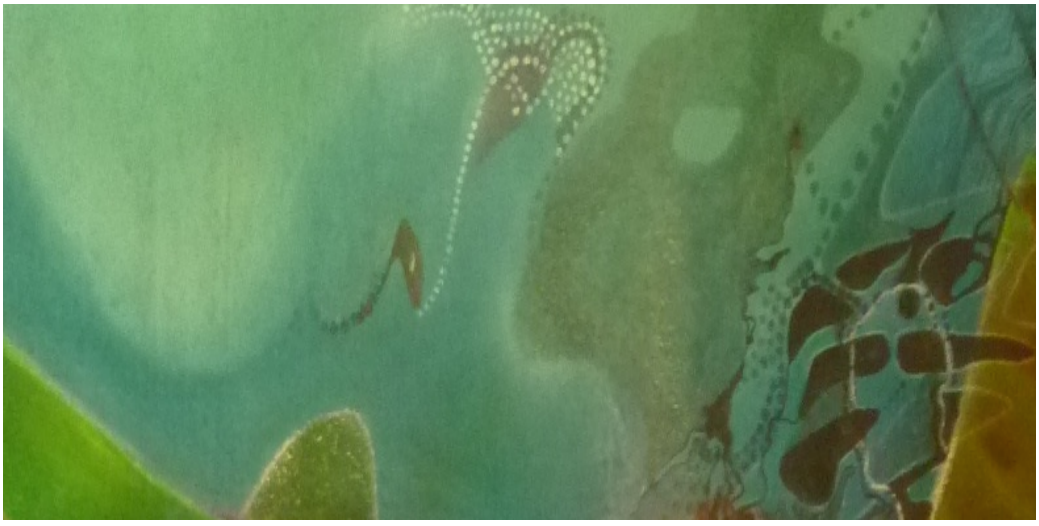
Transforming
the
Food and Beverages Sector

Comments on MPI's Draft Transformation Plan



Sustainability Council of New Zealand
April 2023

Foreword

Our Place in the World and GM

New Zealand holds an enviable status as a premium food producing nation, with a reputation for environmentally responsible innovations that lead the world. When I travel around the globe to promote my television series and accompanying cookbooks, it never ceases to amaze me how favourably the outside world looks on our country and its food and wines. As well as getting the opportunity to speak with my audience, I'm also lucky enough to rub up against food importers and exporters, prominent media figures, scientists, and food writers from all around the globe.

And whether from France, or in the UK, Portugal, China, or the USA, the feedback from my audience is overwhelming; "You are so lucky to live in such an astonishingly beautiful country, with a food basket of the world right at your fingertips".

People relate to our values-based lifestyle, the culture of manaakitanga (making people feel welcome and at home), and the spirit of guardianship of the land which guides us all — as farmers, growers, and citizens.

In the fast-paced world we inhabit, the issues of climate change, declining resources, the intrusion and power of social media, and global, social and political unrest are placing enormous stresses and pressure on people everywhere. Increasingly, trust and safety are paramount, and never more so than when it comes to food. People want to know they can trust the food they buy, and they will vote with their wallets to support brands which demonstrate this commitment of safety and care. We need only look to younger generations, who are increasingly values-driven in their purchasing power, to understand that this demand is only going to grow.

Which brings me to MPI's draft Food and Beverage Transformation Plan. It is exciting to see a plan in development. It is needed to support our producers – big and small – to meet the challenges they face. However, I am concerned about the analysis that points towards a weakening (or even elimination) of the regulation of gene edited organisms – which could jeopardize New Zealand's unique marketing position and global brand. There are many innovations and technological advances that demonstrate New Zealand as both a thought and a practice leader. Given that, singling out GM/gene editing technologies as key to transformation is surprising: gene editing techniques are still largely in the experimental phase and little has changed in terms of the lack of market demand for GM food products.

The submission penned below by my colleagues at the Sustainability Council outlines some of the issues as we see them, in relation to both the market and to our national brand, as well as the current state of GMO science. As a small country targeting high-value production, we need to be especially careful and ensure formal regulatory processes are in place to govern the outdoor use of GMOs. New Zealand's current GM-free food producer status is important to ensuring our continued access to premium food markets - and premium prices - around the world. It takes a long time to build a brand, and it can be broken so easily.

Allowing gene edited products into our domestic and export-oriented food chain without a robust process for protecting our exporters, our national brand and economy from any flow-on effects would seriously undercut the high-trust model we are renowned for. Our

customers' demands for assurances of provenance and quality can only be met if we are committed to strong regulatory standards.

Thank you for taking the time to read our submission and should you have any queries please don't hesitate to contact me.

Annabel Langbein
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Sustainability Council Board Member

In this submission

1. Overarching comments on the plan

A sector plan is a key piece of organisational 'infrastructure' for a country heavily dependent on food and beverage sales to make its way in the world. We fully support the plan's development.

Our focus for improving the draft (the Plan) is in the areas we are most familiar with, but particularly with respect to the gene editing issue. Here we have maintained a twenty-year research programme of a form that tends not to be replicated by others. This is also focused on due to the outsized emphasis given to gene technologies in the Plan.

