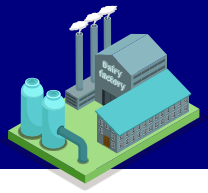
Amul

CREATING A TECHNOLOGY ROADMAP

Introduction

Amul is one of the largest dairy cooperatives in India, renowned for its extensive contributions to the dairy sector and pioneering the "White Revolution" in the country (Drishti IAS, n.d.).

Established in 1946, Amul operates on a cooperative model, where milk is sourced from millions of farmers and processed into various dairy products for domestic and global markets (Team C, 2023).



Project Outline Approach

Overview Objective

Operational Efficiency, Product Quality and Sustainability

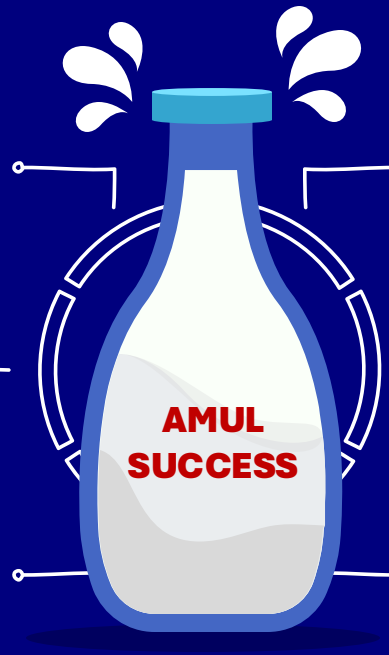
Key Focus Areas

Supply Chain Digitalization, AI - Driven Quality Control, Data-Driven Decision Making

Benefits

Cost Savings , Transparency, Enhanced Consumer Trust

AMUL Strategy



01 Robust Supply Chain

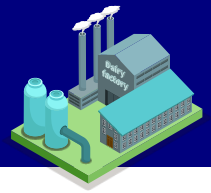
02 Low-Cost Strategy

03 Diverse Product Mix

04 Strong Distribution Network

05 Technology & e-initiatives

06 The Brand Value of Amul (Quality, Value for money, Service, Availability)



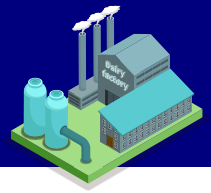
Overview & Trends

01 Global Dairy Industry Overview

02 Regional Overview

03 Consumer Trends

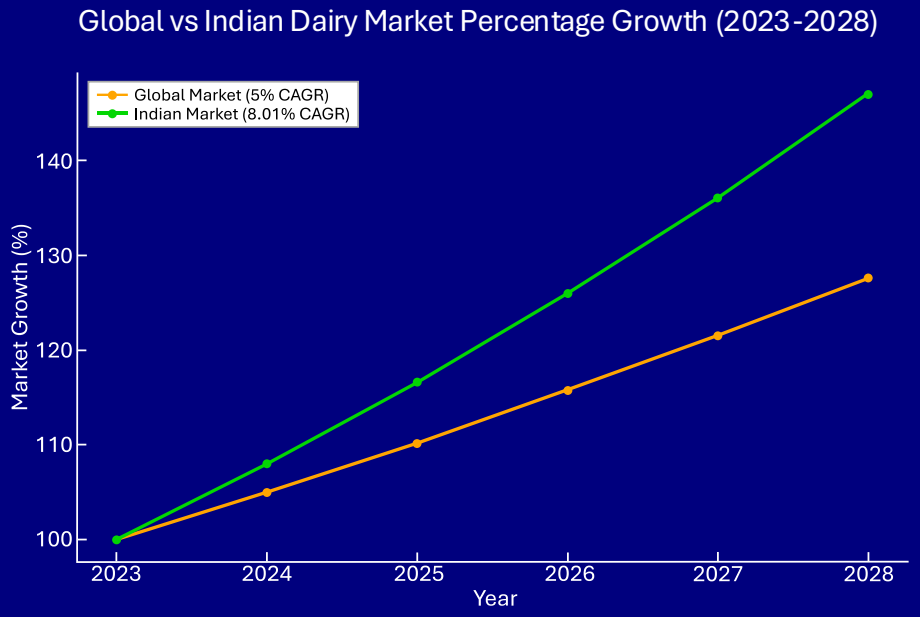
04 Technological Trends



Global & Regional Industry Overview

Global Market Size and Trends

- Global Dairy Market was valued at approximately $871 billion (Markets, 2024).
- Global market to reach $1.1 Trillion by 2028 (Markets, 2024).
- India Dairy Market growth rate (8.01%) exceeds Global Market rate of (5%) (Kharrati, K, 2024).

