Submission to the Australian Agricultural Traceability Alliance Sustainability Committee

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Key Points

- Under the leadership of SADA the SA dairy industry has formed a co-operative approach to industry which is endorsed by farmers, processors, regulators and the SA Government.
- This co-operative approach is captured in the South Australian Dairy Industry Action Plan 2024-2029 (successor to the previous plan 2019-2024).
- This plan incorporates a number of strategies including a key focus on sustainability.
- SADA has subsequently engaged in significant research to develop a distributed ledger-based technology that enables comprehensive oversight of the whole supply chain.
- This research has been completed and in its next iteration mechanisms for recording non-linear data will be developed, including tracing emissions production as part of recording the information stored on the ledger.
- This submission includes general outlines of the significant traceability work which has been completed to date by SADA and its partners including Woolworths, DairySafe (the state regulator), the Fleurieu Milk Company and six participating farms.
- This submission contains a general overview of the working prototype which has been created enabling the recording of significant data using hash transactions on the Hedera distributed ledger chain.
- This submission considers the next phase of technological development of the working prototype which has been created and how sustainability values can be incorporated into the ledger.

Assuring Sustainability Working Group submission

SADA has been deeply involved in planning for the future for a number of years. SADA has written and published two Dairy Industry Action Plans in South Australia. Those plans were the 2019-2024 and the 2024-2029 plans respectively. Both plans were the product of extensive consultation across the supply chain including input from processors, regulators and government agencies.

The 2024-2029 plan in particular has incorporated sustainability as a central plank. Consequently SADA has engaged in the development of traceability technologies (with a view to incorporating sustainability issues) which will be addressed in detail in this submission.

SA's commitment to sustainability – the SA Dairy Industry Action Plan 2024-2029

The 2024-2029 is the second Dairy Industry Action Plan in South Australia. The second plan builds on the solid foundations laid out by the first Dairy Industry Action Plan 2019-2024. In 2019, the South Australian dairy industry was not the co-operative continuum which it is today. The 2019 plan harboured at its core the need to create an aligned industry which worked towards a common goal of a thriving and premium jurisdiction.

In spite of challenges along the way, the core element of the 2019 plan has been achieved. At the expiration of the 20219-2024 plan time came to use that alignment to reach into the future and to create a future built on the foundations of that alignment incorporating sustainability as a central consideration.

The Dairy Industry Action Plan 2024-2029 cast in stone the ambitions of the earlier plan and incorporated the amendments which were necessitated by time and changing circumstances including an increased focus on sustainability.

South Australia has produced dairy products for over 150 years. Producing about five percent of Australia's Milk, the South Australian Dairy Industry committed itself to continuing to secure a position at the premium end of the national and international marketplace.

As global wealth, particularly in the Asian region continues to grow, opportunities for the positioning of South Australian dairy products also grow in markets that are largely untapped by a culture of dairy consumption.

Asia accounts for more than half of the world's population. That population is generating more disposable income with each passing year. It is becoming increasingly clear that the 21st century will be Asia's century. South Australian dairy aims to be part of that picture from New Delhi to Tokyo.

Nevertheless, the South Australian dairy industry's ambitions aren't just for Asia. The South Australian dairy industry is setting its sights around the planet to be globally recognised as one of the safest and greatest places to obtain world standard and sustainable dairy product.

The Action Plan is a deliberate and conscious expression of the industry's desire to make South Australia second to none in the world.

Why a new Plan for 2024-2029?

The 2019-2024 plan was about galvanising the mindset of all who are in the dairy chain.

The chain is represented by the cow, the farmer, the processor, the wholesaler, the retailer and the customer, each of which have a part to play in the process of getting milk from grass to glass or from paddock to plate. There are other components which impact the chain including regulators, social licence, and the environment.

In the past the dairy industry was considered in terms of its discrete elements. The ambition of bringing a world class product to the world demands that a segregated industry coupled with a segregated view of the supply chain is no longer a viable proposition.

Historically, compartmentalised thinking has meant that the relationship between producers and processors has eroded opportunity at the expense of the product overall.

The Action Plan represents a continuation of its predecessor in creating a vehicle by which all parts of the chain have a role in improving the image and the performance of the dairy product in the journey from cow to customer.

The plan seeks to galvanise supply chain participants into not only considering their discrete parts of the chain, but to also consider the needs, expectations and requirements of other participants along milk's journey to the customer.

The first Dairy Industry Action Plan did much to create the correct environment for growth. It worked because it was the product of broad consultation and agreement. The second iteration of the Dairy Industry Action Plan seeks to now use that environment to grow the seedlings which took root in the earlier plan.

The Dairy Industry Action Plan of 2019-2024 was adopted by the industry it served and became a touch stone for representative organisations that sought to advocate for the industry to legislators, ministers, governments, decision makers and others who had influence in the industry.

Consistent messages started coming from industry to those who had an effect on industry and positive outcomes arose.

The 2019 – 2024 Plan said, "*In short and industry that owns shared goals is an industry with a shared future*." That has proven to be true for the earlier Plan and remains true for the second iteration of the plan.

Historical Context of the SA Dairy Industry

The Dairy Industry Action Plan 2019 – 2024 provided a short history for context for the South Australian Dairy Industry. Those four years it also contributed to the history of the industry, with the impacts of COVID 19 being pronounced. The South Australian Dairy industry has followed, and be influenced by, the national and international environment.

In 1907 there were over a thousand small dairy farms in South Australia. With the passage of time the number of farms had steadily decreased to 241 farms by 2017-18, when the first Dairy Industry Action Plan was released. By 2023 the number of farms fell to 181, but these numbers need to be seen in context.

In the period after the second world war herds were generally about 70 cows. Today the average herd size exceeds 374 cows.

Herds have become larger, and cows have become more productive. SA's production was 474 million litres in 2022 – 2023. This represents 5.8% of the overall production in Australia.

The overall state herd has also become smaller in recent years. At the turn of the century the South Australian herd was 120,000 cows. By 2018 the state herd was 70,000. There are around 67,650 cows in production in SA in 2021 - 2022 with an average yield of 7,358 litres/cow. This compares with 3,650 litres/cow in 1985 and 6,820 litres/cow in 2018 - 2019.

In the two years preceding 2018 dairy markets locally, nationally and internationally faced a number of confronting issues.

The years 2016 and 2017 were difficult years for producers in SA and this was also experienced by the industry nationally and internationally, however by late 2017 South Australian exports were starting to show initial improvements in their volumes.

By early 2018 prices were showing some return but the movement was still muted.

Historically there have been sharp ebbs and flows in overall milk production in South Australia. In 1980 annual production was about 300 million litres. By 2000 that had increased to 600 million litres and the production for 2023-2024 was just under 500 million litres. In 2017 the state's annual production fell back to 487 million litres then rose to 497 million litres in 2021 – 2022.

Improvements in technology and animal husbandry has seen an increasing dislocation between herd numbers and productivity. Individual cows in the correct environment can now produce as much as 13,000 litres per year. This represents an output nearly twice the average for a cow in South Australia.

The Dairy Industry Action Plan 2024 – 2029 builds on the optimism outlined in the earlier plan with a strong focus on sustainable growth in a sustainable market.

In the past 5 years South Australia has demonstrated an inclination towards investment and technological change in the state. Robotic dairies and research into blockchain based traceability technologies reflect the faith that farmers, processors and related organisations have in the future of the industry.

The ongoing challenge for this Dairy Industry Action Plan is to continue to create an environment of consistent growth based on the export of sustainable premium dairy products to both the rest of Australia as well as the world coupled with sustainable conduct to protect the industry into the future.

Other industries, particularly wine, have already made their mark making wine one of the most lucrative exports for the state, but dairy is now emerging from the shadow cast by wine to establish itself as a premier industry using the latest in technology to create a future for dairy that will be second to none in the world.

The dairy industry in South Australia will continue to forge links with partners such as state and federal governments, trade organisations and Australian representatives overseas to advance the reputation of the dairy industry in this state.

The purpose of this current plan is to make South Australia the go to Australian jurisdiction for dairy and dairy products from buyers around the world.