Before taking up that focus, we offer high level comment on critical, big picture issues.

Ecological Fabric: Climate Change, Biodiversity, and more

Climate change is indeed a major driver of sector change, as identified. Biodiversity is increasingly gaining recognition as an issue of similar standing as biodiversity losses carry a separate capacity to also undermine ecosystems to the point that fundamentals collapse. A good proportion of those losses are directly linked to agricultural practices. Biodiversity thus merits special mention alongside climate issues, and integration into the plan under a broader banner that speaks about risks to the **ecological fabric** in general from current practices.

When addressing just climate change, the Plan indeed sees both the threat and opportunity side of this issue. It notes that it's changing how we produce things and that consumers are willing to pay for products that demonstrate attention to it. And it elevates climate rectitude to the level it is that incorporated in the Plan's overall vision statement: "The sector is the foundation of a high-wage, low-emissions economy".

Given this, it is alarming that not one of the 16 action points refers to a task directly targeting emissions reduction or risk to the ecological fabric. Certainly there are points that look to improve marketing under which climate change could come but, as the Plan notes, consumers want to see evidence of action – and not simply branding of natural advantage.

Even a little research time will soon discover that:

- The majority of New Zealand's international emission reduction obligations are planned to be met through the purchase of offshore carbon credits where mechanisms to ensure adequate environmental integrity are yet to be developed.
- New Zealand's "permanent" forests are not required to be in place for more than 50 years to earn that moniker – when the de facto international minimum for reputable carbon credits is 100 years. So where are exporters to locally source high grade credits to back carbon neutral claims?
- Credits for sequestration issued under the ETS are in any case indistinguishable from those issued to polluters as a subsidy against any disadvantage arising from untaxed imports.

The Plan needs to go beyond recognising drivers and high-level impacts: it needs to target actions that genuinely confront what transformation is going to take. That means going right

back to analysis of the sustainability of current production methods and what it will take to make them truly sustainable.

Bypass: Synthetic Foods as Competition as well as Opportunity

Pastoral agriculture faces two converging challenges that collectively make sharp rises in environmental standards inevitable:

- Increasing awareness of the impacts of meat and dairy production on the environment, and
- Direct competition from plant-based foods that provide an alternative to animal protein products and have much lower environmental footprints.

The Plan acknowledges the rise of synthetic foods (e.g., cultivated proteins and those plant based) – but only as opportunities. Yet the starting point for analysis about such foods is that they represent a major risk to established production methods. They carry the potential for creative destruction of large slices of market share and, in the extreme, bypass of traditional food production methods altogether.

Alternative milks and alternative meats generally carry only a fraction of the environmental footprint, no animal welfare issues, and can typically be produced at lower cost (or are expected to be in future). Younger consumers in the West are already disproportionately favouring products with good environmental and animal welfare credentials.

Coming alongside alternative milks that have been on the market for some time (such as nut and bean-derived products) are plant-based compositions designed to deliver the same taste experience as milk. And what were lab experiments just a few years ago are now various brands of synthesised plant products designed to resemble meat – right down to simulated blood.

For New Zealand's pastoral products to successfully compete with these alternatives, they too will need to achieve ambitious environmental credentials, given growing consumer expectations. The nation's response to the 'food miles' challenge showed how New Zealand can develop enduring solutions - e.g., establishment of the carboNZero programme (now Enviromark Solutions) that was behind the first carbon neutral food products. As pastoral production costs will tend to be higher, the sustainable market position is the premium shelf where demonstrating high environmental and animal welfare performance attributes will be critical.

One cautionary note is that while the threat to traditional milk sales is very clear in the West, there could be a split response globally – at least initially. China for example is currently expected to triple its demand for dairy products within the next three decades, and Asian consumers in general have been exhibiting a growing rather than waning interest in dairy products.[1]

In essence, commodity milk from pastoral production risks losing out on price to alternatives, meaning that the premium end of the market that values a 'traditional' fully natural protein product will be the most economically rewarding: the entry requirement for this will be

[1] https://edairynews.com/en/chinas-growing-milk-consumption-a-global-concern-says-study-58608/

advanced environmental sustainability credentials. Red meat will need to similarly embrace this environmental challenge and at the same time confront the health and animal welfare critiques.

These pressures are combining to push market expectations towards animal protein products being fully carbon neutral - with the market transformation likely to occur before any national climate target would require this, in the West at least.

The Plan must have action points directed at helping the pastoral sector attain carbon neutrality for its products. And it will need to present "being recognised as a global leader in environmental excellence" as more than an "opportunity": for transformation, this is a 'must-have'.

2. GM and the proposal to engage the sector

Context

Ten years ago, the Sustainability Council appealed a decision by the Environmental Protection Authority (EPA) that would have deregulated two gene editing techniques and paved the way for the deregulation of others. The Council took that appeal in order to protect food exporters from the consequences of New Zealand being ahead of the marketplace and to ensure that there is a proper process for assessing and managing use of the new techniques.