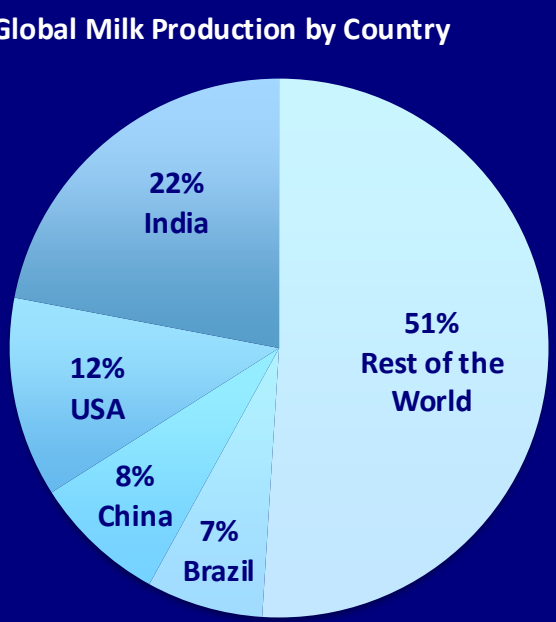


* CAGR – Compound Annual Growth Rate (CAGR)

Global & Regional Industry Overview

Regional Overview

Production
India is the largest producer in the world, contributing about 22% of the global milk output
(UN FAO, n.d.).



Global Dairy Companies

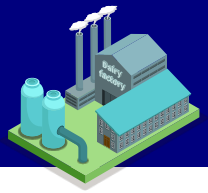
Rank	Company	Revenue (2023)	Country of Origin	Founded Year	Market Presence
1	Lactalis	€27.9 billion	France	1933	Global presence, with 50% in Europe
2	Nestlé	€22.3 billion	Switzerland	1866	Global presence, with 32% in North America
3	Dairy Farmers of America	€20.1 billion	US	1998	Primarily in North America
4	Danone	€18.2 billion	France	1919	Global presence with investments in many dairy companies
5	Yili	€16.2 billion	China	1993	Global presence, primary markets in Asia
14	Amul	€6.6 billion	India	1946	Limited global presence, primary market in India

Relative to Amul, the top companies have a long history and a global presence through M&A or investments into foreign companies

Amul operations is still primarily based in India.

Kharrati, K. (2024, March 8). India dairy market size reach $290.8 billion 2033 - CMI Team. Custom Market Insights. https://www.custommarketinsights.com/press-releases/india-dairy-market-size/






Overview & Trends

Key Industry Trends

01 Health and Wellness

Growing consumer awareness of health and nutrition is shifting demand toward organic, low-fat, and fortified dairy products (Neethirajan, 2023).

02 Sustainability and Eco-Friendly Practices

Increasing focus on sustainable dairy farming practices and eco-friendly packaging solutions (Neethirajan, 2023).

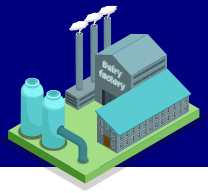
03 Technological Advancements

Adoption of Industry 4.0 technologies, including automation, AI, and blockchain, to streamline operations, improve traceability, and ensure quality control.

04 Changing Consumer Preferences

Consumers are leaning towards value-added dairy products such as yogurt, cheese, and milk-based beverages due to their health benefits and convenience (dairyreporter.com, 2024).






Amul's Production Framework

Farmers

- Village Co-operative Societies (with chilling units)
- Village Co-operative Societies (without chilling units)
- Local Restaurants / other milk related business
- Milk sold to village & local residents

Milk Processing Unit & Warehouses

Chilling Plants

GCMMF Warehouses

Wholesalers / C&S

Retailers

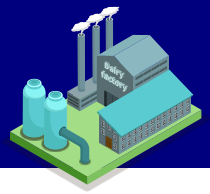
Home delivery contractors

CONSUMERS

Network Services

- Veterinary Services
- Animal Husbandry
- Animal Food Factory
- Milk Can Producers
- Agriculture University
- Rural Mgt. Institute



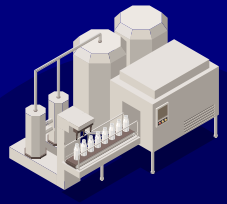




Overall Company Operations

Milk Collection

Amul collects milk from over **3.6 million** farmers daily, leveraging its extensive supply chain across rural India (History - AMUL Dairy, n.d.).

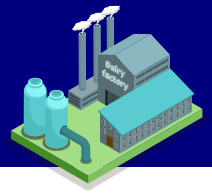


Processing Facilities

Amul operates several state-of-the-art processing plants for pasteurization, homogenization, and packaging (History - AMUL Dairy, n.d.).

Distribution Network

Amul products are available across 1 million+ retail outlets, with a robust cold chain system ensuring product freshness (History - AMUL Dairy, n.d.).