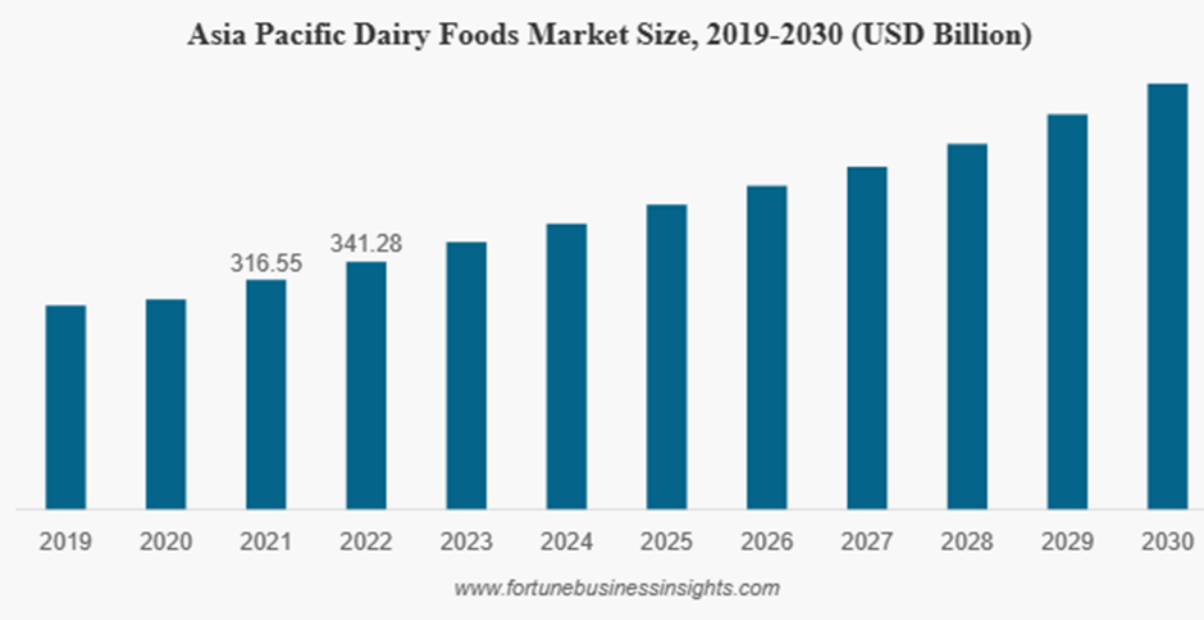
A growing taste for dairy and its implications for sustainability

In spite of the contraction which came with COVID 19 the dairy product continues to show strong signs of becoming increasingly popular in the international marketplace. As global wealth increases so does the demand for products derived from milk production.

South Australia remains in a strong position with its premium dairy products. Getting dairy products out to the world will be enhanced as South Australia will be able to demonstrate that it produces some of the cleanest and greenest dairy products on the face of the planet.

Growth is projected to continue into the foreseeable future and with countries such as Indonesia and other parts of Southeast Asia on our doorstep the opportunities will continue to emerge.

But in a competitive international marketplace South Australia will still have to say ahead of the game with our premium reputation as reputation alone doesn't guarantee success. Reputation has to be earned, maintained and demonstrable at all times.



A Commitment to Premium through sustainability

The Australian product is amongst the best in the world. South Australia is no exception to the rule, and we can justifiably claim to be among the best of the best. The taste for what South Australia does will be supported by traceability technology that will embed our deliverables in uncorruptible ledgers for all to see.

Premium will be more than just what is inside the package but premium will come to mean what is around the package such as proof of sustainability, fairness in trading, adherence to environmental standards and adherence to biosecurity standards all of which will have to be verifiable to anyone who seeks verification at any time.

Verifiably Premium and proof of sustainability

Technology is changing at an astonishing rate, and it is increasingly inserting itself into the dairy industry.

In the past 5 years the South Australian dairy industry has seen substantial investment in technologies, particularly on farm with many farms advancing their milking systems to accommodate greater capacity both in terms of cow numbers but also overall volumes of milk processed.

This has led to an increased capacity to harvest information from their systems. That information, while informative to the farmer, does not necessarily find its way to a greater audience.

Equally information is harvested by processors and again that information is used internally when it represents an overall picture of high standards of quality control.

Over the past 5 years it has become manifest that premium does not only attend to what is inside the wrapper but also what supports the assertion of premium.

Recently the South Australian Dairy Industry has positioned itself to become a world leader in traceability research. This research aims to create a distributed ledger/blockchain based system

which harvests information from all participants in the supply chain to prove premium. Moving forward if any jurisdiction is going to claim premium status, not only will it have to demonstrate the quality of the product inside the wrapper, but attention will also have to be paid to:

- Environmental impacts and carbon footprints
- Child labour/slavery standards
- Biosecurity guarantees
- Animal welfare standards
- Regulatory standards
- Quality standards such as ISOs
- Conveyance oversight and compliance

This non-exhaustive list will also need to be independently verifiable to the customer so that the claim of premium can be easily validated by the simple inspection of an independent and trustworthy ledger where this information is stored.

Currently, this technology is in its infancy globally, and the SA Dairy industry is at the forefront of the development of distributed ledger/blockchain technology to enable these standards to form part of our premium product.

The Dairy Industry Action Plan 2024-2029 commits South Australian dairy to the ongoing development of technologies which will ensure that standards are not only maintained but improved and moreover are verifiable to any person who asks.

Positioning the South Australian Product

On the global scale South Australia is a tiny part of the world's market. South Australia produces 5.8% of Australia's milk. Australia produces less than 2% of the world's milk and maintains high gate prices for farmers because of the operation of the Dairy Industry Code which sees processors competing for Australia's production.

Simply expressed, South Australia's dairy industry cannot compete in the world commodity market, having neither the volumes of product or the cost essentials in place to make such an approach viable.

In lieu of a commodity-based approach what the South Australian jurisdiction can underscore is an ability to offer premium produce to the world. The Dairy Industry Action Plan 2019 – 2024, the SA Government and a number of South Australian exporters have already positioned themselves via their strategic planning to take up the mantle of being premium producers.

The strong advantage for the dairy industry is its presentation to the world. South Australia is blessed with cobalt blue skies and fields of emerald green. South Australian cows can be presented, because they are, as the most content and well-tended animals in the world.

Coupled with verifiable standards, this capacity to present the South Australian product as clean and green builds on the premium standard that has been set.

The South Australian dairy industry believes this remains the correct approach and as such should be supported and endorsed by Governments, federal, state and local as well as other participants and decision makers who have influence and impact on the industry.

South Australian farmers should be prepared to look overseas and adopt the notion that for certain types of premium products such as cheeses there need to be specific breeds of cow to cater to the needs of the processor, and such flexibility is already recognisable in some dairy herds in SA.

South Australia Dairy's Position on International Arrangements

A premium product does not mean an exclusive attitude.

As the South Australian dairy industry positions itself in the international marketplace there are clear indications from processors that a greater supply in Australia is needed for both domestic and international reasons.

Over the past 5 years the focus upon China has diminished in light of international events. China has demonstrated a disposition towards weaponising trade on diplomatic grounds which has had a profound impact on other industries in SA. While nothing in the Dairy Industry Action Plan seeks to prevent trade with China, dairy will not create an environment of over reliance on a single market, particularly where that market has proven itself to be unreliable. Equally, the current US administration has indicated a disposition towards tariffs which will have to be considered as those policies become clearer over time.

South Australian dairy accepts that it is part of the global economy. South Australian dairy welcomes the investment by other countries in the local industry. It is acknowledged that the dairy industry is not only not immune from the challenges of the international marketplace but more over is intrinsically bound to it, with all of the challenges that accompany that internationalism.

Investment by foreign businesses in the premium product that the South Australian dairy industry offers is an expression of faith as well as a certain mechanism to participate in those marketplaces in other countries. Expecting entrée should be considered and approached as though it is a two-way street. A positive acceptance of foreign investment that reflects the ambitions and ethos of South Australian Dairy Industry Action Plan and the South Australian Dairy industry as a whole, will be embraced by the industry and expected of any such investor.

This includes a commitment to sustainability.