In the intervening decade, surprisingly little has changed: gene edited products are still almost wholly in the pipeline - not on the market. Equally, the technology remains an untested proposition that carries a real risk for New Zealand's reputation as a food producer: that consumers and gatekeepers will regard gene editing food and beverage products as GMOs even if regulators don't. From an ecological and public health risk management perspective, the intervening decade has also confirmed that the science of gene editing is still in its infancy and that it can still present surprises along the way, thus posing safety and reputational risks for New Zealand.

The proposed conversation on GM

MPI is proposing to engage the sector in a conversation about new gene technologies, their potential use and regulation, as part of the plan to transform New Zealand's food and beverage sector.

We are surprised that MPI singles out gene editing technologies for prominence in the Plan. There are a host of technologies and approaches that will be vital to genuine, sustained transformation but gene editing is likely to deliver more to mitigation of effects than transformational progress: different plug-ins to current land use and management practices. And while transformation can be achieved by a mix of mitigation practices and systems change, gene technologies remain highly speculative. They can also have long-ramp R+D times to market and it is not simply (as some would have it) because regulation has a braking effect. This raises a question not identified in the transformation plan – how much NZ should invest in public science funds to deliver GM 2.0 agriculture given the relatively small pool of funds and the relative merit of other investments for transformation? It is also a question of where MPI's valuable time is best placed.

That said, the Sustainability Council supports conversations about new technologies, including gene editing techniques, for New Zealand on the basis that:

1. Those conversations are:
    - Honest and realistic about where the technologies are at
    - Without bias or political management that marginalises positions that do not accord with the prevailing narrative and/or supports developer enthusiasm.
    - Alert to the politics in the food system, domestically and internationally, and how this can frame scientific assessment.
2. There is a commitment to:

- (Re)examine assumptions that are not supported by analysis.
- Accountability and responsibility to nature and people
- Transparency whereby:
    - Developers provide full information about the technologies, their products, and their safety
    - Citizens are readily able to choose to use or avoid GM products
    - Growers and food producers are protected from spill-over effects from use of GM crops/ingredients and can readily vouch for the ongoing integrity of their products in the domestic and global marketplace.

We note that the document is not intended to carry the full analysis of the strategic issues around use of gene editing in New Zealand's supply chain. It is also clear that MPI is not advocating any particular outcome of a conversation at this time and that it has yet to invest in any serious analysis of the issue. That said, the response to our request for the evidence base behind certain statements in the draft plan is nevertheless of concern, as is the uncritical evaluation of where the technology is at.

It is clear that if MPI is to host such a conversation, officials involved in facilitating this conversation and MPI senior leadership would need to commit to: build a much deeper understanding of the issues; dig deeper than the analysis provided by other entities (Productivity Commission and Te Puna Whakaaronui) and go beyond the often simplistic, aspirational understanding of where gene editing is at as a technology/bundle of technologies. This will require in some cases, forming a different analysis to that given by GM developers and their science partners and larger agribusinesses that have considerable influence in the primary sector. This is critical to ensure there is an accurate, well-rounded appraisal that the sector can base its future on.

The following sections address issues that are central to any conversation about the role of gene-editing in New Zealand agriculture.

Terminology

In this submission, we do not use the term "genetic technologies" because it encompasses a wide range of techniques and application, including many (such as genomics, gene sequencing and diagnostics) which can support a range of technologies and applications and whose value have never been seriously disputed. This creates confusion as to where the real rubpoints are – to the extent that they exist for certain parts of the sector. The bleeding edge of gene technologies is the use of GM to create new organisms that have to be released into New Zealand's productive lands or into the supply chain to realise the benefit of the technology. For that reason, we use the terms:

- **GM 1.0**, to cover the GM techniques that have delivered the first generation of GMOs for outdoor use (such as GM herbicide- and pesticide-tolerant broadacre crops cultivated predominantly in the Americas as well as the GM pine and ryegrass that NZ CRIs have been developing for the last twenty-odd years), and
- **GM 2.0** or gene editing to refer to emerging techniques that are often referred to as gene editing.

3. Where gene editing science is at

Commercialised products can be counted on one hand

We agree with MPI that "[t]he risks and opportunities in genetic technologies warrant better understanding" and that "the discussion must be informed by evidence".

This will require filling in the gaps left by industry and science-provider documents to date. It will also mean going beyond the tendency on the part of some, if not many, industry commentators to give the impression that gene editing of foods as a well-established commercial technology, ready at the gate and waiting only for New Zealand to liberate gene editing from the burden of unnecessary regulations.[2] It is not. **Gene editing remains overwhelmingly a laboratory exercise in all countries -** even those which effectively do not regulate gene edited food products (such as the US).

The evidence of that is plain, and it's in the marketplace.

Up until September 2022, of **the three gene edited food products** known to have been on the market anywhere in the world, **just one remained.**

Two had been pulled from the market after short, bumpy rides: a herbicide-resistant canola (called SU canola and later Falco canola) was released in 2016 but disappeared from the market five years later due to a host of issues including law suits following poor agronomic performance and the company's weakened financial position.[3] The second, a soybean with lower fatty acids (Calyno soybean) was withdrawn around two years after it was commercialised due to low yields.[4]

That left the GABA tomato – a CRISPR engineered tomato - released in Japan. While it is difficult to establish what further commercialisation has taken place since then, production is certainly niche – it was to be made available to home growers in 2022.