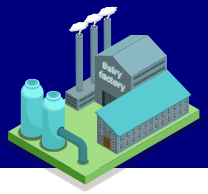
Business Goals

Business Goals

- Enhance Operational Efficiency
- Improve product quality
- Promote sustainable growth

Key Objectives

1. Improve product and cash flow traceability
2. Enhance milk quality through data-driven monitoring
3. Optimise supply chain efficiency
4. Leveraging AI for cow health monitoring
5. Promote sustainable practices



Reason for Improvement

01 Rising Competition

Increased competition from local and international dairy brands forces process improvements to maintain market leadership.

02 Consumer Demand for Transparency

Consumers demand more transparency about the origins and quality of their food, which requires better traceability through technology.

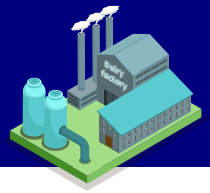
03 Operational Inefficiencies

To scale and meet growing demand, there is a need to optimize supply chain processes and reduce waste.

04 Sustainability Concerns

Amul needs to adopt greener processes to reduce its environmental footprint and meet global sustainability standards.






Current Operations

Revenue Distribution

Member Producers

Local dairy farmers that are part of the district foundation

Village Dairy Cooperative Society

Collection of milk and distribution of money to local farmers

District Milk Unions

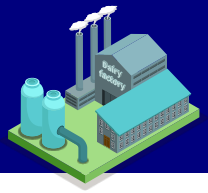
Management of dairy supply flow and production. Final products are sold to the State

State Milk Federation

Responsible for product sales in markets

Monetary remunerations & support services (vets, trainings)

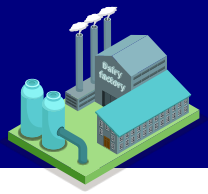





Gaps in Current Operations

Problems	Use Case	Technological Implementation
Lack of Product and Cash Flow Traceability	• No existing tracking of milking dates • Financial transactions between different levels of unions	• Utilizing Blockchain for tracking of product quality
Limited Raw Material Quality Monitoring	• Health of cows are not monitored quantitatively, based on farmer's experience only	• Utilize IoT devices to provide quantifiable metrics to determine cow health
Inadequate End-to-end Supply Chain Transparency	• Large number of stakeholders across different the production supply chain	• Data visualization for various end users
Insufficient Usage of Predictive Analytics	• Predicting health of cows, raw materials	• Using AI to predict health of cows and milk production






Value Proposition Canvas

- Blockchain technology for product quality and transaction tracking
- IoT utilization for cow health metrics
- End-to-end data visualization
- Predictive analytics using AI

Products

- Real-time transparency to identify inefficiencies and optimize end-to-end process
- Proactive real-time audits of quality of source with projected ~10% improvement
- Prescriptive and Proactive approach in monitoring equipment and herd health
- Accurate forecasting and informed decision making

Gains Creators

- Reduction in fraudulent transactions, Improved traceability of product quality
- Enhanced visibility on quality of raw material source
- Informed decision making to optimize process and remove bottlenecks
- Improved forecasting and enhanced product yield

Pain Relievers

- Increase consumer trust through improved transparency
- Improved quality & reduced wastage
- Reduced operational costs and lower downtime
- Improved efficiency and product yield

Gains

- Lack of Product & Cash Flow Traceability
- Limited Raw Material Quality Monitoring
- Inadequate End-to-end Supply Chain Transparency
- Inefficient operations, poor forecasting

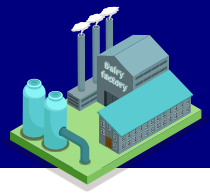
Pains

Amul

- Enhanced cash-flow traceability and sustainable practices
- Improved product quality
- Optimize supply chain efficiency
- Enhanced product yield and output planning

Jobs





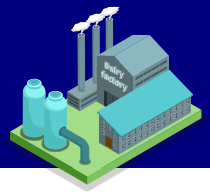

Technology Overview

India's Dairy Farming Landscape

1. Fragmented milk supply chain with many small farmers
2. Lack of training for best dairy farming practices
3. Little to no traceability of milk supply from multiple sources, difficult to monitor quality

	Supply Traceability	Quality	Operational Efficiency	Sustainability	Direct Yield Gain	Implementation Cost
IoT Devices						Medium
Data Visualizations and Dashboards						Low
Blockchain						High
AI Integration						Medium






Dairy Blockchain

Amul's Current Situation

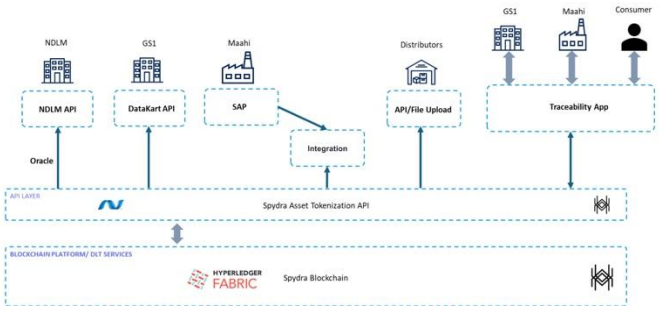
- 80% of payments to farmers are currently paid in cash or cheques at point of delivery (BNP Paribas, 2018)
- Risks of non-payment, manual errors or theft and fraud between unions
- Collection of milk occurs across many different farmers
- Risk of milk adulteration, causing quality issues upstream and difficulty in traceability

How can Blockchain help?

