. the things coming from machine can't be negated in the human body but the bacteria coming from human hands can easily be digested.
>
> In future if we want disease free and healthy cattle, it is advisable to follow Brazilian model of cattle management with respect to collective breeding, selective breeding, tuberculosis testing and treatment. It is worthwhile to know that Indian breeds of Brazil yield more milk than milk from Jersy and HF and they are less susceptible to diseases. Hence India should borrow innovative ideas in cattle management from them….In future Government should engage in increasing veterinary science colleges and corresponding research output. Presently in comparison to 40 medical colleges in Maharashtra there are only 6 veterinary colleges with admission capacity of 60.Veterinary dept. is most neglected dept in India. We cannot be expecting cattle wellness and milk yield out of this situation. Unless veterinary dept. does not improve, there is a slim chance that the dairy dept. and animal husbandry will improve.

I infer that the industry has a bright future that is expected to grow gradually over next three to 10 years. The excerpts of exploratory survey ascertain that the future of the industry is bright provided we project DCM instead of A2 milk. Crucial to the future growth of the industry is training and educating farmers, and utmost priority is to increase the pedigree for indigenous breeds, that is, increase quantity of indigenous cows. Additionally, veterinary colleges need to increase which is six veterinary: 40 medical colleges at present. In the future Government should engage in increasing veterinary science colleges and corresponding research output without which the dairy development is a far-fetched hope. It is advisable for India to borrow innovative ideas in cattle management from the Brazilian model and follow their cattle management closely with respect to collective breeding, selective breeding, tuberculosis testing and treatment. Consumer awareness and mind-shift towards Indian culture through digital marketing tools would be of help. A visible acceptance and profit margins on cow-based bi-products would help the desi market to grow eventually. Export potential of desi cow milk is as good as ruled out considering its exponential price point. Customised testing kits if provided to the consumer as a complimenting tool would help in boosting confidence.

Conclusions

1. The indigenous cow market (DCMM) in India is driven by passion and emotions rather than profit. I could sense a unique sense of bonding and respect for the desi cows in the minds of the vendors. They were given a unique status like a mother and experienced a sense of pride in doing the business. The belief that all businesses are profit-driven is a perception that needs revision. Desi cows were not treated as a business resource or a factor of production. They were viewed as a valuable compassionate collaborator in this initiative. This emerged as a unique finding.
2. The DCMM is at a nascent phase and young entrepreneurs with a belief in India's ancient culture and conventional medicine are taking a keen interest in the business. Young entrepreneurs driving this sector are well-qualified, open-minded, have an appetite for innovation and technology adoption and vision to transform the Indian mindset towards reposing confidence in conventional health systems. Swarupa (2016) has emphasised the need to attract, recruit and retain more skilled people who can use effective skill development programs for marketing strategies upon which the long-term success of the Indian dairy industry depends. The players are attempting to build it as a start-up model and envision change in the following decade, suggesting high growth prospects.
3. Knowledge Repository on Indigenous Cow Milk Market: The dairy management is overruled by an animal husbandry, disease management and veterinary mindset. The culture and mindset of the Department of Animal Husbandry and Dairy Management requires a re-casting. Consensus within cases emerged that there should be a paradigm shift in the culture of training and development from disease management to cattle/ dairy management. Farmers' training needs a science-based approach and adoption of technology is crucial to the growth of this sector. The training is inadequate and a systematic approach to embracing technology to make the diary management processes effective and efficient in yield, breed and nutrition management, marketing, insemination, reproduction and biological aspects, TB diagnosis, treatment and recovery, record and registry keeping is severely found wanting.

However, where focussed training has been given by regulatory bodies the yield has gone up because of nutritional training by 6%–8%. Especially in Maharashtra training provided is suboptimal bringing down the desi yield substantially. Training was well structured in Punjab and Haryana where the yield of desi milk has increased as per government data. This increased the yield in six months (Respondent in this study). Hence the roles and responsibilities of doctors, supervisors, technicians, lab-assistants and nurses should be monitored frequently. Role reversals can be discouraged. The training medium can shift if the new entrant-first- generation- educated entrepreneurs could engage as forwarding agents to train the farmers at frequent intervals who are more in direct contact

with milk suppliers in order to make it more impactful. Placing the right man on the right job by the authorities for training vendors in the DCMM is also a critical factor. In this the motivation, will and sincerity of the authorities is found missing.