Subsequently, a USDA report notes that two varieties of gene edited fish were notified to the relevant Japanese regulatory authorities late in 2022 but it is unclear how widely, if at all, these are now available on the Japanese market.[5]

The gene edited foods product pipeline – one typically described by developers – suggests more is on the way. However, while such pipeline reports provide a good indication of the traits and crops being experimented with, they tend to be a poor guide to *actual*

[2] Te Puna Whakaaronui's reference document states that "products developed through genetic techniques are being used more widely for health, animal feed, food and nutrition." This is certainly not true of gene editing and only true of GM 1.0 in that the four commodity crops that make up 99% of global GMO production are predominantly used for animal feed.

[3] A law suit was filed in 2021 by Cibus' insurance company in the wake of insurances claims resulting from payouts to growers due to crop losses from the herbicide use. (see Hous. Cas. Co. v. Cibus U.S. LLC. 19-cv-00828-BAS-LL). Cibus itself announced its decision to divest its canola breeding programme to the Canadian Farmers' Business Network in 2021. https://www.realagriculture.com/2020/10/fbn-moves-into-canola-breeding-buying-haplotech-and-cibus-canola-assets/. No SU Canola – developed using the gene editing technique, ODM – has been commercially available since then.

[4] Issa B. 2020. Calyxt To Exit Farming Operations And Focus On Seed Science. Seeking Alpha. https://seekingalpha.com/article/4394048-calyxt-to-exit-farming-operations-and-focus-on-seed-science.

[5] The GAIN report notes that developers have notified Japanese authorities of a sea bream and a puffer fish ready to put on the market. USDA. 2022. Agricultural Biotechnology Annual: Japan. GAIN Report JA2022-0092

commercialisation trajectories because product pipeline announcements are often used to attract investment and are aspirational. The actual commercial rollout of GM 1.0 – once again even in countries with regulatory light touches – is evidence of the slim proportion of GM food projects that make it through the "valley of death" - the period between hopeful product pipeline and an actual commercial food.

Another reality check concerns **the difficulty in engineering complex traits**, whichever GM technique is used. To date, commercialised GM products for food and fibre are overwhelmingly herbicide- and pest-tolerant or a combination of the two.[6] That is, the ultimate impact of this innovation on output for all but a tiny fraction of GM crops is nothing more than a reduction in harvest losses.

This is not solely down to the fact that the major developers of these products are agricultural input companies (Bayer, Dow, etc) looking to entrench market dominance across seeds and inputs. The range of GM traits has been constrained to herbicide and pest tolerance because they are relatively easy to engineer whereas other traits such as virus and drought resistance - so-called multi-gene traits – have proved challenging. An example is Monsanto's drought resistant maize that, despite years of investment - was deemed to perform no better than locally suited, traditionally-bred varieties.[7]

While there is a considerable amount of R+D underway, it is not yet demonstrated that GM 2.0 - gene editing techniques - will be able to deliver step-changes in crop performance reliably in the field or do this with the predicted speed. This conflicts with the impression given to those participating in a survey the Plan cites. The description of gene editing Research First provided participants suggests a level of demonstrated stable performance of gene editing that has not been achieved at any scale in commercialised products:

> Our survey participants were provided with the definition that: "Gene edited foods are not the same as genetically modified foods (GM foods or GMO). GM foods add a gene (DNA) from a different plant or animal, whereas gene editing just changes the DNA that is already there; nothing new is added in. With gene editing, we can disable some genes, correct harmful mutations, and change the activity of some specific is genes in plants and animals."[8]

We also note that the description of gene editing is not correct in that some gene editing techniques routinely use foreign DNA (for example, the techniques sometimes classed as Site-Directed Nucleases 3 (SDN-3) and that current use of site directed nucleases 1 or 2 does sometimes/often involve use of foreign material – an example being the TALEN-soybean briefly on the market in the US).

Similarly, the Productivity Commission's description of gene editing suggests that the science can reliably deliver major performance in complex environments:

> Gene-editing technologies can be used to improve plant traits such as drought tolerance, disease resistance, fruit ripening, and reducing greenhouse gas emissions in grazed

[6] The most recent ISAAA report on global production of GMOs covers 2019. In that year, 43% of all products planted globally were herbicide resistant; 12% were pesticide resistant and 45% were a combination of the two (so-called stacking) ISAAA. 2019. *Global Status of Commercialized Biotech/GM Crops in 2019.* Brief # 55.

[7] USDA. 2011. *Monsanto Company Petition (07-CR-191U) for Determination of Non-regulated Status of Event MON 87460*

[8] https://researchfirst.co.nz/wp-content/uploads/Gene-Editing-July-2022_v1.1-twopager.pdf

> animals; and animal traits such as increased meat yield and disease resistance. These technologies can also speed up conventional plant-breeding processes, allowing innovations such as new cultivars to be developed more quickly (Royal Society Te Apārangi, 2019b). Improved disease resistance in crops can in turn reduce the need for chemical herbicides and pesticides.[9]

The critical word is 'can'. The reality of progress with gene editing is 'might be able to' because most gene editing experiments have not been trialled in the field. This is not to say that those traits cannot be achieved via gene editing, but as MPI will be aware there is a big difference between 'can' and 'could' when evaluating new techniques and how public policy – enabling resourcing and regulation - should accommodate them.