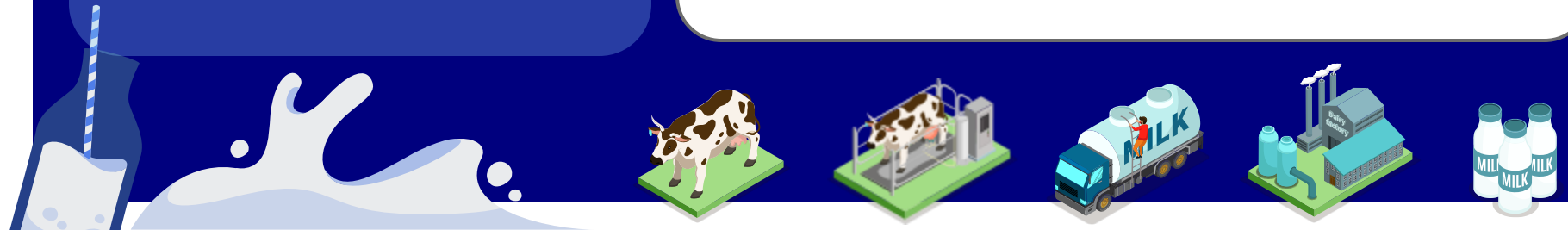
- High levels of traceability, able to accurately track and trace origin of dairy products
- Digitization of payment contracts to prevent frauds or non-payments

Use Case of Dairy Tracking with Blockchain

www.spydra.app/gs1-maahi-ghee-traceability-case-study



- Dairy products (Ghee, milk) are tracked and critical events like the transfer of ownership of items is recorded.
- Data from the blockchain network is integrated into the system (SAP e.g.), and the admin can track the location, time & inventory via an API
- User can scan the QR code and be able to identify the source of the product.



IoT Integration

Amul's Current Situation

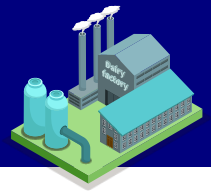
- 60% of surplus milk comes from unorganized sectors, difficult for technological penetration into these markets (InvestIndia, 2021)
- Quality of milk becomes difficult to monitor, especially during transportation, which results in wastage of resources.

How can IoT devices help?

- Provides real-time tracking of cow health including heat detection, feeding time data, digestion alerts (Fitcows, 2024). .
- Able to real-time monitor the quality of milk (temperature, pH, fat content) (Afimilk, 2023).

Use Case of IoT Integration with Cowlar

- The wearable constantly monitors the cow's temperature and behavior (e.g. mating, eating, sleeping) of the animal through motion-sensing trackers.
- Data is fed into an algorithm to determine the cow health and any irregularities
- To accommodate to the customer's demographics, the app sends the farmers text message alerts on managing their cows.
- Trials in Pakistan claim to increase milk yield between 8 to 14% (Tech in Asia, 2016).



Predictive AI Model

Amul's Current Situation

- 43% of Indian farmers are small cultivators and most dairy farmers raise animals in a traditional way with low productivity.
- Limited knowledge of optimization of milk production

How can Predictive AI help?

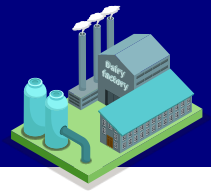
- Utilizing neural networks to predict future milk yield, using factors like genetics, health and nutrition and herd mates (Vries et al, 2023)
- Using vocal cues from cows which allows farmers to understand specific needs of cows to improve feed efficiency and reproductive management. (MooAnalytica, 2024)
- Allows small-time farmers utilize big data to improve overall yield.

Use Case of AI Modelling

cainthus

- Utilize predictive imaging to identify and tag individual animals based on their hide patterns and movements
- Data is converted into metrics (water intake, behavior) then is used to anticipate possible issues
- Improve overall efficiency and bridge knowledge gap.

https://www.cargill.com/2018/cargill-brings-facial-recognition-capability-to-farmers



Data Visualization

Amul's Current Situation

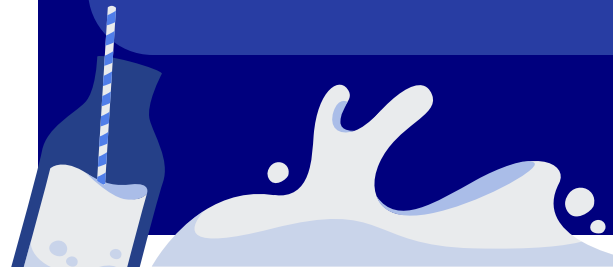
- No visibility across the entire milk products production process from source, production and sales to customers
- Operations is complex and require tangible metrics to determine overall production efficiency and yield

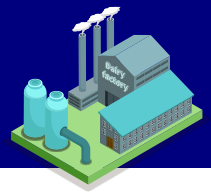
How can Data Visualization help?

