

No part of the candidate's evidence in this exemplar material may be presented in an external assessment for the purpose of gaining an NZQA qualification or award.

SUPERVISOR'S USE ONLY

S

93105A



Draw a cross through the box (X) if you have NOT written in this booklet

☐

+

TOP SCHOLAR



Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Scholarship 2025 Agricultural and Horticultural Science

Time allowed: Three hours
Total score: 24

ANSWER BOOKLET

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

Write your answers in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

Do not write in the margins (///). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Page 1

QUESTION ONE: The impact of the internet and social media

With reference to ONE primary production system, discuss the impact that the internet and social media has had on the production, marketing, and consumption of your primary product.

In your discussion consider:

- what groups, organisations, companies, or individuals have an online presence relevant to your primary production system
- the benefits the internet and social media have on the primary production system
- the threats the internet and social media pose to the primary production system.

Primary production system:

PLANNING

Begin your answer to Question One here:

B *I* U

The advent and growth of internet and social media technologies has helped to revolutionise the dairy primary production system, affecting all aspects of its production and marketing, as well as the external consumption trends in the market.

Working in the often remote and challenging conditions of dairy farms can be an isolated job that places a strain on rural mental health. This is a big issue that has come to the forefront in recent conversation in the sector, and social media groups such as Farmstrong can help to provide a sense of connection over shared mahi that empowers dairy farmers in their day-to-day work. This also applies to groups trying to advocate for the role of women on dairy farms, who can connect online to support one another and encourage more women to pursue careers in the primary sector. A better online and social media presence that increases the attractiveness of dairy farming to potential employees, and helps to remove the potential detractor of isolation, also helps to increase the size of the rural workforce, which is currently ageing with fewer and fewer young people becoming involved in dairying. Part of the reason for young people not pursuing dairying as a career is because they have a high value for social connection with others, and see rural communities as remote, but as social media fosters rural connection it will also help to attract and retain the rural dairying workforce.

Furthermore, forums such as New Zealand Dairy Farmers on Facebook are important for peer learning. This page is used for dairy farmers to share their experiences, mainly with the adoption of new technology or feeds, and other issues on their farm that they feel can be educational to other dairy farmers across the motu. It has been shown that farmers are more likely to embrace innovations that they see being adopted by others, and these groups can therefore be crucial in ensuring the spread of technology and innovation that is crucial to the success of dairying and our primary sector as a whole.

The risk of social media use at an interpersonal level as a tool for continuing the success of New Zealand dairying is twofold. Social media is designed to be highly addictive, and alters the chemical systems such as dopamine in the brain to ensure this. Therefore, the dairy sector is currently navigating its environmental considerations effectively by shifting towards the environmentally-friendly strategies that will benefit customer perceptions at home and overseas, increasing long-term profitability, but there is room to improve in how it can deal with social issues such as its role in the national culture and rural employment. While abstract and qualitative, these are spaces that interact with the potential success and profitability of the dairy sector in the future, and must be navigated effectively to fully ensure economic sustainability.

if social media becomes a lifeline to the outside world, information, and the wider farming community, and develops in everyday usage, then there is a high risk that dairy farmers, like other users, could become addicted. Addiction actually subverts the potential benefits for rural mental health as it means these individuals will be constantly online and comparing themselves to others. Similarly, while important information and innovations can be communicated through forums like New Zealand Dairy Farmers, there is also a risk of disinformation. The online world is full of a range of perspectives, and false information is becoming increasingly prevalent, so farmers may actually be consuming false or misleading experiences about these innovations that they then convey onto their own dairy farms. Therefore, while these groups can be a source of inspiration and guidance, it is important that dairy farmers seek verification before making any decisions based on this information.