Somethings change, some stay the same: targeted but not necessarily precise

MPI notes that genetic technologies have changed dramatically over the last twenty years.

It is more accurate to say that methods to engineer changes in organisms have *evolved*: they use different approaches that are indeed more targeted than GM 1.0 but they are not necessarily precise. Nor is there: a history of safe use in food crops of reasonable scale to support the claim that gene edited products are safe by design or surety that safety concerns will be overcome with consumers and gatekeepers in high-value markets.

In that respect: new GM techniques share many **real-world features** with first generation GM techniques, particularly in respect of the biosafety issues that researchers and developers are encountering as they apply the technology.

Chief among them is t**he potential for the gene editing processes to cause unintended effects, often in unexpected locations in the genome and often undetected by developers.**[10] Since CRISPR was first 'announced' in 2012, for example, a large body of scientific literature has accrued documenting such unintended effects from use of the technique.

The first gene edited commercial crop – the SU Canola that has been pulled from the market – is a case in point. The developers claimed, after commercialising the crop in the US, that although a gene editing technique was used, the product was the result a surprise reaction in a petri dish and not the direct result of the use of gene editing – hardly a confidence-building start for a technology that has centred its assurance claims around precision.[11]

A more spectacular example is the hornless cattle engineered using a gene editing technique (TALENs). It was the US Food and Drug Administration that identified some 4,000 base pairs of "unexpected" insertions in the cattle, including bacterial DNA that contained foreign genes conferring resistance to antibiotics. This, despite the developer claiming: "We

[9] Productivity Commission. 2021. New Zealand firms: Reaching for the frontier , p. 176.

[10] J. A. Heinemann, D. J. Paull, S. Walker and B. Kurenbach. 2021. Differentiated impacts of human interventions on nature: Scaling the conversation on regulation of gene technologies. In: *Elementa: Science of the Anthropocene*. Vol. 9 Issue 1. DOI: 10.1525/elementa.2021.00086

[11] The company published its response on a now deleted marketing website for the SU canola but reported in *Politico EU*, 7 September 2020. EU countries may have a way to find gene-edited crops in imports.

have all the scientific data that proves that there are no off-target effects."[12] This discovery by a regulator – not the developer - made the cattle GMOs - even by the US's relatively light standards - and reinforced the FDA position that all GM animals are to be regulated.

This instance has particular relevance to New Zealand: the TALEN technique used was one of two that the EPA had determined to deregulate in 2013 - but were re-regulated following the High Court determination the Sustainability Council obtained.

The above does not necessarily mean that all or many gene edited organisms will be harmful or that gene editing should never be used for food production. It does mean that risk regulation is required to:

- set the independent standards that all developers must meet before a gene edited food is put on the market.
- sift out prior to market those gene edited organisms that independent safety standards identify as harmful or potentially harmful.

Unpacking GM Science Narratives

MPI will be well attuned to stakeholders' seeking to shape the accepted science narrative through its work across multiple arenas of science and practice within Aotearoa New Zealand and at the international level.

This framing is also at play with use of GM and has been for at least three decades: What is seen as appropriate regulation is often influenced by perceptions as much as the facts. Those potentially subject to regulation are therefore incentivised to shape the public narrative to their advantage.

The Plan states that "[a] discussion with the food and beverage sector **should consider the interests of food innovators – including marginal voices and emerging industries – as well as the food production system and traditional industries more broadly.**

To do that, we urge MPI to critically evaluate its own implicit framing of GM 2.0, as well as the framing that from developer interests and proponents of deregulation more generally. MPI will have to unpack competing narratives about gene editing to ensure good outcomes across all dimensions - from economics and trade to the protection of nature and the Crown's obligations to Māori.

As the Plan notes, some food regulators (including FSANZ) and other countries have deemed some or all gene editing techniques to be safe by design and not requiring any risk management. Taken superficially, this may seem like evidence that the science is settled, the regulatory pathways clear (to follow other countries) and now it is simply a policy process issue for New Zealand to follow suit. However, all of the processes that have led to these outcomes are highly political and often heavily influenced by vested interests (including GMO developers and their

[12] Piore A. 2017. This Genetics Company Is Editing Horns Off Milk Cows. *Bloomberg Business Weekly.* https://www.bloomberg.com/news/articles/2017-10-12/this-genetics-company-is-editing-horns-off-milk-cows#xj4y7vzkg

science supporters). That has led to a dominant narrative that is promoted in order to help open the path for gene editing's use in agriculture. That narrative relies on:

- Advancing premature conclusions that certain or all techniques are safe by design and require no regulation
- Attributing the failure of GM 1.0 to move beyond broadacre, input-tolerant commodity crops to GM regulations.

Against that backdrop, New Zealand is unusually dependent on agricultural exports and high-value markets to make its way. Our situation is vastly different to that of the current GM exporting countries (such as the US and Canada and, indeed, Australia) and those circumstances merit an analysis clearly recognising the differences.