Despite this there is growth spurt as claimed by vendors. The percolation of information about the benefits of DCMM is slow within the consumers more through word of mouth, people influenced by evidence-based medicine and clinical advice of Ayurvedic doctors are making a measured difference. A streamlined way to organise this niche sector would be to marry the ancient and contemporary repository of knowledge in a scientific manner, and work on an awareness drive using technology like social media, YouTube, and non-tech forces like lectures, seminars, workshops and debates in urban areas and rural areas integrating the benefits of desi milk and its bi-product would help build momentum in this sector. Bazhan et al. (2017) distantly resonate such thoughts in their findings. Women had trust deficits in the health claims of functional dairy products for various reasons like distrust in food manufacturers, exposure to contradictory information, and fear of side effects due to taking them. The participants agreed on the need for more information from a trusted and credible source such as health professionals or authorities through different communication channels like television, training classes, shopping centres, and so on.

4. The nature of data and research evidence is evolving in DCMM. The importance of published research findings to catapult growth is a divided house. The sect believing in evidence and process of natural experimentation defies the logic of research as they feel consumers must experience it to believe it. The commercial-minded sect feels published articles can improve the chances of growth. Academicians, regulators and government officials find the need for published sources to make the philosophy of DCM work in society. Truswell (2005) infers that the A1/A2 milk hypothesis was imaginative. He concludes that if the scientific evidence had worked out it would have required huge adjustments in the world's dairy industries. This review concludes, however, that there is no convincing or even probable evidence that the A1b-casein of cow milk has any adverse effect on humans.

Research will certainly be longitudinal and the results will be driven by clinical experiments and evidence management at the same time. This is a distinct conclusion drawn in this study.

There is an accompanied resistance from the Government of India to proclaim the benefits (or not) of DCM in public domain probably due to the threat of demolition of *status quo* in the conventional milk market. This could seriously chaos the market with associated impact on demand, income, output, employment and profits for which the government is not prepared. This is endorsed in literature by Kanter et al. (2009), who infer, that participants view conventional milk more negatively after the introduction of rBST-free and organic milk. This finding is further supported by these authors who concur with the idea that conventional milk becomes a stigmatised good after BST-free and organic milk are introduced into the

marketplace. Also, the introduction of rBST-free and organic milk could potentially reduce the demand for all types of milk. The implication of the stigma effect found here is that the dairy industry will have to confront this issue head-on or risk a possibly major negative impact on milk consumption itself by Kanter et al. (2009).

The voices maintain that the Government is not keen to pump funds for research in this field and cannot be fully ignored that some evidence is on purpose kept discrete. This is echoed by Sirohi et al. (2009). A clubbed research by veterinary hospitals and colleges, dairy-driven universities and Agro universities with a PPP supporting investment in research could be a stimulus for growth.

The market is following an oligopoly structure. Competition is at a blue ocean phase. Industry is embryonic. Price of DCM is not dictated by competition instead by distribution network, transportation and packaging type. Scattered geographical demand is high which the suppliers are unable to meet. Similar finding is echoed in literature by Bressler and Macleod (1947), while examining the problem of excessive delivery mileage in milk marketing and proposing various solutions. Authors inferred that such milk distribution systems are inefficient and marked savings in delivery mileages and significant reductions in the numbers of trucks and men employed would be possible under more 'rational' organizations. There is no way to evaluate objectively all of the pros and cons of marketing reorganization except through actual experience. Findings also suggest that it is impossible to foretell how these savings from cost reductions would be divided among producers, consumers and middlemen.

Research, competition, government certifications and price are not emerging to be an influencing variable to spurt demand. A modest 10%–12% YoY growth *(respondents of this study)* is evidenced despite these factors being less active in the sector.