- Combination of all critical factors e.g. from cow health, stock levels, production yield and distribution levels
- Dashboards can track key performance for various users
- Ensures quick decision-making, helping district unions optimize the dairy process and avoid bottlenecks.

Use Case of Mengniu

- Mengniu announced the world's first fully intelligent dairy factory in Jun 2023, with the highest labour efficiency ratio globally.
- The intelligent production system is monitored centrally with a visualization of key metrics
- Utilize digital means to connect consumer trends to collaborate between market, factory and supply chain.





Global Use

Blockchain

Trace milk sourced from New Zealand across to warehouses and factories in UAE for quality control (foodnavigator-asia.com, 2019).

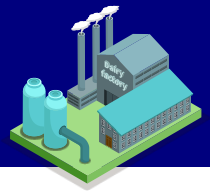
AI

Utilizing AI in pastures to analyse health, exercise, diet in cow ear tags before drawing precise and nutritionally balanced feeding formations (dairyreporter.com, 2021).

Data Visualization

Digitalize workflow for milk production processes, reduce human errors and enhance data visualization of metrics






Cost Benefit Analysis

Assumptions

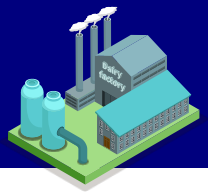
- Operating for 1500 cows (5 big farms)
- Average of 15% additional milk yield per cow [1], with baseline of 25 kg of milk per cow daily [2]
- Average retail price of milk per kg: 0.65 USD [3]
- Average cost reduction of 10%

*Please refer to the appendix/excel for the cost breakdown analysis

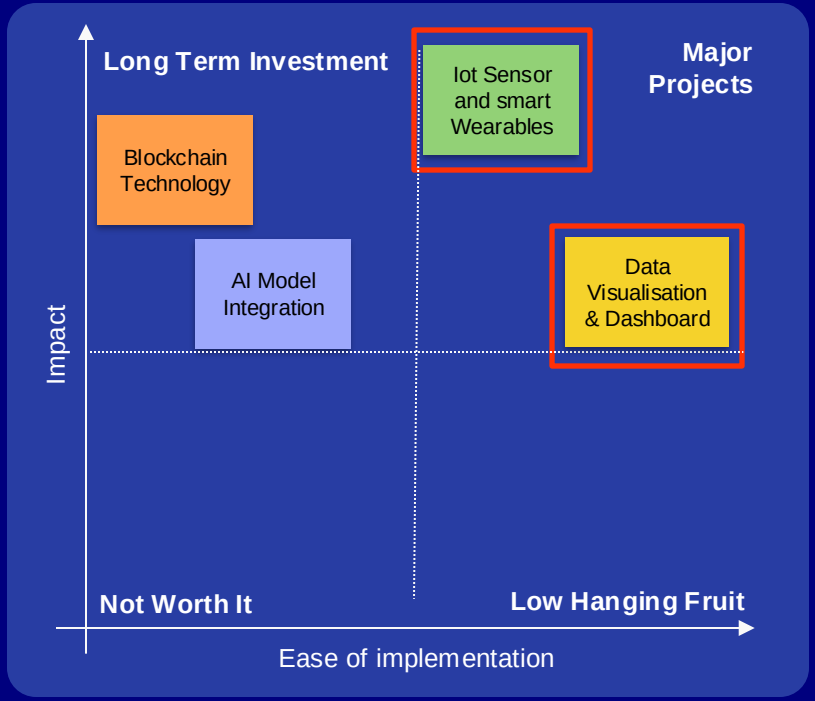
Year	0	1	2	3	4	5
Benefits	$0	$266,906	$266,906	$266,906	$266,906	$266,906
Total Costs	$366,455	$70,455	$70,455	$70,455	$70,455	$70,455
Data Visualization	$1,080	$1,080	$1,080	$1,080	$1,080	$1,080
IoT Sensors	$168,000	$18,000	$18,000	$18,000	$18,000	$18,000
Blockchain	$193,775	$47,775	$47,775	$47,775	$47,775	$47,775
Artificial Intelligence	$3,600	$3,600	$3,600	$3,600	$3,600	$3,600
Net Cash Flow	-$366,455	-$170,004	$26,448	$222,899	$419,350	$615,801

With the additional profits gained from the increase in yield and decrease in cost, we estimate that the farms will break even from Year 3 onwards.






Prioritization Matrix



Major Projects

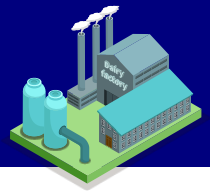
Data Visualization and Dashboards

Easy to implement with existing data tools (like Tableau). Provides immediate insight and control over operations.