The internet has allowed for the growth of a range of online or internet-powered tools that can aid in running production processes for a dairy farm. Firstly, precision agriculture systems such as irrigation systems can be powered by the internet and machine learning processes to optimise these systems. In irrigation this helps both to save on the cost of water and have ideal moisture conditions in the fields, as well as the environmental benefits from not overusing water, which has been an issue with the depletion of waterways like the Selwyn River in Canterbury. An even more revolutionary innovation is the use of Halter for dairy herds, a technology that is powered by the internet to act as a virtual fence for stock control and constantly monitor the health of herds through measures such as heart rate. This can optimise herd health, therefore reducing any veterinary costs caused by late interventions, and also reduce on-farm costs associated with fencing and moving dairy cattle between the paddocks. Dairy farms are known for the intensive fencing into small paddock areas to control grazing, and this can be achieved less expensively and more conveniently through the use of Halter technology. Secondly, business tools such as Xero or MYOB for accounting can help dairy farmers to monitor the success of their farm from an agribusiness standpoint. These tools place the agency in the hands of farmers, allowing them to more closely monitor their economic sustainability, and potentially reduce costs associated with external accountants or farm consultants.

However, data storage is one of the large risks associated with the use of these technologies in the production process for dairy. The data from dairy farms, such as transactions, herd health, water usage, and supplier relationships is accessible by third-party businesses, who may even sell the private data about a dairy farm's performance. A New Zealand Farm Data Code of Practice does exist, and this has been identified as an area where consideration needs to be taken with the risks it could have for dairying, like cyber-attacks which have been increasingly prevalent in other industries. Furthermore, unlike traditional technological investments on the farm, which had high and even prohibitive start-up costs, internet-based technology may be cheaper to start with initially, but since precision agriculture systems are based on internet applications, they are able to charge continually subscription fees for farms to be able to access data from the product which they have installed. This is not ideal because unlike the set cost of initially purchasing a piece of equipment like a tractor, the subscription fees are variable, and it will be hard to account for the real cost of any internet-based technology to a dairy farm over time. Over reliance on precision agriculture to make day-to-day farming decisions can also erode the traditional knowledge held in dairy farming communities. This means they may lose knowledge of the very innovations and processes that made New Zealand a dairy powerhouse nation in the first place.

In terms of marketing a product, internet technology also allows for e-commerce, where dairy farms can use template online platforms such as Shopify, or their own custom platforms, to sell direct-to-consumer. This could look like small-scale dairy farms selling milk to be delivered in the local area, or other dairy products they may process such as yoghurt or cheese. The potential for direct-to-consumer sales is valuable because it places control of their milk into the hands of the farmers, and can be more lucrative as they have full profit-taking ability as a result of their own ingenuity, rather than the potentially less and more unstable Farmgate milk prices for Fonterra, or the equivalent from other processors. Additionally, a website as a form of internet presence can be used by dairy farmers to expand the reach of their unique brand as a farm to a large audience online, potentially attracting them to make a purchase.

Social media specifically has become a powerful tool in every business' marketing toolkit, and dairy is no exception. This marketing is customer-facing, so is normally carried out by processors such as Fonterra, which processes 95% of New Zealand milk, and its brands such as Anchor or Mainland, or small-scale farms that do their own direct-to-consumer sales. Different social media platforms target different consumer groups, with brands focusing on young people relying more on Instagram, while Facebook could appeal to an older audience, and Fonterra even has a LinkedIn presence to strengthen its corporate relationships. A social media presence allows consumers to gain more exposure to a brand name, and therefore increases brand visibility and reputation by virtue of merely existing and creating some amount of content. Dairy brand's social media pages can also be interactive, either through content such as polls, or by engagement with comments and direct messages for those interested online. Consumers have been found to value interacting with brands, which strengthens their perceptions of those brands.

Social media is also powerful in its speed, allowing marketing messages to be communicated almost instantaneously. Furthermore, these platforms have global reach, specifically relevant for dairying as 95% of New Zealand milk is exported, so there are many customers interested in Fonterra brands from Anchor to Anmum living in other countries. Another advantage of social media marketing is that it is free, which sets it apart from expensive mass-media above-the-line marketing approaches such as television advertising or billboards. Therefore, consumers can be reached and convinced about a business' values at no cost to the business. There is even the potential for a dairy brand's content to go viral, as social media algorithms find that viewers engage with the content and therefore spread it widely into feeds, increasing a brand's exposure. The crucial mechanism for why this marketing of exposure and reach is important is that the more consumers see one of these dairy brands, the more they will be thinking about it, and the more likely they will be to be compelled to make a purchase.