5. Adoption of technology for lineage protection, breed increase, reproduction and insemination protocols, ancestral, DNA registries of desi cows emerge dominant determinants influencing the growth of this sector. Upkeep of public data like mass clinical records and health registries would support taking well-informed decisions using predictive intelligence and machine learning techniques. There is wider scope to use predictive technology to estimate the geography, time and consumers' demand for milk. This can deflate costs and inflate margins. Training to vendors and small farmers is crucial to improving the quality of milk and health of the cows. Desi cow migration across territories within India must come to a halt for better progeny prospects, yield, health and characterization. Increasing the quantum of desi cow breeds needs immediate and top focus to grow and sustain. These conclusions are an extension of conclusions drawn by Lampe and Sharp (2015) who identified the contribution of modernization through specific new technologies and practices which led Denmark to become a world leader in dairying in terms of productivity. They inferred that Danish farmers' education, disposition to use modern methods, adoption of practices, barn-feeding, biological innovation, contributed to year-round efficiency of production, increase in the number of cows and hence to higher milk yields.

Dairy management of DCMM needs a culture and mind shift. Adoption of the DCM and its bi-products requires a cultural-mental shift. This shift is likely to be gradual upon a concurrent transformation in the regulatory and technological infrastructure, Government disposition, and vendor-farmer technology adoption and consumer awareness. The paradigm shift in the skill set, tool set and mindset of the industry are key determinants for sustained growth. Such new inferences are the result of a long-drawn interview capturing respondents' state of mind and emotions.

6. I infer from the extract of the cases that the DCMM sector is highly capital-intensive-big investment business. Technological interventions are possible at every level from insemination and conception of pregnancy of the cow up to door delivery of milk. The adoption of technology is possible if the scale of business is high. Small farmers need to be tech-trained to improve the quantity of desi cows breed. For this concerted training on disease, nutrition, safety practices, reproduction, case registries is to be provided to them. Their economic condition (unviable cattle and farm size, refusal by next generation to carry on milk business, nuclear families) does not support being tech-intensive. Customised technology would probably suit the needs of small vendors better. I infer, hence that technology is emerging to be the most crucial determinant of growth in this sector. Unless technology dependence increases, the breed quantity will not increase. It is also important to provide training on how the use of technology itself can simplify processes to make it more affordable, accessible and an enabler for credible decision-making.
7. I look at the success of DCMM in India as a unified whole, and not in fragmented parts. Literature has support for all the fragmented variables but for this study, the variables are co-related and have relevance for the entrepreneur and consumer at the same time. Indigenous milk market is neither like the conventional market nor like other commercial business entities. The market is niche and nascent. The stakeholders (government, farmers, entrepreneurs and consumers) of this sector need to understand the DCMM as a holistic philosophy disengaging with commercial aspects. DCMM has an ancient, health, spiritual, emotional and commercial significance. Unless the stakeholders integrate themselves with this philosophy they would be unable to appreciate the indigenous milk benefits. Upon this, I predict a steady growth pattern for the industry.
   Future growth of this niche sector is bright. 'A decade from now would be a realistic capture of the time when the industry would be operating full-fledged'. (Respondents *of this study*). Demand and supply would show symmetry as awareness in consumers, vendor participation, adoption of technology and breed size would have heightened. The DCMM is a dynamic and parallel set-up looking seriously for its growth and revival today. It is nebulous for consumers and nascent for entrepreneurs. The evolution hence is predicted to be a gradual 10-year process when it would have gained full momentum as an established entity, reviving all the past glory as it originally existed with undiluted pedigree of breeds at play.