South Australia will support Free Trade Agreements which are genuinely free. Tariff walls and Geographic Indicators will remain barriers to free trade and the South Australian industry will not endorse arrangements which do not reflect a genuinely free market.

Partnerships that reflect our ambitions will have the effect of increasing the value and presence of the South Australian dairy industry throughout the world.

Driving Profit and Driving Productivity

Since deregulation in 2001 median prices have generally grown consistent with historical trends, however prices have been subject to much greater volatility. That volatility became manifest during the latter half of the 2010s where the retail price of milk fell well below the retail price of bottled water.

The Australian Competition and Consumer Commission (ACCC) investigated pricing practices and in 2019 placed responsibility of the harm which was being done to the industry at the feet of processors. Since that time a compulsory Dairy Industry Code of Practice has been passed into law, levelling the contractual playing field between processors and farmers.

SADA seeks to ensure that all participants in the supply chain are ensured of fair access to market coupled with fair treatment by other industry players based on good faith approaches to doing business. History has taught the Australian dairy industry that ruthlessness amounts to a short-term gain for long term pain.

Productivity reflects a demand. South Australia cannot be a participant in the lowest cost commodity supplier race. In the first third of the Asian century South Australia continues to compete in an environment of countries with lower overheads and wages that many of our competitors are possessed of.

Wages and costs will increase in Southeast Asia and India as they have in China and South Korea to almost western levels, but that will not occur within the immediate future.

As a jurisdiction, South Australia need to be able to fold efficiencies into profits, and those are profits which will come from a premium status. Premiumisation will provide for business performance and a stronger defence against rising problems in an oversupplied commodity space.

Dairy industry profitability is a fundamental driver in attracting new skills as well as retaining existing talent and expertise. Productivity growth will remain an important component as the industry seeks to retain an edge against the long-term downward price directions that affect products. Moreover, an increase in productivity growth which is better than those who we compete against transitions from being a shield of protection to a more assertive sword of competitive advantage.

As a sector, South Australian Dairy will be obliged to offer information in a way that easily transmits the commercial advantages of adaption, adoption and sustainable practices. This means transferring supply chain information to other parts of the chain to enhance accurate and robust decision making across all sectors, with a particular focus on the production component of the sector, hence the focus on traceability and distributed ledger/blockchain technologies.

This process demands a whole of sector focus, which includes partnerships with Governments, trade organisations and where necessary across commodity sectors. Priority will evolve to be given to systems that embrace these considerations across the supply chain.

Industry therefore will need to have technology that can measure stock performance, labour capacity, transport challenges, market penetration, sustainability, proper environmental practices and standards compliance as part of industry processes, all the while, maintaining an attitude of partnership at all points in the supply chain.

Sustainable both in presentation and practice

Environmental concerns form an important component of the Dairy Industry Action Plan 2024-2029.

In 2020 a systematic literature review on sustainable indicators and dairy industries showed that the sustainability indicators in the dairy industry are emerging and lacked comprehensive research.[1] The review found seven papers, highlighted indicators of the environmental, eleven of the social and eight economic dimensions, that may be considered fragile and initial. A sustainable supply chain framework for dairy farming operations will be a central consideration to address these challenges and ensure long-term sustainability. Such a framework can help to ensure that the dairy farming industry is socially, economically, and environmentally sustainable.

Sustainability is the practice of using natural resources responsibly today, so they are available for future generations tomorrow. This demand for sustainability is growing exponentially across the world and all manufacturers will not only have to have systems in place but verifiable systems to prove compliance.

Sustainability is a broad and complex concept that involves balancing the needs of the present and the future, as well as the economic, environmental, and social aspects of human activities. There are many definitions and interpretations of sustainability, but one of the most widely accepted ones is from the 1987 report by the World Commission on Environment and Development, also known as the Brundtland Commission. According to this report, sustainability is "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*."

Some of the main challenges and goals of sustainability are to conserve natural resources, reduce greenhouse gas emissions, prevent biodiversity loss, promote social justice, and ensure human well-being.

To achieve these goals, sustainability requires the collaboration and participation of various stakeholders, such as governments, businesses, civil society, and individuals. Sustainability also requires the adoption of innovative and responsible practices, such as renewable energy, circular economy, green technology, and sustainable consumption and production.

Given this definitional boundary, the Dairy Industry Action Plan and the South Australian dairy industry will position itself to deliver, as well as demonstrate delivery of, sustainable practices.

The Australian dairy industry has a Sustainability Framework which promises to provide nutritious food for a healthier world. The industry's commitment to addressing emerging sustainability issues is about keeping dairy in business for the long term and improving the industry's resilience to meet challenges as they come, including a changing climate.

The Australian dairy industry recognises it has a role to play in Australia's contribution to international sustainable development goals and intends to be an integral part of the national and global effort to address the world's biggest sustainability challenges. The framework has four commitment areas:

- Enhancing farmer livelihoods
- Improving the wellbeing of people
- Providing best care for all our animals
- Reducing environmental impact

The Dairy Industry Action Plan adopts those principles not only to develop sustainable practices but by being seen to engage in sustainable practices.

[1] Feil, A.A., Schreiber, D., Haetinger, C. *et al.* Sustainability in the dairy industry: a systematic literature review. *Environ Sci Pollut Res* **27**, 33527–33542 (2020). https://doi.org/10.1007/s11356-020-09316-9

Exports to develop a growing and sustainable future

For the industry to grow in South Australia, there must be a focus on the development of foreign markets.

The demand for domestically supplied milk remains strong in South Australia. It is a product that is well established and has been entrenched in the consumer psyche in South Australia for a very long time. Therefore the opportunity for expansion of this marketplace is unlikely unless some new use for dairy products is discovered, beyond normal population growth in the South Australian market.

The South Australian Dairy Industry Action Plan 2019-2024 identified an increasing middle class in Asia and Southeast Asia including China. That plan anticipated that the trade barriers with India would be lowered with the passage of time is has now become clear from negotiations between Australia and India that dairy will be quarantined from any FTA arrangements. Furthermore, the black swan event of COVID 19 did have a pronounced impact on trade arrangements with other nations.

Nevertheless, as with the earlier plan, the current plan still seeks to target countries such as Malaysia, Vietnam, Indonesia and Thailand because these nations are also seeing a greater level of disposable income with the passage of time.

It isn't anticipated that South Australian or even Australian product can compete with local markets in these countries either based on demand as a competing commodity or alternatively on cost.

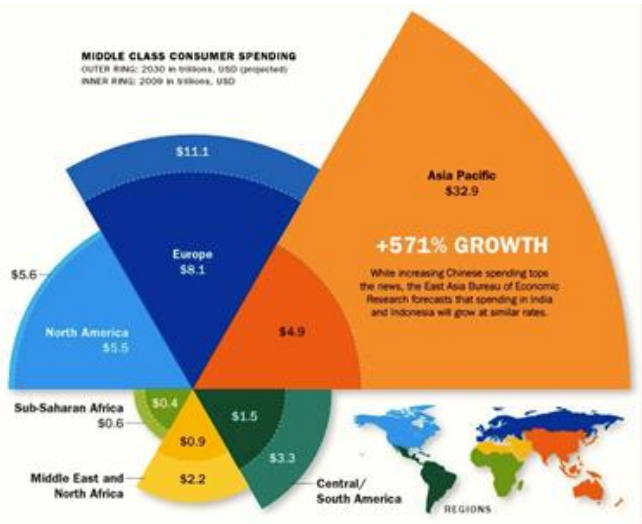
What South Australia possesses, remains, a reputation for being clean and that our products are untainted by the pollution of Asia.

The commitment to sustainability of the South Australian product will enables South Australia to overcome some of the cost differentials that exist with Australian products and our competitors in countries like China. As part of Dairy Industry Action Plan the South Australian industry will continue to monitor the emerging middle classes in these nations as it is that group of consumers that will be able to afford the more expensive South Australian product.

It remains important to position South Australia as being a producer of premier product.

Deregulation has positioned the industry to compete in global markets and South Australia has product that can, will and has successfully competed on the international stage.

The Dairy Industry Action Plan 2024 – 2029 commits the South Australian Dairy Industry to exploring and developing markets around the world with our attention firmly fixed on our near neighbours to the north.