However, the same advantages of speed, reach and viral content also become disadvantages when they apply to negative content directed against a brand. This could take the form of angry comments on a dairy brand's post to targeted campaigns such as Greenpeace's recent critique on Fonterra's sale of its consumer brands to Lactalis. It is even said that 'bad news sells' and these negative comments could have even wider reach and become more viral than content aiming to build a brand in a positive light. Nevertheless, social media can also be a forum for crisis management by dairy brands against this negative content and misinformation. In early 2025, following rumours circulating online about Fonterra trialling the controversial Bovaer feed additive, the cooperative was able to use their social media presence to quell these rumours and reassure customers.

One of the biggest barriers to any form of internet and social media usage by dairy farmers is the skill set. There is a high degree of tech literacy required to operate many of these online systems, or make effective use of social media as a marketing tool, and these skill sets differ greatly from what would be conventionally expected of a dairy farmer. With the average age of farmers in New Zealand at 58, there may not be the technology skills that exist with younger generations, and the adoption of any form of internet and social media technology will be impeded and may even be achieved in an ineffective or damaging manner.

When it comes to consumption, social media is known for the viral and short-lived trend culture that it creates. Users on social media platforms want to mimic the actions and beliefs of the so-called 'influencers' who they admire, and therefore follow along with many suggested or endorsed lifestyle changes. Dairy processors must target their brands and products towards the needs of consumers, and if these trends are unpredictable and fast-changing this can be harder to achieve. It can also be damaging if consumers move away from purchasing dairy products. Recently, environmentally-conscious and health-conscious consumers, driven by this online trend culture have moved away from milk and towards alternative products such as oat milk or soy milk, which has seen the risk of changing consumption trends come to fruition with these patterns undermining the standing of conventional dairy brands with younger generations. However, consumption patterns can also be changed by effective social media marketing from dairy brands, like Fonterra's recent multi-media advertising campaign for their 'Zero Lacto' milk and cheese that shows the emotive human stories behind people enjoying dairy products again, and encourages lactose intolerant consumers to try these lactose-free dairy products and experience that kind of enjoyment for themselves.

Therefore, the internet and social media have create changes in the production, marketing, and consumption of dairy products that present both opportunities and threats for farmers and processors in the dairy industry. While attracting workers, managing a complex dairy operation and marketing to a large audience has never been easier, there are growing and unique risks associated with internet and social media technologies, most worryingly with consumer trends shifting away from conventional dairy products. As a result, dairy farmers must move with the times to adopt and engage with these new technologies while remaining aware of the associated threats.

Page 2

QUESTION TWO: Diversification within primary production systems



With reference to TWO primary production systems, discuss how primary producers have diversified their production.

In your discussion consider:

- how the primary producers have diversified their production
- what the drivers for diversification were
- comparing your TWO production systems' ability to diversify from their current production system.

Primary production system (1): Dairy

Primary production system (2): Viticulture

PLANNING

Begin your answer to Question Two here:

B I U     

The Ansoff Matrix is a tool that considers growth strategies for a business on the factors of new or existing product sold in a new or existing market. Diversification occurs when businesses sell a new product in a new market, and is often considered the riskiest growth strategy. However, related diversification - within a primary production system - makes use of some degree of existing knowledge of processes and existing resources, minimising some of the associated risk. Diversification as a strategy for primary producers has been growing in significance over recent years, and is done in both dairying and viticulture.