IoT Devices (Cow Tracking)

Monitors health metrics to prevent production issues, improving yield. Requires investments in sensors but aligns with operations.



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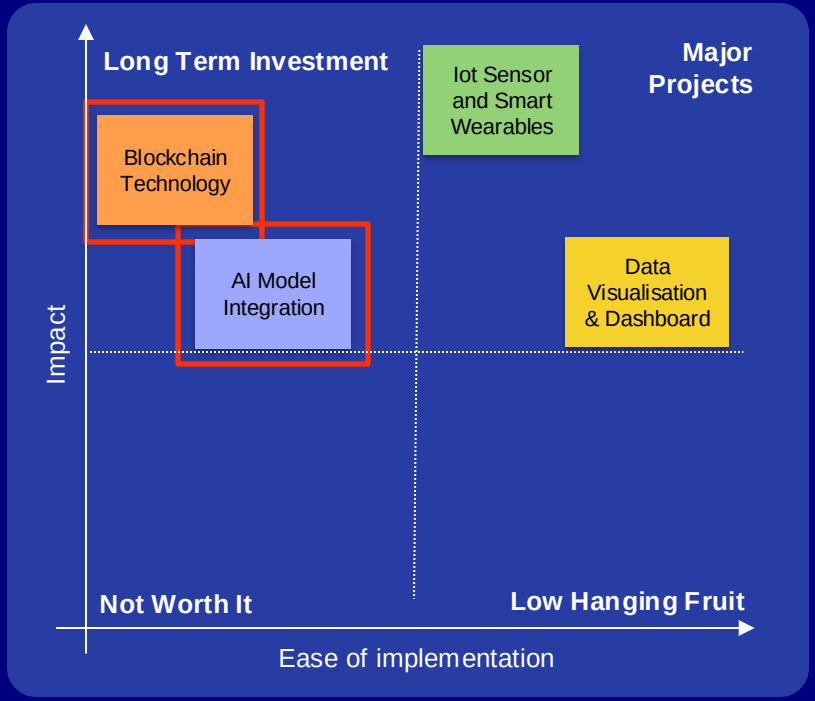


Long Term Investments

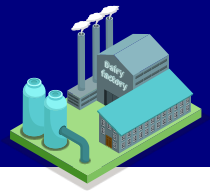
Blockchain Technology

High impact on traceability and payments but involves infrastructure and training investments.

AI for Cow Monitoring (Facial Recognition)

Great for advanced monitoring but harder to implement as it requires substantial technical resources and training.

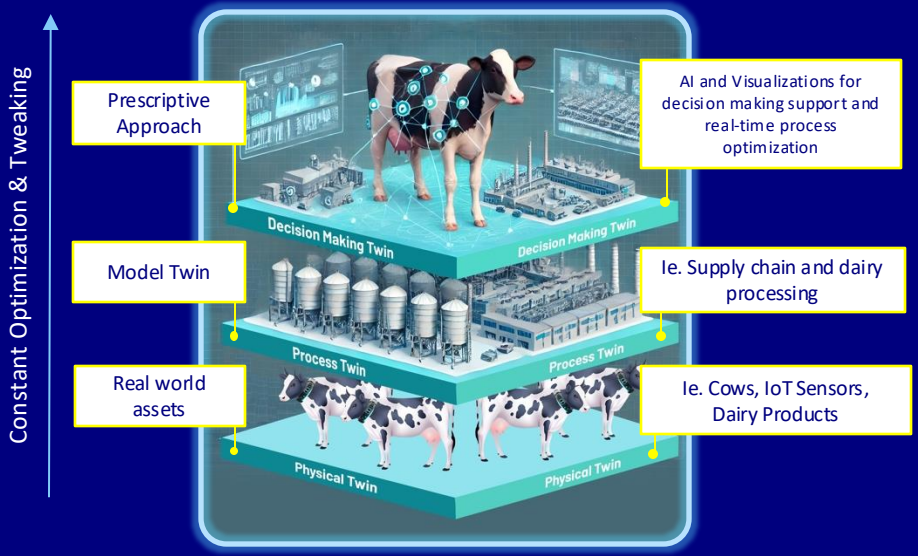






Digital Twin

Multi-layer Digital Twin



Simulate interaction between these layers to determine how I4.0 Technologies would enhance overall efficiency and profitability

Convergence of 4 Technologies

1. Dashboard and visualizations
2. IoT Integration
3. Blockchain
4. Predictive AI

Advantages

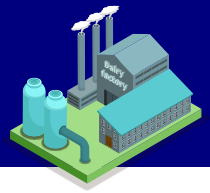
Improve CAPEX and decrease chance of cost overrun
reduce operational costs and improve ROI of strategic projects

Risk Management Strategies
Bowtie approach to having necessary contingencies to corresponding risks