Supply chain enhancement

Within the term of the current plan dairy producers and processors in South Australia will come to be reliant on a more robust and verifiable supply chain mechanism. Currently, the milk flow is compartmentalised by existing arrangements across the supply chain.

This compartmentalisation creates an increasingly unacceptable risk profile for participants in the supply chain. These issues can be addressed by creating a supply chain with increasing standards of monitoring along the chain. Dairies which use robotic technology or scanning technology are already in a better position to spot issues before milk leaves the farm, lowering risk to milk in tankers or in processor vats. Protecting the supply chain's integrity means lowering the risk profile. Innovation will be incentivised by lower risk profiles leading to higher profits.

Part of the process will mean better and more open communications across the whole supply chain, which will be confirmed by improving traceability technology. This will create mechanisms that have integrity so that each participant can trust in information shared on the traceability record thereby improving supply chain outcomes. This means transparent access to relevant parties to improve systems and streamline outcomes. As time passes this transparency will become an expectation expressed as contractual terms between parties in the supply chain.

On farm biosecurity

There are a number of farming practices that require the transport of feed on farm. Biosecurity standards and practices have seen improvements during the period of the operation of the first Dairy Industry Action Plan. Nevertheless, challenges in relation to movement of product such as substantial amounts of food to cattle on farm will keep its commitment to making certain that the risks of fodder production are limited in emerging farming models.

An Industry Focussed Flatter Milk Supply

Being able to offer consistency in milk volumes is an important element for milk processors. Dairies will be encouraged to find mechanisms which enhance a flatter milk supply from the state or even regions within a state. This will require collaboration between farmers and processors, and processors have already acknowledged flatter supplies by adding step ups to contracts where flatter supplies are offered by farmers. Consistency of supply is a central goal for the supply chain. Supply that is both reliable and predictable for processors means a better capacity for planning and growth of dairy products going forward.

Transport of Milk

Changes in vehicular and 'internet of things' (IOT) technology means a revisit of transport issues. In the previous Dairy Industry Action Plan it was noted that B double vehicles had an array of configurations that mean it is possible to reduce the number of visits by milk trucks to farms. This means that farms also have to affect changes to their storage systems and vat sizes. The current iteration of the Dairy Industry Action Plan will work to increase communications along the supply chain using IOT and developing traceability technologies. Vats, which talk to processors which in turn talk to transport companies via the internet will become a central component on the collection and delivery of milk from farms to processors.

As with the last Dairy Industry Action Plan 2019-2024, work is continuing to be done to address communication issues along the transport corridors which the industry relies upon. As IOT increases its presence effective rostering between processors, producers and markets will mean new efficiencies can be found across the supply chain.

Processor Advancement

In pursuit of demonstrable premium farmers and processors will increasingly become reliant on information recording and storage. As dairy consumption essentially stabilised in South Australia the ability for processors to get product into the growing international marketplace is the next important step in the post COVID 19 era. As supply chain integrity, verifiability and transparency will become an increasingly important component of the dairy industry globally.

Retail Involvement

The future of the supply chain involves a constant communication with the retailer in terms of the way various dairy products are presented on the shelves and how they are tracked through the supply chain. The involvement in by a major retail chain in dairy research in South Australia is reflective of the understanding and importance the retail sector brings to the need to be part of the supply continuum.

This includes reconsideration of product packaging and labelling to improve the retailer's capacity to present the dairy product to the consumer for verification purposes. A reliable supply chain stored on a distributed ledger will offer greater clarity for all participants in the supply chain including retailers.

For retailers improved value chain co-ordination also improves inventory control and responsiveness improving losses through spoilage and missed sales.

Consumer input

Traceability and distributed ledger technology will provide a direct vehicle for consumers to have input into products. Naturally, the best input a consumer can have is to leave a product on the shelf, but in a world where the consumer can trace a product back to a single processor, farm or even cow, then the consumer can pass their input directly back through the system.

Driving Innovation for monitoring sustainability matters

The industry as a whole must drive innovation. At the time of the South Australian Dairy Industry Acton Plan's launch farmers, processors, technology companies and representative organisations are committed to research which seeks to improve the supply chain and its transparency. This is a direct result of the earlier Dairy Industry Action Plan being implemented, but the work cannot stop as it is still, at the time of launching the second iteration of the Dairy Industry Action Plan, in its infancy.

Nevertheless, the quality of co-operation needed for such work will be vital in creating a future that can embrace the ambitions of the South Australian Dairy Industry Action Plan. Getting each participant in the supply chain to step back and look what they do must be incentivised by outcomes.

Getting people in the chain to take the risk of communicating with others in the chain in full and frank ways will lead to better understanding and more open discussions. Agreements between players across the chain which contain protection for participants must become an essential part of the communication process so that the best technologies can support the best products. This will be reflected in all areas including:

- Getting produce on farm/biosecurity
- An Industry Focussed Flatter Milk Supply
- Transport of Milk

- Processor Advancement
- Retail Involvement
- Consumer input
- Driving Innovation

A Centre of Excellence to develop a sustainable industry

South Australia is a state with a rich history and potential in the dairy industry. South Australia produces just under 500 million litres of milk annually, which accounts for 5.8 % of the national production. The state has just under 200 dairy farms, mostly located in the Southeast, Fleurieu Peninsula and Barossa Valley regions. The dairy industry contributes about $700 million to the state's economy and employs over 2,500 people directly and indirectly.

However, the dairy industry in South Australia also faces many challenges as well as opportunities in the changing global and domestic markets. Some of the challenges include increasing costs of production, environmental sustainability, animal welfare, biosecurity, consumer preferences, and competition from other regions and countries. Some of the opportunities include innovation, value-adding, diversification, niche markets, and export potential.

To address these challenges and opportunities, South Australia needs a dairy centre of excellence that can provide leadership, research, education, and extension services to the dairy industry and its stakeholders.

A dairy centre of excellence would be a hub of excellence and innovation that would bring together the best minds and resources from the government, industry, academia, and community sectors. A dairy centre of excellence would aim to achieve the following objectives:

- To enhance the productivity, profitability, and resilience of the dairy industry in South Australia through research and development, technology transfer, and adoption of best practices.
- To advance the development of sustainable practices across the dairy supply chain.
- To support the development and growth of the dairy value chain in South Australia including processing, manufacturing, marketing, and distribution of dairy products.
- To foster the skills, knowledge, and capacity of the dairy workforce in South Australia including farmers, processors, service providers, educators, and researchers.
- To promote the social, economic, and environmental benefits of the dairy industry to the wider community and consumers in South Australia, Australia, and overseas.
- To collaborate and network with other dairy centres of excellence, organisations, and institutions at the national and international levels to share information, expertise, and resources.

A dairy centre of excellence in South Australia would be a strategic investment that would benefit not only the dairy industry, but also the state and the nation as a whole. It would enhance the competitiveness and sustainability of the dairy industry, create more jobs and income, stimulate innovation and entrepreneurship, and improve the quality and diversity of dairy products. It would also contribute to the food security, health, and wellbeing of the population, and support the regional development and social cohesion of the state.

To achieve the ambitions of the current iteration of the Dairy Industry Action Plan South Australia needs a dairy centre of excellence to realise its full potential and opportunities in the dairy industry,

and to ensure its long-term viability and success.

SADA and SA based dairy processors have made a substantial contribution to the development of a bid to the SA government in support of such a centre of excellence by creating a project development document, budget and commitment to the contribution of land to such a centre of excellence in SA.

Creating a Workforce which understands sustainability

The dairy industry remains a vital part of the agricultural economy and the rural communities in South Australia.

According to the South Australian Dairy Industry Snapshot, the state's dairy industry accounts for a substantial contribution in generated revenue and employs 2,500 people directly on farms and in processing plants. The industry also produces high-quality dairy products that are sold in domestic and international markets, targeting the premium end of the consumer demand.

However, the dairy industry in South Australia, as well as in other parts of Australia, faces some significant challenges and opportunities in terms of its workforce development. One of the main challenges is the shortage of skilled labour at all levels of the industry, from farm managers and workers to processors and marketers.