Annexure

Computation of cost, margins, profits and quantum of breeds respondent calculation

Milk Cost and Profit

I supply to distributor at the rate of ₹80 per litre and he sells it to consumers at ₹100 per litre as he has to cover transport costs.
Cost of 10 cows = ₹7 lakh (₹70,000 each)
Let us assume we did our first investment ₹7 lakh on 1st January 2021. You will get 80–100 litres of milk per day.
If we sell it at ₹80 a litre, then we get business of ₹8000 per day. Cost of feeding and maintaining each cow = ₹150 per day
₹1500 cost for all 10 cows. ₹500 for extra nutrition
Total cost per day for cow maintenance = 2000 ₹.
Sale @ ₹8000 minus input cost ₹2000 = Profit of ₹6000 ₹1000 expense on labour, transport etc.

Thus Net Income = ₹5000 per day. Yearly Income = ₹18,25,000.

that is, per cow income = ₹500 per day Monthly it becomes ₹15,000 per day.

This is the calculation for milk, if we sell it at ₹80 per litre.

Gobur/Cow dung calculation

Cow gives 10 kg **gobur** every day.
If we make 40 bi products/gobur based products viz. bricks, fertilizers, kande (for hawan) etc. then ₹50 can be earned daily; ₹1500 per month can be made.
Considering above two factors income from one cow = 15000 + 1500 = ₹16500 per day.

Goumotra/Cow Urine Calculation

Goumotra at night time is considered to be best used for medicines. Goumotra arka is consumed as medicines.
Cow generates 2 litre per day. From 2 litres of goumotra after distillation, 0.5 litre of goumotra ark can be produced.
The market price of goumotra ark is ₹150 per litre.
Thus you get ₹70–75 (let us assume ₹70) per cow per day out of goumotra. Monthly you get 70* 30 = ₹2100 per cow.

By adding everything, you get almost ₹18,000 per cow of net income.

Now let us consider breeding. Menstrual cycle of cows go for 31 days unlike humans for 28–30 days. So if we assume that cow is born on 1st January, we skip the first heat on 1st February. But in 45 days after its birth, it should get pregnant. We get Nandi (bull) first and then cow. We allow it for natural mating. After nine months nine days, it will give birth to the calf. From the day of pregnancy, for seven months it gives milk. We stop the milking for last two months of pregnancy so that development of cow and calf should be done in well manner. So out

365 days in a year, cow gives milk for 295–305 days. Our cows gir, sahiwal and rathi gives milk for this much span of time.
On an average 2500–3000 litre milk is given by a cow. Business model is built on annual yield of milk.
Let us assume yield is 2500 litre per anum per cow. 2500 * 80 = ₹200,000 will be sales from milk.
One should calculate income from milk, gober, goumutra.
If you give enough attention on breeding policy, you would get 10 calves every year out of 10 cows. After seven months, we have to buy another lot of cows. Two rotations are required for breeding. But after that you do not have to purchase a single cow. I have studied the govansh (bovine) also.
In five years, you would be having 40 cows and 80 calves.
Our market value of those initial 10 cows was 7 lakh Rupees.

It becomes ₹36 lakh.

This is our asset value gain calculation

Working Profit on Sale of Desi Cow Bi-Products

Edible Biproducts -

I. Cost of Ghee Production
25–28-liter milk per 1 kg ghee (4% fat per litre of cow milk)
Cost of production
Cost of milk per litre = ₹60
Cost of 25 litre milk = 60*25 = ₹1500 Cost of fuel = ₹100
Other costs = ₹100
Total cost per kg of ghee = ₹1700 Selling price of ghee = ₹2000 per kg
Perishability of ghee five years; Older the ghee, better it is

Types of ghee production techniques

1. Cream separation - boil the cream, resultant should be called butter oil and not the ghee. Normally, in the market, butter oil is sold as ghee.
2. Cream collection from milk and boil it. It is also the butter oil.
3. Bilona method - actual ghee by traditional method from milk to curd to ghee.

II. Chenna yield is 200 gm per litre of milk. 800 gm rasgulla with 200 gm of chenna. Selling price of Rasgulla – ₹200 per kg

III. Shrikhand yield is 400 gm per litre of milk Cost of milk for 800 gm Shrikhand - ₹120 Selling price of shrikhand – ₹300 per kg Remaining curd can also be *sold.*

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