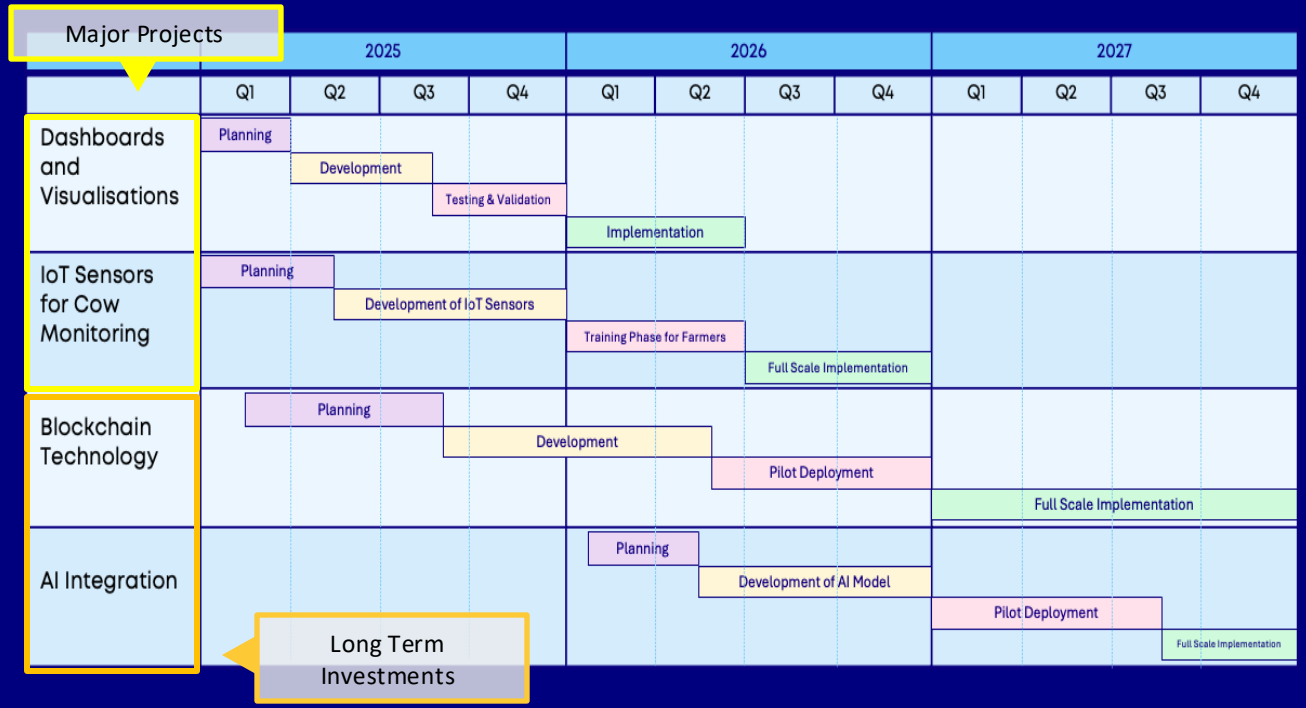
Accelerated time to market
Speed up real world deployment through validation of internal processes virtually

Strategic alignment with business goals
Simulate how technology contributes to the overall strategic objectives of Amul





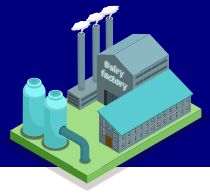

Gantt Chart



Key Highlights

- Multi-layered Digital Twin ran prior to project implementations
- Strategic Sequencing of Major Projects – Implementation of Major projects first
- Phased Rollout with Focused Training and Validation
- Major Projects serve as enablers for Long-Term Investments





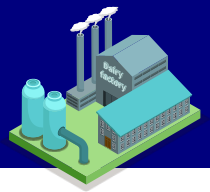

Conclusion

Key Benefits of Strategic Roadmap Implementation

Meets Business Goals and Key Objectives

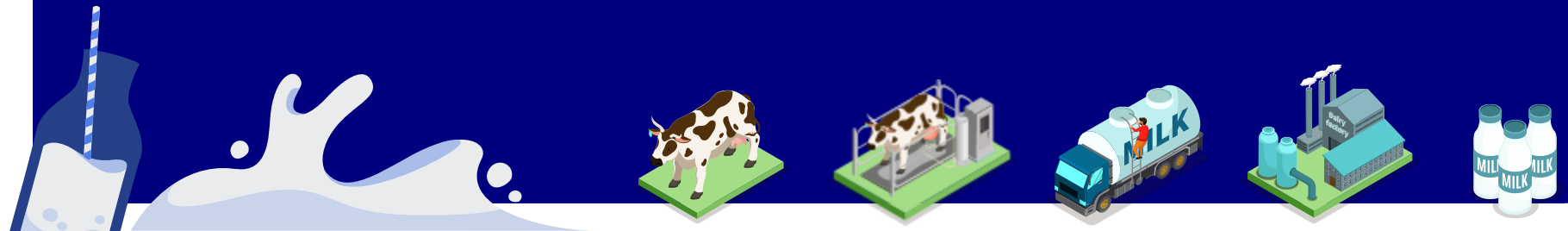
1. Enhanced Operational Efficiency
2. Improved Product Quality
3. Promoted Sustainable Growth
4. Data-Driven Decision-Making
5. Stronger Customer and Stakeholder Trust