One of the key drivers for diversification is to achieve risk-bearing economies of scale. This occurs as the producers become less reliant on a single market and how it can have a disproportionate impact on their success and profitability. Using viticulture as an example, 72% of New Zealand wine production and 88% of wine exports are of the Sauvignon Blanc variety. This means that the industry as a whole, as well as individual winemakers and viticulturists, are unduly impacted by any changes in market conditions for Sauvignon Blanc. If these are adverse, such as market preferences shifting towards other varieties, it would have the potentially to be catastrophic for undiversified producers who only grow the one variety. The same concept applies to dairy, but specifically with regards to markets. If a dairy processor only sold to the Chinese market, and there was a recession there with lower consumer spending, or an unfavourable appreciation in the New Zealand dollar, then they would see a disproportionate decrease in revenue and profitability as they are undiversified.

Another driver is economies of scope, where primary producers can benefit from the synergies created between the production of different products, by allowing them to utilise their resources more efficiently. This is specifically true for viticulture, as growing different varieties of grapes so that a vineyard has a mix of early-ripening and late-ripening grapes will allow them to spread the stress on their seasonal labour and processing facilities at the winery. Furthermore, this could allow for a reduction in the seasonality of cash flow into the vineyard, so that they can have more stable year round earning and spending. In this example, the benefit could be achieved not only by different varieties but by using the same variety and having some harvested early, with less brix content, and some harvested later in the growing season to produce a sweeter wine.

In a context where consumer preferences for primary products in both dairy and viticulture are changing rapidly, diversification allows for producers to cater to these more effectively. For the dairy market, there has been an increase in consumer demand for products such as lactose-free milk, milk containing the A2 protein, or raw and non-homogenised milk. This has been followed by the diversification of New Zealand's dairy sector, from Anchor's 'Zero Lacto' milk and cheese, to the A2 Milk Company, to the non-homogenised milk from Lewis Road Creamery. In viticulture, these changing consumer preferences are mainly towards low-alcohol wine, for which diversification can take place in the manufacturing processes of our vineyards.

Additionally, diversification in the product portfolio can be used to reach new consumer segments that were outside the traditional scope of the primary production system, either completely new customers or reaching the same customers in a different way. This can be seen in the dairy system, where diversification towards flavoured milks like chocolate milk and strawberry milk target younger consumers as more of a 'sweet treat', set apart from conventional dairy products like cheese and ice cream. Fonterra owns the 'Primo' brand, to diversify their milk into this consumer segment, and Lewis Road Creamery even produce flavoured milk, enriched by brand partnerships such as with Whittaker's Chocolate.

A diversified product portfolio on the shelves can also increase brand strength, as consumers gain greater exposure to the brand and are even able to buy more different products from the same brand, increasing customer loyalty. This has the added benefit of brand extension being able to be used when already successful brands diversify, such as an established wine label in Chardonnay launching Pinot Noir and Rose onto the shelves under the same label, and attracting the interest of customers.

An important consideration for dairy is that milk, the generic and least processed dairy product, is considered a commodity product. This means that New Zealand dairy farmers and processors cannot charge a high price for a product with many identical substitutes, as Anchor milk is seen as essential the same as supermarket own-brand milk from Pam's or Woolworths. Diversification allows the dairy sector to move up the value chain into higher value-added products such as cheese, yoghurt, and ice cream, earning higher profit-margins on each sale. This is also relevant because as a commodity consumers will opt for the cheapest price milk, and small dairy farms will not have the necessary economies of scale to compete at low prices with larger processors like Fonterra, or even overseas companies.

For viticulture, environmental considerations are also a key driver of diversification. Global warming is causing an increase in temperatures, which shifts the climatic conditions in each of New Zealand's wine regions, generally with them becoming warmer and more humid. The distinct flavours of wine rely on it's terroir, the specifically environmental conditions in which it is a grown, such as slope, sunlight, and soil composition. As climate changes, these conditions will change, and therefore change the characteristics of viticulture in New Zealand. More importantly, each variety has a very specific range of climatic parameters in which it is best grown, which influences the existing characteristics of New Zealand wine regions, with Marlborough known for its Sauvignon Blanc, and colder Central Otago for Pinot Noir. As temperatures rise, vineyards will need to diversify into new varieties that could become more suited for the local conditions. It has been suggested that with rising temperatures, there is potential to grow more Chardonnay in Central Otago, heat-resistant and drought-resistant grapes like Albarino are being trialled in Marlborough, and there may even be scope to introduce new warmer Mediterranean varieties of grape such as Grenache and Mourvedre. Vineyards need to diversify in order to adapt to these changing conditions and even become familiar with the different growing practices required for new varieties while it is still an option to be growing them, not a necessity.