The 2020 National Dairy Farmers Survey found that 70 per cent of farms with 500 cows or more reported difficulties in recruiting staff. Some of the factors that contribute to this challenge are:

- Inadequate business profit to employ more workers as the dairy industry is subject to market and climate volatility, which affects the profitability and cash flow of dairy farms. Many farmers struggle to pay competitive wages and offer attractive working conditions to retain and attract workers.

- Negative perception of the jobs in the industry as the dairy industry is often perceived as a low-skilled, low-paid and physically demanding sector, with long and irregular hours and limited career prospects. This perception discourages many potential workers, especially young people, from considering a career in dairy.

- An ageing workforce as the average age of dairy farmers in South Australia is 56 years, and many of them are approaching retirement without a clear succession plan. There is a need to attract and develop the next generation of dairy farmers and leaders, who can bring new skills, ideas and innovation to the industry and who understand the importance of sustainable practices in the industry.

To address these challenges and create a workforce that can support the growth and sustainability of the dairy industry in South Australia, some of the possible opportunities are:

- Investing in training and education - The dairy industry will provide more opportunities for training and education for its current and future workforce, both on and off the farm. This includes offering formal qualifications, short courses, workshops, mentoring and online learning, that cover a range of topics such as animal health, business management, technology, environmental management and marketing. Training and education can help improve the skills, knowledge and confidence of the workforce, as well as enhance the image and reputation of the industry as a professional and rewarding career choice.

- Promoting the diversity and innovation of the industry - The dairy industry will showcase the diversity and innovation of its products, processes and practices, to attract and retain a diverse and talented workforce. This includes highlighting the different types of dairy farms and products, the use of technology and automation, the adoption of best practices for animal welfare and environmental sustainability, and the opportunities for value-adding and niche marketing. Promoting the diversity and innovation of the industry can help demonstrate the variety and quality of the jobs and careers available in dairy, as well as the potential for creativity and entrepreneurship.

- Building partnerships and networks - The dairy industry will build stronger partnerships and networks with other stakeholders, such as government, education providers, research organisations, service providers and community groups, to support its workforce development. This includes collaborating on policies, programs and projects that can address the workforce challenges and opportunities, such as labour market analysis, workforce planning, recruitment and retention strategies, skills development, career pathways and recognition. Building partnerships and networks can help leverage the resources, expertise and influence of different stakeholders, as well as foster a sense of belonging and pride among the workforce and the wider community.

Creating a workforce for the dairy industry in South Australia is a complex issue that requires a strategic and collaborative approach from all industry participants and partners. By addressing the challenges and seizing the opportunities, the dairy industry will ensure that it has a skilled, diverse and innovative workforce that can drive its growth and sustainability in the future.

Emerging Challenges & Opportunities through a sustainability lens

Biosecurity

As with 2019 when the first Dairy Industry Action Plan was launched, in a world of increasing movement biosecurity incidents will become and increased risk over time. This was reflected in the Foot and Mouth as well as the Lumpy Skin Disease scare of late 2022. Working in partnership with the whole supply chain and government the dairy industry in South Australia commits to its role in being outbreak ready in the case of a disease and further commits to making certain that other bio-security threats are minimised. This includes having an effective response to diseases like Bovine Johne's Disease and other recognised maladies in dairy cattle. Where necessary the industry will continue to throw its weight behind research that makes our industry more insulated from biological threats.

Changing Technologies

In an everchanging world the dairy industry in South Australia will not only embrace technology as it is developed but rather actively participate in the development of technology such as distributed ledger technology to advance South Australia to global industry leader.

Animal Welfare

The ethical treatment of animals will continue to be an industry priority. The South Australian Dairy industry acknowledges that there is an increasing expectation that animals will be treated respectfully and carefully into the future. This means a continued commitment to abandoning redundant practices and the use of humane systems of management including pain relief where

required.

Planning issues

With increasing demands on land and different expectations on land, title, use and planning issues will be an essential component of the development of the industry. This means working with Government and competing title holders, to make them an important part of the planning process for the industry moving forward.

Water

The South Australian Dairy Industry commits to using water in a responsible and sustainable fashion. This includes the responsible and sustainable use of on farm effluent and waste solids as well as the careful extraction, harvesting and collection of water from various sources to be applied to the production of milk for the benefit of all in the supply chain.

Government Relationships

There is no industry which works in splendid isolation from the influences of Government be it local, state or federal. The industry will increase its political positioning moving forward seeking to develop an increasing presence in the government sphere to enable positive relationships to develop with a view to legislative and policy structures that will suit industry.

This includes working with various regulators who either directly or indirectly maintain a policy interest in the dairy industry at any point along the supply chain.

Our work with methane capture

SADA has already spent money on researching dung beetles as a vehicle to sequester carbon as well as funding feasibility research into generating electricity from manure.

The major source of greenhouse gas emissions on dairy farms is enteric methane (CH_4) produced by methanogen bacteria in rumen (55% of emissions). This methane is burped out by cows as part of the rumination process. Methane and nitrous oxide (N_2O) from animal manure are the second largest source of emissions.

Carbon dioxide (CO_2) is emitted from farm diesel consumption and coal-fired power stations used to generate electricity used on dairy farms. There are also emissions associated with production of grain, fodder and fertiliser bought onto the farm (pre-farm embedded emissions).

As methane is a far more assertive emission than carbon (a ratio of 84:1 over a twenty-year period), SADA has chosen to look closely at those emissions as an opportunity to use that methane as a fuel.

Decomposition of herd effluent is also a substantial source of methane production, particularly where that effluent is collected in high concentrations such as primary settling ponds on Total Mixed Rations (TMR) systems or hardstands near dairies where cows accumulate.

Therefore, implementing strategies to reduce emissions in dairy cattle will benefit the environment and the economy. Although most of the variation in methane production is due to non-genetic factors (such as feed and handling), the animal genetics can be notably used to reduce methane production in cattle due to its influences on the ruminal microbiome composition.

Notably:

- Currently in South Australia some growers are selecting breeds with the express intention of limiting methane production.

- Also, the work with seaweeds to eliminate methane from cow burps is advanced with two commercial projects currently under development in South Australia.

However, neither of these approaches offer a solution for methane that is generated from effluent.

SADA has already conducted two preliminary investigations of a farm in South Australia for its suitability for an effluent methane/power generation system. Bioenergy generation is achieved by converting an effluent lagoon into a Covered Anaerobic Lagoon (CAL) to generate electricity from biogas. Implementation of this approach is less capital intensive as compared to the traditionally engineered digesters, which offer an economy to farmers.

Typically, the capital cost for implementing a fully operational CAL system is higher than a pilot plant. Pilot plants, while cheaper to establish do not provide a fully operational CAL system.

Typically, a Combined Heat Power (CHP) engine cost is one third of the total capital cost of a methane project. In such a project initially biogas generation, organic loading rates and other parameters are assessed. Once assessed a suitable size CHP engine is installed for electricity generation. In this option, heating of the CAL will need to be completed during the process for optimum production of biogas.

SADA is currently working on a fully operational system which should be developed for converting existing infrastructure on the proposed farm into a fully operational CAL.

The anticipated payback for a fully installed system would, converting existing infrastructure into a CAL, be in the range of 4-5 years.

Operational systems can be developed while operating the waste to energy plant and this can become a good demonstration site for other dairy owners. Awareness about climate change and cost-effective greenhouse gas reduction in the dairy sector will be maximised by implementing a waste to energy project.

Such a project achieves not only economic benefits but also environmental benefits for the dairy sector and the region.

Based on the work already done by SADA, a fully developed demonstration CAL will be installed at a dairy when a participating dairy can be identified. After installation of these systems, it will be important to continue to assess outcomes of the system to fine tune the gasses that can be recovered for the purposes of electricity generation. Therefore, while feasible such an installation would still be in part, experimental.

The expectation is that the ponds would make the site substantially independent of the electricity grid should the project go ahead.

Exact greenhouse gas reduction for dairy operations at the trial farm, will be calculated with further development of a standard for implementation in other dairies.

The South Australian Government has articulated an emissions reduction target of 50% reduction in emissions by 2030. Dairy farms, by virtue of their operation already provide opportunities to readily reduce emissions by the application of careful management.

SADA's ambitious target will be assisted by support for expanded trials surrounding a number of technologies such as sequestration using dung beetles and tapping methane as an energy source.