4. The Markets are Key

We agree with MPI's proposal that "[o]rienting the sector towards consumers and the market" should be a pillar of the transformation plan. This is vital when it comes to policy and regulation of GM food technologies and products because New Zealand is a standards taker: exporters have to deliver to overseas consumer expectations first. It is about what global customers want and our ability to deliver that without contamination

It is well documented that market resistance to GM foods is one of two main reasons that GM ag 1.0 has remained corralled to input-tolerant broadacre crops that largely just service animal feed and food product markets where GM content is unlabelled.[13] (The other is the technological challenge of developing other GM traits that perform competitively and reliably infield and in the market.)

Since 1996, when GM 1.0 first began to reach market via herbicide-resistant soybean production in the US, the role of the gatekeepers – retailers, food processors, among others – has effectively determined the fate of GM crops. It is they who have dictated the market standard for deliberate use of GM ingredients in food products that are labelled for GM – avoidance. Critically, that have also set the standards for avoidance of trace contamination.

Private standards on GM are what really bite for New Zealand exporters

Key to understanding the environment New Zealand exporters must operate within is that it is not just government regulation or domestic social licence that determines whether use of GM and gene edited products is a good strategy for NZ Inc. The rule of thumb is that government regulations on GM have typically set the *minimum* standards for exporters, but do not guarantee market access or shelf space. This is because private standards around the world – those set by individual companies or supply chain certifiers - set the standards that count.

[13] See for example: http://www.sustainabilitynz.org/twenty-two-years-on-gm-foods-still-a-story-of-commodity-crops-and-the-americas/

The market situation in the European Union provides evidence of this: over 50 GMOs have been approved for use in food products but as the USDA reports, **almost no GM ingredients are present in food products on the European market because gatekeepers** – food processors and retailers – have refused to use them in order to satisfy customers and consumers:

> … because of consumer negative perceptions, food manufacturers continue to reformulate in order to avoid the "Contains GMOs" claim. […] Most food retailers, especially major supermarkets, promote themselves as carrying only non-GE products. There are several initiatives in the EU MS [Member State] level to differentiate themselves at the retail level by using voluntary GE-Free labels. […] Some retailers also fear actions by activist organisations that would likely target any retailer offering GE-labeled products, which means an unacceptable brand risk that hinders the introduction of GE-labeled food[14]

That gatekeepers call the shots is well understood by exporters in the marketplace but, despite thirty years of experience from GM 1.0 to draw upon, commentators seeking to guide conversations about GM 2.0 have largely failed to get this. Recent reports advocating or implying the need for deregulation focus exclusively on government regulation of gene editing in our key markets:

> **Te Puna Whakaaronui** provides no analysis of where commercial players are on gene editing; it frames and understands the market conditions as being exclusively determined by government regulation. This is surprising for a business-led group wanting to promote food and fibre sector understanding of the technology.
>
> The **Productivity Commission's Report, Frontier Firms,** also makes no mention of private standards or what buyers of New Zealand food and beverage products expect when it comes to GM content.
>
> Neither of the **Royal Society Gene Editing Panel**'s 2019 reports provide any analysis or understanding of the critical role markets play.[15] Indeed, when the Sustainability Council urged the panel to research market responses for its report to the primary sector, we were told that the Panel "did not have access to that information".

The Plan is **currently tracking to make the same mistake.** It refers to regulatory change in other jurisdictions (p. 24) and implies, by making no mention of where market gatekeepers sit, that trading partner regulations on GM alone set the standards New Zealand exporters must meet.

Providing a fuller picture of the market barriers to gene edited products - where markets players are at and how this informs the receiving environment for GM products - is a baseline requirement for the Plan. Otherwise, it will present a distorted, supply-side, GM developer perspective that will not benefit the food and fibre industry.

Government regulations set the *minimum* standards (market entry) but do not guarantee market access or shelf space

Private standards set the standards that count

[14] USDA Foreign Agricultural Service. 2022. Biotechnology and Other New Production Technologies Annual. GAIN Report # E42022-0069

[15] The reports are: *Gene Editing Scenarios for the Primary Industries* and *Gene Editing Legal and Regulatory Implications.*

Market Reception of Gene Edited Food Products: Current Signals

How gene edited foods will ultimately settle with consumers and gatekeepers remains to be demonstrated. The technology simply hasn't been put to any meaningful market test so far. The only products commercialised to date stayed in close-looped production in North America (before being pulled from the market) or are in limited production in the country of origin (Japan)

The reception of gene edited foods could go one of two ways: consumers will bundle GM 2.0 (gene editing of foods) with GM 1.0 and similarly reject them, or they will distinguish GM 2.0 from GM 1.0 and be more tolerant or even receptive.

However, the market response may not be linear and stay the course in one direction. For example, one of the first GM 1.0 products (the GM Flavr Savr tomato) was initially well received and suggested that GM 1.0 would be embraced by consumers. However, the trajectory changed radically and long-term with the introduction of GM herbicide tolerant soybean in 1996.