Warmer and more humid temperatures also create a greater risk of diseases such as botrytis to infect the grapes, so the heat-resistant varieties adapted to these higher temperatures like Albarino will have a significantly higher chance of success, and reduce pesticide costs for the vineyards. Another reason for vineyards to diversify the varieties that they grow is to decrease the amount of monocultures. Monocultures occur when only one variety of grape is grown in a vineyard, and are undesirable for two reasons. Firstly, it is easier for diseases like powdery mildew and botrytis to spread between the vines when they are all of the same variety, meaning more environmentally-damaging and expensive pesticides will need to be used with monocultures. Secondly, soil is meant to have a wide range of different plant roots to prevent erosion and ensure soil fertility, and if there is only one variety grown, soil fertility will decrease and the vineyard will become less sustainable for viticultural usage in the future.

There may also be a personal drive on the part of the primary producers, whether in dairying or viticulture, to try something new, which may maintain their interest in the work they are doing. However, the reverse is also true. Farmers and growers may have an 'if it's not broke, don't fix it' mentality, which is counterproductive to diversification, and fails to consider that while conditions on farm may not be changing, they are changing fast in the markets to which their products are sold. Nevertheless, the average age of a New Zealand farmer or grower is 58, and they are more likely to be trying to 'hold out' until they retire than to introduce new products or processes.

It is also easier than ever before to diversify in primary production systems. There is a range of different breeds, such as high-A2 cows, and varieties, like the heat-resistant Albarino grapes, available to diversify into on farm. Furthermore, precision agricultural systems also make it easier to manage a complex primary sector operation, like the multiple timelines required for growing two different grape varieties in parallel.

In dairying, there is little scope for diversification at a farmer level. Farmers could choose to work with a different breed of cow, such as those which have more A2 proteins, to change suppliers towards more niche operations like Lewis Road Creamery in order to benefit from the premium value-added products, or to begin direct-to-consumer sales themselves and take control of their own value chain. Therefore the onus of diversification rests on dairy processors large and small. It is these processors who make decisions about diversification into products such as flavoured milk, lactose-free milk, cheese or yoghurt. For Fonterra, they have crucially diversified the bulk of their business away from these consumer products, which have now even been sold off to Lactalis, and towards the more stable ingredients and food service sales to other businesses. It is also these processors who decide in which markets products will be sold, and it is again Fonterra who has been successfully at selling their products in a range of markets to ensure there is not over reliance on a single market.

In contrast, diversification in viticulture is primarily focused on the vineyards. They are able to choose whether to grow new varieties of grapes in order to move with the drivers of diversification, but this is less of a choice for success like it is in dairying, and more of a requirement for long-term sustainability in changing climatic conditions. There is however more scope for innovation compared to the rigid on-farm efficiency of dairying, such as changing to a more sustainable biodynamic process or diversifying into grazing babydoll sheep under the vines to have alternative non-wine revenue streams from the primary production system. Winemakers are also able to diversify with wines, such as creating new blends between grapes or through low-alcohol processing. There is also scope for innovation here, capitalising on the greater interest in tourism for wineries and vineyards than there is for dairy farms. Indeed, over a quarter of international tourists to New Zealand visited a winery on their trip, so cellar-door experiences such as restaurants, winery tours, or even virtual wine-tastings are further options to diversify viticulture away from purely wine.