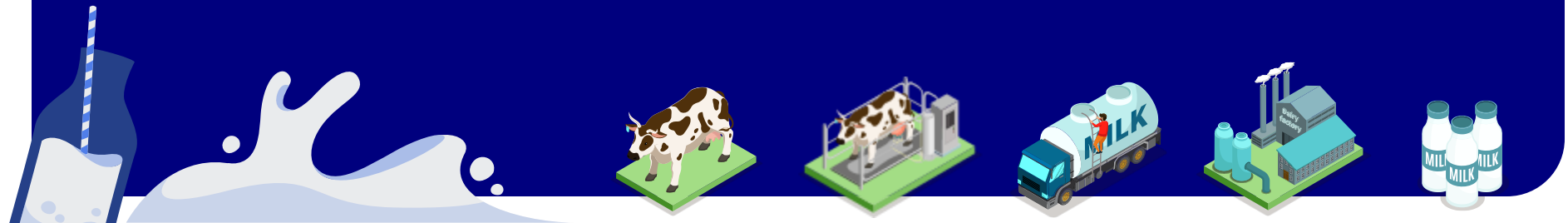

References

1. Afimilk. (2023, April 25). Advanced Cow Monitoring System and tools | Afimilk. https://www.afimilk.com/cow-monitoring/
2. Agarwal, S. (2010, June 6). Amul [Slide show]. SlideShare. https://www.slideshare.net/shikhs03/amul
3. Amul a pillar of India's dairy sector. (n.d.). Drishti IAS. https://www.drishtiias.com/daily-updates/daily-news-analysis/amul-a-pillar-of-india-s-dairy-sector
4. BNP Paribas. (2018). Cash Management. https://cashmanagement.bnpparibas.com/success-stories/amul-when-milk-supply-chain-takes-new-dimension#:~:text=Milk%20is%20purchased%20daily%20and,'cash%20and%20carry'%20basis.%20https://www.promptdairytech.com/blog/dairy-giants-like-amul-know-how-to-save-your-rs-10000-per-year/
5. dairyreporter.com. (2021, June 18). Yili Group explains how it drives dairy innovation. https://www.dairyreporter.com/Article/2021/06/18/Yili-Group-explains-how-it-drives-dairy-innovation



References

6. dairyreporter.com. (2024, May 2). Dairy trends unwrapped: Consumers seek added value, scrutinize claims. https://www.dairyreporter.com/Article/2024/05/02/Dairy-trends-unwrapped-Consumers-seek-added-value-scrutinize-claims
7. Fitcows. (2024, September 27). Milk Monitoring System Using IoT to Check Milk's Quality. Fitcows. https://www.fitcows.com/blogs/milk-monitoring-system-using-iot/
8. foodnavigator-asia.com. (2019, July 17). Blockchain for transparency: Nestle to pilot new tech on dairy in New Zealand. https://www.foodnavigator-asia.com/Article/2019/07/17/Blockchain-for-transparency-Nestle-to-pilot-new-tech-on-dairy-in-New-Zealand
9. History - AMUL Dairy. (n.d.). https://www.amuldairy.com/history.php
10. Kharrati, K. (2024, March 8). India dairy market size reach $290.8 billion 2033 - CMI Team. Custom Market Insights. https://www.custommarketinsights.com/press-releases/india-dairy-market-size/



References

11. Markets, R. A. (2024, March 26). Global dairy food market on the rise: expected to reach $1.1 trillion dollars by 2028. GlobeNewswire News Room. https://www.globenewswire.com/en/news-release/2024/03/26/2852837/28124/en/Global-Dairy-Food-Market-on-the-Rise-Expected-to-Reach-1-1-Trillion-Dollars-by-2028.html
12. Neethirajan, S. (2023). Innovative Strategies for Sustainable Dairy Farming in Canada amidst Climate Change. Sustainability, 16(1), 265. https://doi.org/10.3390/su16010265
13. Team, C. (2023, October 10). White Revolution: Operation Flood - ClearIAS. ClearIAS. https://www.clearias.com/white-revolution/
14. Tech in Asia. (2016). Tech in Asia - Connecting Asia's startup ecosystem. https://www.techinasia.com/cowlar-fitbit-cows-farmers
15. The Digital Milky Way: How Indian start-ups are transform. . . (2021). Invest India. https://www.investindia.gov.in/team-india-blogs/digital-milky-way-how-indian-start-ups-are-transforming-dairy-farming