Our work with EPA compliance

SADA and the state EPA continue to work in advancing compliance with state environmental laws and finding mechanisms to use on farm effluent as a source of energy and nutrients on farm rather than a waste product that merely needs to be disposed of. SADA has actively designed a number of on farm effluent systems which have been approved by the EPA in SA.

Distributed Ledgers, Sustainability and the Tokenisation of Real-World material items

The purpose of this section of this submission is to outline the work which is being done by SADA to advance the tokenisation of real-world material items so that they can be tracked on a distributed ledger. SADA has completed two trials of increasing complexity to demonstrate the practical application of this technology.

This includes the ability to track not only assets but also other real-world objects such as carbon and its equivalents.

Please note that some of the material in this submission is commercially sensitive. The information in this document is only to be used for the purpose of the sub-committee of the Australian Agriculture Traceability Alliance for sustainability purposes. This document is not for distribution beyond the committee absent written permission of SADA for dissemination beyond this purpose.

Introduction to ledgers and how they can record inputs into a supply chain

The South Australian dairy industry and the South Australian Government have adopted the South Australian Dairy Industry Action Plan 2019-2024.

This plan's adoption from participants in the SA Dairy supply chain and subsequent adoption in the South Australian Government's growth ambitions which in turn has been adopted by the South Australian Government as the State's policy.

SADA has taken the lead in the exploration of these technologies by partnering with Datahash Pty Ltd, a South Australian distributed ledger development company.

This lead has resulted in expenditure by SADA in conducting a trial of distributed ledger-based technology in South Australia as a proof of concept.

Those trials, which were completed using the Hedera Hashgraph ledger, are now approaching successful completion. It resulted in the technology proving effective operational capability along existing supply chains.

SADA in partnership with Datahash now intends to move forward with the development of a ledger capable of recording information important to establishing proof of sustainability.

Distributed Ledgers – What are they and how do they work?

Distributed ledger technology is a digital or binary system that records transactions related to assets and goods both tangible and intangible. Transactions on a distributed ledger, as well as other

information relating to a transaction, are simultaneously recorded at discrete places on computers that support the distributed ledger as a whole.

Information on a database recorded on a distributed ledger does not include an administration system or central data storage. Rather, the database exists among multiple unrelated computers across different geographical locations, which are run by unrelated parties.

Distributed ledger technology permits users to record, share and synchronise data and transactions across a distributed network. The network is made up of numerous unrelated participants.

Distributed ledger technology, as well as information stored on the ledger, can be classified as either public or private. The classification depends on the pre-set accessibility protocols of the ledgers by anyone or by their devices. These devices are generally referred to as nodes. These nodes serve the overall ledger. Depending on the system, the ledger can be classified as permissioned or permissionless based on whether participants require permission from a certain entity to enter information onto the ledgers.

Distributed ledger technology has been identified as being useful for many applications, such as government financial systems, clean energy and manufacturing, and can help to improve existing processes. Distributed ledger technology removes the requirement of a central record keeping system, hence it can increase the speed of transactions. Moreover, it can reduce transaction costs.

Since the records are held at each network node, manipulating or successfully attacking the record is exceedingly difficult and therefore distributed ledger technology is believed to be a more secure way to keep business records. As the information is shared across a network, distributed ledger technology provides a more transparent and secure means of managing records.

Blockchain and distributed ledger technologies are frequently used as synonyms. However, both are different. Blockchain uses many technologies for applications. Distributed ledger technology is one of them. Blockchain is a form of distributed ledger technology that uses cryptography. This makes it effectively impossible to manipulate a record. It is unchangeable and distributed ledgers are used for recording transactions, tracking assets and recording the execution of contracts. Blockchain and similar technologies ensure security, transparency and trust in different types of transactions involving digital, and increasingly, real world assets.

In blockchain technology, as the name suggests, data is organised and stored in packages known as blocks and those blocks are chained together. The blocks in the chain cannot be edited, as blockchain technology allows only the addition of more blocks of data.

Furthermore, blockchains are usually public, implying that transaction histories can be viewed by anyone. In a blockchain, anyone can become a node and participate in the operations. Thus, blockchain is permissionless.

Alternatively, not all distributed ledger technologies necessarily use chains of blocks. Where they do not, they still employ cryptographic validation. Distributed ledger technology creates a ledger in a decentralised way for obtaining consensus from the participants who do not automatically have a trust relationship with each other. Hence, new information is added only when all the participants consent to the action.

Unlike blockchains generally, distributed ledger technology usually imposes restrictions on its access, use and who is permitted to be a node. Nevertheless, as a technology it uses cryptographic signatures to timestamp a new entry automatically.

Distributed ledger technology provides both public and private features. Also, it can be both permissioned and permissionless. Permissioned and permissionless systems are systems which either require authorisation from a governing body to use the system or alternatively a system where anyone can use the system without the permission of a governing body. In more mature distributed ledgers bodies are less prevalent.

Why Hedera Hashgraph?

Hedera Hashgraph is a distributed ledger project which currently is still a governed ledger. There are currently 39 businesses and corporations which form the governing council of the project. These businesses include Boeing, IBM, Google, LG, Deutsche Telekom, Standard Bank and Eftpos. These businesses are time limited in their role and participants are drawn from multiple interest groups including information technology companies, academia, supply chain managers, retailers and communications companies.

The ledger is the brainchild of Dr Leemon Baird who created the system to attend to some of the limitations which blockchains are subject to, particularly scalability.

Any distributed ledger or blockchain is impacted by a 'trilemma'. This trilemma means that a chain is either secure, widely distributed or slow. Blockchains like Bitcoin are extremely secure and are widely distributed with the resulting impact that they are slow, processing about 7 transactions per second. By way of example, Visa executes about 1,600 transactions per second. Similar blockchains like the Ethereum network execute at about 15 transactions per second. This makes the transactions expensive, and scalability becomes a problem in these traditional systems.

Hedera Hashgraph has a 10,000 transactions per second capability because of the protocols which have been designed into it, without diminishing its security. The system is designed to also be inexpensive as transactions on the system typically cost one ten thousandth (1/10000) of a US cent to execute. This capacity to sidestep the trilemma is the product of the protocols (non-blockchain but still a distributed ledger) the system uses.

Combined with the calibre of the governing council, and at those speeds and costs, the project and its ledger are difficult to resist for the purposes of the proposed Beta trial.

For more information on Hedera Hashgraph please visit: Hello future | Hedera (www.hedera.com)

Datahash and their role

Datahash Pty Ltd is an Australian data company. Over the past four years Datahash has built and immutable Event Ledger (and advanced database) and an application programming interface (API). The Event Ledger records certain agricultural supply chain information, while the API allows this data to be seamlessly exchanged with other users' systems.

Datahash's Event Ledger operates on Hedera, an enterprise grade distributed ledger technology (DLT), and as pointed out above, that is governed by up to 39 of the world's largest companies, academic institutions and non-profits, including Google, IBM, Boeing, LG, Deutsche Telekom, Nomura, Standard Bank, UCL and Eftpos.

Datahash is currently one of the only two agricultural companies operating on Hedera. The use of Hedera means Datahash has inherited superior properties of trust, scalability, security, stability and fair ordering. Datahash supports the tokenisation of all supply chain assets such as goods, money and contracts.

Hedera is the third generation of what is commonly called 'blockchain'. Generation one (Bitcoin) and two (Ethereum), are traditional blockchains. Hedera is also a public ledger, but overcomes the challenges of time, cost and energy consumption through its unique application of gossip and virtual voting protocols. Hashgraph is an alternate distributed ledger protocol to blockchains and the only authorised ledger is Hedera Hashgraph. Hedera's native cryptocurrency is HBAR, ($\hbar$).

The Hedera patent of the Hashgraph algorithm prevents forking and therefore protects all HBAR value. (Forking is when competing development teams take open-source code and create their own block chain variants, which duplicates tokens on the network, and potentially undermines all the value stored on the network).

Datahash's API is 'smart' because it allows simultaneous access, validation, and record updating on a network that's spread across multiple entities and locations. This is important as it allows for the transparent transfer of ownership, transaction recording and asset tracking and in an environment where trust is confirmed via a third party using digital payment methods.