The barriers to diversification in both primary production systems are similar, such as a lack of skills or information about new diversified products or varieties, a lack of long-term interest in diversification for farmers and growers who lease their land, and high start-up costs from all the associated infrastructure required by these diversification projects. However there are still differences in how diversification is achieved between these primary production systems; it can be seen that there is greater flexibility for innovative diversification in viticulture, which has been exploited to their success, while specifically dairy farmers have a limited scope to change their processes away from the efficient existing model, with the focus of diversification on new products and balanced markets from the processors.

QUESTION THREE: Economic sustainability

With reference to ONE primary production system, discuss how primary producers navigate social and environmental expectations to achieve economic sustainability.

In your discussion consider:

- the social factors / expectations influencing the producer
- the environmental factors / expectations influencing the producer
- the positive and / or negative impact the above factors have or may have on the profitability of the primary production system.

Primary production system:

PLANNING

Begin your answer to Question Three here:

B *I* U

Dairy producers in New Zealand must navigate the complex interlinked web of social and environmental expectations in order to succeed with their economic sustainability. The dairy industry is the backbone of New Zealand's primary industry, and therefore its economy as a whole, with Fonterra, which processes 95% of New Zealand milk, making up 7% of our GDP alone. This means there is a large amount of public interest and expectations placed on the dairy industry that must be navigated to ensure its economic sustainability.

Recently, much of the controversy regarding Fonterra's sale of its consumer brands, such as Anchor and Mainland, to the French Lactalis has come from Winston Peters and his New Zealand First political party. This group claims that these brands are an intrinsic part of New Zealand identity, and selling them off would be similar to selling a piece of our national culture. This embodies the consideration for the dairy industry that it is both culturally and economically important to our nation. Since its early years, New Zealand has been known for its high-quality agricultural products, specifically lamb and milk. Well-established dairy brands like Anchor have been around for a long period of time, and have brand recognition with almost every New Zealand, being essentially icons of Kiwiana. Other smaller dairy companies like Westland and Tatua also play a key role in their local communities, as part of the cooperative culture of dairying from the early days of the industry. This is currently a strength for economic sustainability in many ways, as New Zealand dairy brands can benefit from a large amount of brand recognition and loyalty, as consumers are aware that buying from a brand like Anchor means that they are supporting New Zealand dairy farmers. However, it can also create undue controversy around financial decisions that are best for the business, like with the Lactalis sale. The sale is intended to allow Fonterra to focus on their higher value and higher growth ingredients and foodservice business section instead of on their commodity consumer brands, and 88% of farmer shareholders are in favour of the sale, but a resulting lack of public interest in the brands following the sale could devalue its impact.

Dairy farms are also an important rural employer, specifically in areas known for their dairy farming such as the Waikato, Taranaki, and Southland. Rural communities can be reliant on the employment provided by dairy farms, both for the livelihoods of individual families, who may have employment as sharemilkers or farmhands, and for the whole local economy. For rural service towns like Te Aroha on the dairy-intensive Hauraki Plains, when dairying is successful then the town is successful also. This is because the value from dairy profits and employment brings funds into the local economy, which are used to support shops and restaurants as well as ancillary farm services like stock-and-station agents. The recent trend to increase economic sustainability is to increase the size of dairy farms in order to benefit from economies of scale. It is also ideal for economic sustainability to move towards more automated and mechanised on-farm processes such as milking, as the cost of labour is often greater than the cost of machinery. However, dairy farmers need to navigate how these changes, which reduce rural employment in the dairy sector, can effect the local dairy-reliant economy. There may also be potential backlash from community groups about such changes, including for processors with the controversial closures in dairy factories causing significantly more job losses than would be by a town. This is often uniquely bad because it creates an irreversible trend, if there are fewer jobs in the rural area, then people move away into the cities, and then if at any point more employees are needed, there will be fewer to choose from. Nevertheless, increasing the size of farms and increasing automation will make dairying more profitable.