There is a risk that even if initially there is a favourable reception to an individual gene edited product, a trigger from a subsequent product could plunge consumers into a negative view of gene editing products overall.

Notwithstanding the observation that it is too early to call how gene edited food and beverage products will be received, there are some signs that GM 2.0 is on a similar market trajectory to GM 1.0. The following gatekeepers and sectors that operate high-trust, high-integrity food production or certification have already laid the foundations for market differentiation that will allow consumers to choose to avoid gene edited products:

- The US Non-GMO Project, which certifies around US$40 billion in products annually[16] (including Fonterra's NZ Milk Products)
- The German Non-GM standard (VLOG), which certifies around 13 Billion Euros of products annually[17]
- A number of major retailers in Europe, under the banner of the European Association of Non-GMO Retailers[18]
- The International Federation of Organic Agriculture Movements (IFOAM)[19]

[16] March 2022 figures: https://non-gmoreport.com/articles/non-gmo-project-providing-non-gmo-food-options-for-the-past-15-years/

[17] August 2022 figures: https://www.ohnegentechnik.org/en/news/article/products-sold-for-over-13-billion-euros-maintaining-the-successful-ohne-gentechnik-label

[18] The European Non-GMO Retailers Association. Signatories to the 2021 *Retailers' Resolution* are: ALDI Hungary, ALDI Italy, ALDI NORD Germany, ALDI SUED Germany, ALDI Suisse, Alnatura Germany, BioMarkt Verbund Germany, BNN Germany, Dennree GmbH Germany, Denn's Biomarkt GmbH Germany, Handelsverband Österreich Austria, HOFER KG Austria, HOFER Slovenia, IGBM e.V. (Interessengemeinschaft BioMarkt e.V.) Germany, Lidl Dienstleistung GmbH & Co. KG Germany, Lidl Österreich GmbH Austria, Naturata Luxemburg, METRO Cash & Carry Österreich GmbH Austria, MPREIS Warenvertriebs GmbH Austria, Rewe Group Austria (incl. Billa and Penny), SPAR Österreichische Warenhandel GmbH Austria, Synadis bio France, Tegut Germany, TOP-TEAM Zentraleinkauf GmbH Austria, Transgourmet Österreich GmbH Austria, Unimarkt Gruppe (Unimarkt, Pfeiffer Großhandel, Nah & frisch) Austria

[19] IFOAM. 2020. *Genetic Engineering and Genetically Modified Organisms.* Position Paper

Polls of consumer views on gene editing do vary and to date are conducted in the absence of actual products. However, a number of polls show a strong desire for regulation and labelling of gene edited products in overseas markets. We are happy to provide details if this would assist.

The critical lesson from GM 1.0 for regulators is that large sections of the consumer market were unwilling to embrace GM foods of any form and unless producers can cater to this segment at the same time as using gene editing, they must be able to justify the gains from that move as though they were losing the other share of the market and believe that there is no better route to product enhancement.

5. New Zealand Needs A High-Trust Regulatory Model

The premium food exporters that New Zealand already hosts, and those it intends to foster through the Plan, play to a high-trust business model. In short, they must be trusted providers to earn premium prices.

Many things go into being an individually trusted provider. But underpinning these are New Zealand's regulations - the baseline set in their country of origin.

As the Plan notes: "Effective regulation helps to manage public risks and obligations, and provides important assurances to consumers, foreign governments, and supply chain partners."

This is even more the case with regulation of GM foods. In the first instance, products can be physically impacted by GM foods contaminating non-GM foods - causing loss of premiums or even outright product rejection in certain cases. And even in absence of physical contamination, products can be affected by brand contamination.

These underlying features of the market environment mean there Is a strong case for regulation of some form remaining at least until there Is evidence that the risks regulation can efficiently address are no longer present. **We therefore submit that the Plan needs to frame the question much more in terms of what form of regulation is needed, rather than the current implicit framing around whether regulation is required.**

The food industry is well aware of the costs that safety failures can generate. Our largest exporter Fonterra suffered a loss of around $70 million through its stake in San Lu In the wake of China's melamine scandal, and a further loss in excess of $200 million through the botulism testing failure on local soil. They have also tracked the financial and reputational burden that GM contamination events overseas, and in New Zealand, have generated.

When it comes to GMOs, Fonterra is well aware of the valuable assurance and market advantage that New Zealand's regulatory and market position provides. In its claim pack supporting NZMP's Non-GMO Project certification for the North American market and its non-GM product range, the company sets out why customers can trust the non-GM status of its products:

- "New Zealand has stringent biosecurity regulations, and is well-recognised for its regulatory control of GMOs.

- No genetically modified plants or animals (including cows) have been released in New Zealand, and no genetically modified antibiotics, vaccines, or growth hormones are used on cows here.
- New Zealand regulations do not prohibit the release but no releases have currently been approved following the application process through the New Zealand HSNO Act.
- New Zealand is one of the only dairying countries in the world which has not approved release of genetically modified crops."[20]

That GM contamination in the market can have financial consequences as serious as those for botulism has been demonstrated repeatedly. This can arise through a number of different routes - from trace contamination of a GM food that is not a legal food in a destination market, to contamination that breaches a certification standard (such the Non-GMO Project one noted above). To date there are at least three claims that have resulted in economic impacts measure in the billions of dollars and many more in the hundreds of millions.[21] Caution in respect of potential financial losses alone, not to mention reputation damage, provides additional reason to continue regulatory coverage of all food products deemed to be GMOs under the definitions contained in key international agreements: the Cartagena Biosafety Protocol and Codex Alimentarius.