Results of the trials

The alpha trial achieved its objective of proving the concept that critical supply chain data could be immutably recorded to a distributed ledger and viewed by a third-party consensus service. It also produced a user interface (UI) that can be used to audit or verify claims of the product.

It was highlighted in this alpha trial that dairy supply chains are highly complex, for this reason any system that has to track the supply chain must make allowances for this complexity. This means that material movements are not linear, blending and splitting of material is common and there is high variability of recipes and processes.

Accordingly, the system must be flexible and should eventually be configurable by the administration users from the dairies. This was one of the main issues that occurred during alpha testing. For the alpha trial the configuration of operations and forms was performed by Datahash in conjunction with the trial site businesses.

The alpha trial did identify a number of challenges, peculiar to the dairy industry and the technology was adjusted to accommodate some of these challenges. The beta trial addressed these issues with updated technology and improved UI systems over a greater span of the supply chain, namely from the cow to the loading dock of the retailer.

Ultimately, it is the nature of software development to improve the software over multiple iterations. For the Datahash Dairy application, the feedback from all Trial Site Businesses was generally positive. This bodes well for using the application as a regular part of logging the supply chain within the dairy industry.

The Datahash Event Ledger has recorded immutable data, meaning the data are available indefinitely and cannot be tampered with. Data events are encrypted as a message on the Hedera Consensus Service Network (Hedera Hashgraph proofs).

These two functions allow us to ensure data provenance so the complete history of a data event could be retrieved (if necessary) with Hedera Hashgraph proofs testifying to that history.

The importance of this function is to allow accurate data synchronisation between systems as well as independent verification of events where necessary for compliance-based activities. These are recorded as hash transactions. See figure 2 below.

What does it look like?

The beta trial, which is very close to completion has built on the alpha trial to a functional model which has proven to be operationally functional.

The figures below (figures 1 & 2) represent how the information collected is displayed on an iPhone. The display on a normal web browser enables any person who scans a QR code on a bottle of milk to trace the material to source, in this case the Brokenshire farm.

The final panel shows the Hash Transaction which verifies the transaction on the ledger. Each such transaction is reviewable by clicking on the "View" as it appears on the display.

It is important to note that where a participant in the supply chain has a web site a link will be provided linking the website to the UI so that any customer can click directly on the link to visit the part of the supply chain they are interested in.

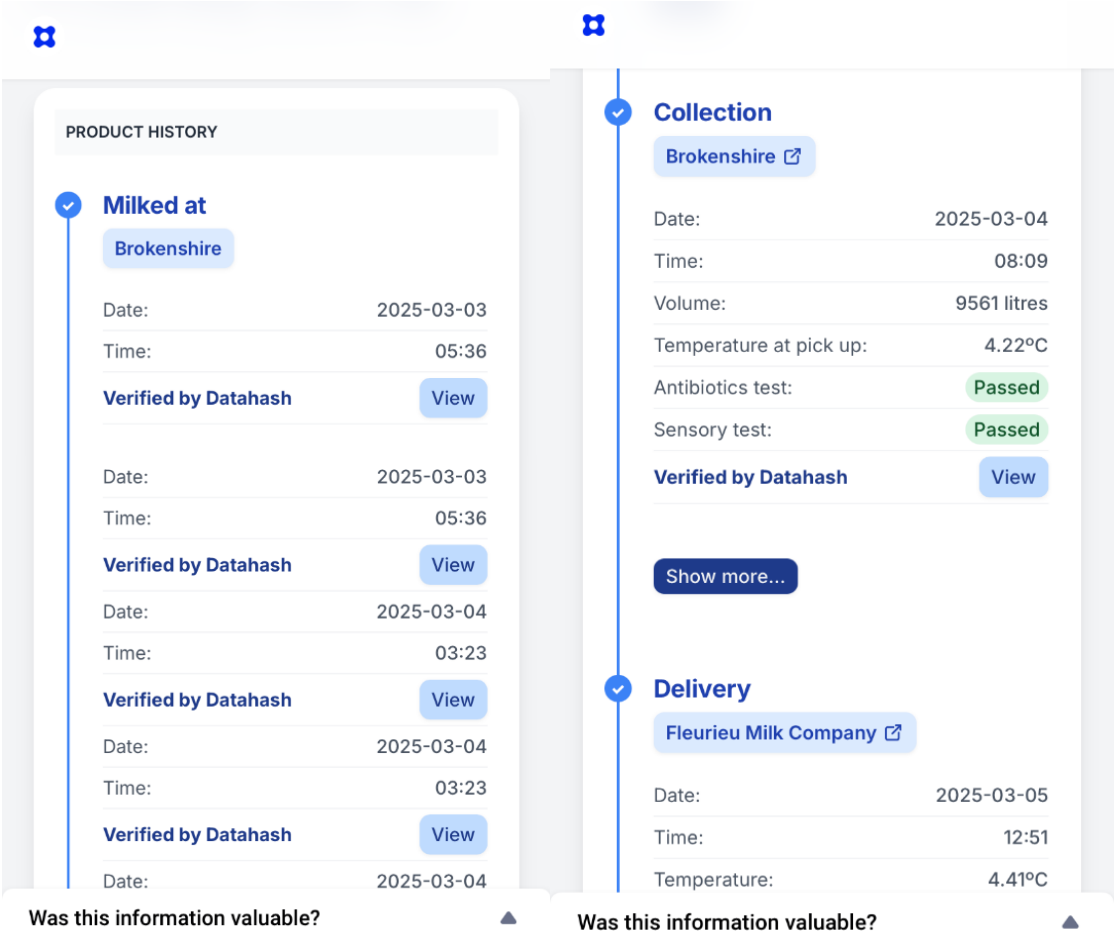


Figure 1 – The Supply Chain on an iPhone display after scanning the milk bottle QR code. This will be available to any customer who scans the QR code to verify the integrity of the journey that the milk has taken to get into the customer's hands.