It is often quoted that agriculture makes up about 50% of New Zealand's greenhouse gas emissions. This is significantly higher than other similarly developed countries, such as the United Kingdom or Australia. Greenhouse gases are considered undesirable because they contribute to the enhanced greenhouse effect in the atmosphere, which traps heat and raises the global temperature. This process of climate change has many negative effects such as sea level rise, coral bleaching, and increasingly intense and frequent storms. Therefore it has become a hot-topic issue, and as New Zealand is a signatory to the Paris Agreement, aiming to limit the global temperature increases, and there is an expectation that changes needs to be made to agricultural emissions, and specifically dairy, in order to reduce our national greenhouse gas emissions.

Methane makes up 44% of greenhouse gas emissions from dairying. During ruminant digestion, methane is created as a byproduct of cellulose breakdown, and then emitted into the atmosphere through bovine flatulence. There is ongoing research into how these emissions can be resolved by using alternative feed for dairy cattle, such as plantain or asparagopsis. Another 44% is contributed from carbon dioxide, mainly in the production and distribution process. As 95% of New Zealand's dairy is exported, there is a large amount of emissions involved in transport to foreign markets, alongside those coming from transport from farm to dairy factories. This is potentially the easiest form of greenhouse gas emissions to limit, by using more low-emissions vehicles and standard industrial emissions reduction technology in the production processes. Another 11% of greenhouse gas emissions come from nitrous oxide, which is emitted from urine or nitrogen-based fertilisers used on paddocks. If farmers shift towards expensive and environmentally-friendly nitrogen-free fertilisers, this can be partly resolved, and alternative feeds such as plantain also help to reduce nitrous oxide in urine. There is even the potential that while less profitable, once-a-day milking could also have a lower greenhouse gas impact than conventional twice-a-day milking as it uses less energy and resources.

The controversial He Waka Eke Noa plan aimed to price New Zealand's agricultural greenhouse gas emissions, including those from dairying, in the existing Emissions Trading Scheme. If enacted, this would have required dairy farmers to monitor the greenhouse gas emissions from their production, which would then either be accounted for by a certain number of credits, or have to be paid for. This would increase costs for dairy farmers, but would create a financial incentive to reduce emissions because excess credits in the 'cap-and-trade' scheme would then be able to be sold off to larger polluters, making the farms both more environmentally and economically sustainable by providing an alternative revenue stream.

The other primary environmental concern from New Zealand dairying is nitrogen and effluent runoff into waterways. This nitrogen can again be from either fertiliser or urine. The runoff upsets the chemical balance of our freshwater ecosystems, and can cause greater turbidity in the waterways, disrupting the biodiversity of the habitats. Aforementioned strategies to decrease nitrous oxide emissions could also be effective in reducing nitrogen usage, and therefore the amount that runs off into waterways. However, additional strategies can also be used to mitigate this such as fencing off waterways and grazing away from them, or riparian planting to use native plants to absorb some of the runoff that would otherwise drain into the waterways. The Freshwater Farm Plans encouraged farmers to make use of such strategies in order to reduce nitrogen and effluent runoff on farm.

New Zealand's image as an exporter, important for the export-reliant dairy sector, is as 'clean, green, New Zealand'. This is reinforced by the popular '100% Pure New Zealand' marketing program. Much of the value that New Zealand dairy products can garner in these foreign markets is as a result of this reputation, so dairy producers need to move with the times and help reinforce this environmentally-friendly image by acting in an environmentally-friendly way and reducing both greenhouse gas emissions and runoff into waterways. Consumers in New Zealand and overseas are also willing to switch spending or pay a premium for sustainable and environmentally-friendly products, so New Zealand dairy producers that act in this way could gain revenue by using Porter's generic strategy of 'focus' by concentrating on this environmentally-friendly market. Therefore, by acting in line with these environmental considerations, New Zealand dairy farmers can ensure economic sustainability by remaining focused on the values associated with New Zealand in export markets and those held by its consumer base. It appears that the dairy industry is aware of how to navigate these environmental considerations, as there has been an overwhelming shift towards the values of kaitiakitanga with regards to limiting the environmental impacts of intensive dairying.