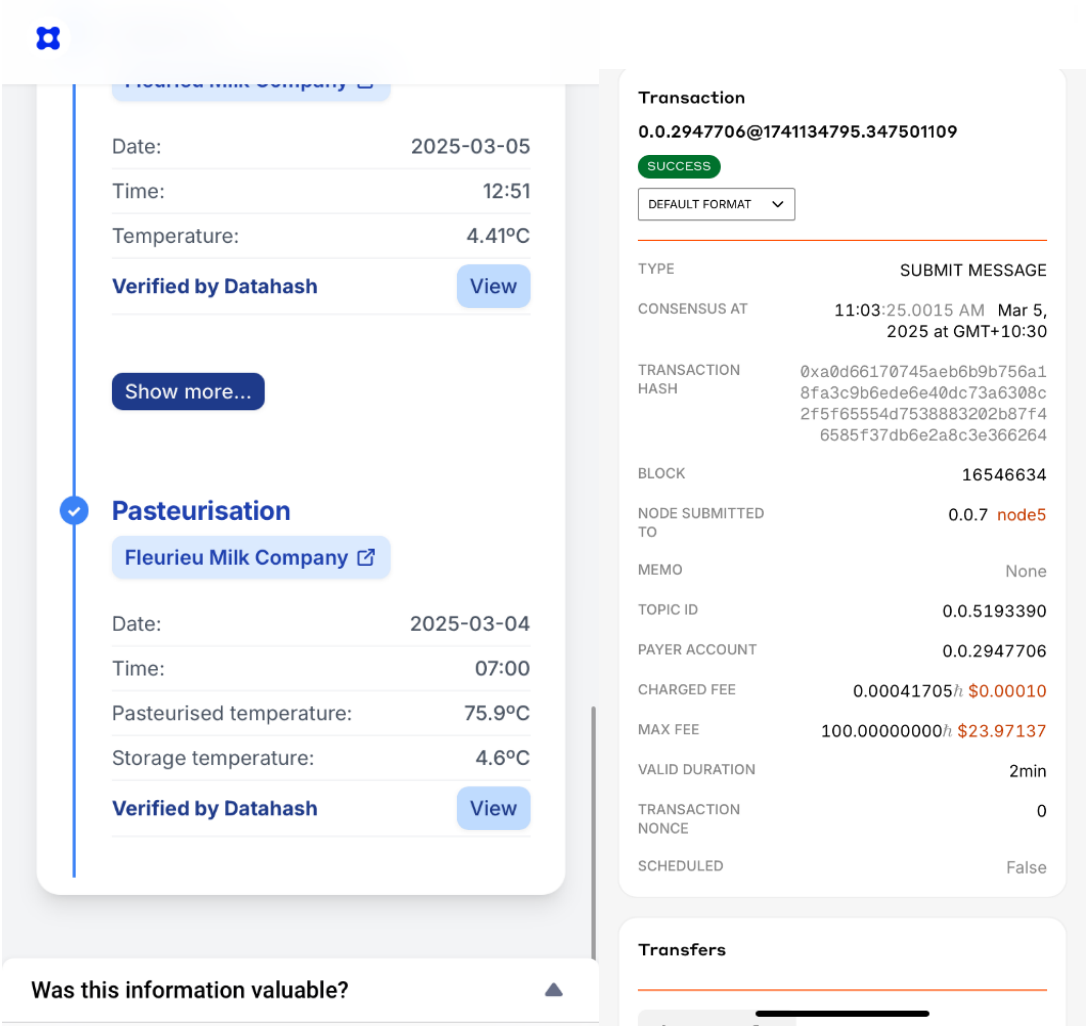


Figure 2 – The Supply Chain and its supporting Transaction Hash with cryptographic public key displayed. The Transaction Hash can be inspected by simply tapping the "View" link in the display. Each "View" has its own and unique Transaction Hash recorded on the ledger. Note the Charged Fee of 1/10000 of a US cent. Increased fees will only be charged in the case of network congestion. The network will only become congested as transactions per second reach 10,000 transactions per second. By way of comparison the Visa system currently manages about 1,600 transactions per second around the world making congestion a remote possibility on the Hedera ledger.

The future development

As the trials are approaching completion the next step is to seek the partners indicated above for the development of the parts of the chain which are not strictly part of the linear components of the information recorded.

Partners in future development will form a complete supply chain from cow to customer, including recording information such as carbon footprints of the supply chain.

Once partners have indicated a willingness to participate, a completed supply chain model can be presented to various funding bodies to enable the next elements of development to be funded.

There are currently no complete distributed ledger-based supply chains in Australian or international dairy supply chain environments.

There are a number of government grants which are, or will become, available to assist with the development of this technology.

At an informal level departmental officials have already contacted SADA encouraging it to make applications. Naturally, were a private business to offer investment in the scheme that would also be accepted, subject to arrangements being formalised between all parties. Any intellectual property would remain the property of Datahash.

The SADA trials have received national attention and regular reports have been made to GS1 and other interested parties regarding progress. Moreover Woolworths (this is not for public discussion), has already indicated its commitment to embrace SADA's Beta Trial and its results. Preliminary indications from Coles have also suggested interest, however, there is no commitment at the time of writing.

Smart Contracts

Another element of this technology will be the development of smart contracts.

Smart contracts are digital contracts stored on a blockchain or distributed ledger that are automatically executed when predetermined terms and conditions are met.

Smart contracts are typically used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss. They can also automate a workflow, triggering the next action when predetermined conditions are met.

Smart contracts work by following simple "if/when…then…" statements that are written into code on a blockchain. A network of computers executes the actions when predetermined conditions are met and verified.

These actions might include releasing funds to the appropriate parties, registering a vehicle, sending notifications or issuing a ticket. The blockchain or distributed ledger is then updated when the transaction is completed. That means the transaction cannot be changed, and only parties who have been granted permission can see the results.

Within a smart contract, there can be as many stipulations as needed to satisfy the participants that the task will be completed satisfactorily. To establish the terms, participants must determine how transactions and their data are represented on the blockchain, agree on the "if/when...then…" rules that govern those transactions, explore all possible exceptions and define a framework for resolving disputes.

Then, the smart contract can be programmed by a developer–although increasingly, organisations that use blockchain for business provide templates, web interfaces and other online tools to simplify structuring smart contracts.

Benefits of smart contracts

Speed, efficiency and accuracy

Once a condition is met, the contract is executed immediately. Because smart contracts are digital and automated, there's no paperwork to process and no time spent reconciling errors that often result from manually completing documents.

Trust and transparency

Because there's no third party involved, and because encrypted records of transactions are shared across participants, there's no need to question whether information has been altered for personal benefit.

Security

Blockchain and distributed ledger transaction records are encrypted, which makes them hard to hack. Moreover, because each record is connected to the previous and subsequent records on a distributed ledger, hackers have to alter the entire chain to change a single record.

Savings

Smart contracts remove the need for intermediaries to handle transactions and, by extension, their associated time delays and fees.

Smart contracts can also be designed to incorporate measurements of pollutants as well as approvals to meet certain benchmarks required by regulation of policy.

Dairy Australia – Carbon Calculator

By applying the Dairy Australia carbon calculator as a component of smart contract executions it will be possible to incorporate a functional measurement into the smart contract as a necessary precondition for contract execution thereby creating a immutable record of GHG equivalences entered onto the ledger from a recognised carbon calculation tool.

Next Steps

SADA is now seeking partners for the further development of expanded technology in South Australia.

As indicated the expanded technology will need supermarkets and processors which have a national footprint. The reason for such a requirement is that the datapoints which are needed to prove up a national model should be demonstrated by organisations which use systems that already operate in the national domain.

What will not be exposed will be intellectual property which resides in the participants and all necessary safeguards will be put in place to protect commercially confidential material.

Smart contracts will be constructed in such a fashion to enable material which is sensitive or confidential to remain encrypted on the ledger or, alternatively, not even collected for the purpose of executing the contract.

The proposed model will replicate and expand on the functionality of the preliminary trials. It will reflect the pre-constructed system where information is extracted from systems only to the extent that they are required to inform the inputs to the ledger.

Once the partners in the supply chain have been formed, the supply chain and all its relevant inputs will be mapped as they were in the alpha and beta trials. The mapping process identifies all the places where the parts of the supply chain intersect with other parts of the supply chain.

The intersection points on the supply chain then form the places where data is entered and/or smart contracts are executed. Many of the points on the existing supply chain are already recorded by way of barcodes/QR codes tracking material through a chain.

Supermarkets already use distribution centres where much of the material is scanned as part of supply chain management. Similarly, processors, transport companies and farmers to varying degrees have points of data entry.

The preliminary trials have already revealed that otherwise non-compatible systems can be interrogated by the interface systems created by Datahash, with that information able to be loaded onto the distributed ledger.

The bulk of the work will happen at this point where Datahash, working with the various businesses in the supply chain, will build the supply chain management system on the Hedera Hashgraph distributed ledger.

This process will also identify points where non-electronic systems exist. The ideal system will be electronic devices which are connected via the internet of things (IoT) and which provide information to the distributed ledger automatically.

Such devices input information into the ledger through code referred to as 'oracles'. These oracles will ultimately communicate with technology such as in-vat testing systems which can do all the milk testing currently done by processors.

Under the current system there can be a delay of up to 6 weeks for a farmer to be paid while tests are completed. Tainted milk mixed in a tanker or a processor's vat can lead to substantial losses for processors and farmers.

However, in-vat testing using an 'oracle' will not only prevent contamination but also will alert farmers to problems earlier. Moreover, when a tanker picks up from the farm the smart contract can execute immediately meaning the farmer can be paid before the tanker leaves the farm.

The final intended result will be a fully integrated supply chain visible to all and smart contracts can be amended to include a breakdown of the farm's sustainability compliance.

Conclusion

As indicated SADA has taken substantial steps to create an environment in which co-operation across the supply chain has led to the development of technology that can at its base function incorporate the monitoring of sustainable practices as part of the requirements of the industry.

Through the co-operation enabled by the South Australian Dairy Industry Action Plan 2024-2029 SADA has been able to develop world leading technologies to the state of a working prototype that will be capable of providing oversight of a supply chain including information relating to sustainable supply chain practices.

SADA is working on these developments now and in July will have fully completed the beta trial which has been referred to in this document.

The completion of the beta trial will lead to further development of the technology which will be able to incorporate an overview of the sustainability practices incorporated across a whole supply chain.