HSNO was developed and amended with a keen eye on those international agreements and its principles remain not only consistent with them, but also allow for gene science to evolve and remain efficiently regulated. Critiques of HSNO being out of date do not acknowledge the robust and flexible definitional structure the law is based on (as further described in the box below). The critique amounts to a GM developer rallying cry rather than analysis and is not a useful touchstone to place in the Plan.

[20] Fonterra. 2017. Leveraging the Non-GMO Project Advantage. Claim Pack https://www.nzmp.com/content/dam/nzmp/pdfs/Claim_pack_Non-GMO_Project_NORTH_AMERICA_ONLY_10Mar2017.pdf

[21] Sustainability Council. 2014. *Busted at the Border. GMOs and the High Cost of Running Ahead of Market Approval.* http://www.sustainabilitynz.org/wp-content/uploads/2014/10/BustedattheBorder_August2014.pdf

HSNO: Past its use-by-date or long-life UHT?

The Draft Plan suggests that the GM regulatory regime is out of date simply because it was first set in 1996 and GM technology has moved on. This take rests on two simplistic assumptions:

1. That because HSNO is around two and half decades old, its provisions are not relevant to manage the risks of new genetic modification techniques that have emerged since it was passed. A second string to this is that HSNO was designed only to deal with genetic modification involving the transfer of genes from one species to another. A structural analysis of the Act shows that HSNO provides a risk-management regime for new genetic engineering technologies in general (not just the variants that first emerged).

   The HSNO definition of a GMO focusses on **heritability of engineered traits, not the source of the genetic material**. As such, it does not restrict itself to organisms into which foreign genes have been introduced. These were just the first GM techniques being trialled at the time. This is relevant because the use of foreign genes is not the exclusive source of risk when using GM techniques, as Heinemann et al note:

   > Examples such as sickle cell anemia disease demonstrate the impotence of using pseudo-scales such as foreignness as legislative triggers for techniques that might only change a single nucleotide, but at the global level might change patterns of habitation.[22]

2. That gene editing of organisms is safe by design and there is no need for any regulatory risk management. This, as noted above, should not be the government's operating assumption. Gene editing of organisms – even those techniques that generally described as lower intervention (SDN 1 and 2) - is well demonstrated to cause a number of unintended changes and requires regulation.

   Some gene edited organisms may not be harmful but the way to ensure that only those that are not harmful are on the market and released into nature is to regulate them. Further, the HSNO Act is sufficiently flexible to reflect different degrees of risk, where this is warranted.

Detection of Gene Edited Organisms

Detection has become something of a chestnut in debates about regulation of gene edited products. For some years, a projected inability to detect gene edited organisms has been

[22] Heinemann J, Paull D J, Walker S and B Kurenbach. 2021. Differentiated impacts of human interventions on nature: Scaling the conversation on regulation of gene technologies. *Elementa: Science of the Anthropocene* (2021) 9 (1): 00086.

presented as an argument that regulating gene edited products is simply a moot point: they can't be regulated because they can't be detected.

This take has rested on the assumption that while the ability to engineer organisms will evolve rapidly, the technologies to detect them will stay marooned in yesteryear. This ignores two key technology drivers:

- State and private sector requirements to track and trace GMOs drove detection methodologies to date. This has seen the specificity of detection methodologies improve radically since the 1990s and the cost drop to make GMO detection cheap and ubiquitous. One of those same drivers is present now, in the form of the influential private standards such as the North American Non-GMO Project certification - for gene edited organisms. The absence of products is currently the main issue – as is the resistance of developers to making samples of genetic material available.[23]
- It is well established that if developers are required to provide information that identifies their products, detection is possible. This is true even of organisms where just a single-base pair has been changed. In this respect, the ability to detect new GMOs is as much a factor of political will, as it is technological capability.

In the real world, the science of detection is moving apace since conversations about regulation of gene editing first started. For example, Zhang, et al. [12] successfully developed genome edited rice and, in parallel, developed PCR-based tests for each event, including one consisting of a single nucleotide alteration. There appears to be general acceptance that real time PCR (qPCR), digital PCR (dPCR) and next generation sequencing (NGS) hold promise for the detection of "NGT products" and that in the case of gene edited organisms, it may be that flanking regions – not the target site (for the modification) as in the case of GM 1.0 organisms – that detection methods zero in on.[24]

When asked for evidence of the stated difficulties regulators are experiencing (which regulators, in which areas and how often), MPI sent a single article on detection of gene edited organisms (Weidner et al 2022).[25] Some context may be helpful. The article is a response to a detection method developed by Challiyil et al[26] for the first gene edited GMO on the market – the now withdrawn Cibus herbicide-tolerant canola. Weidner et al conclude that while sufficiently sensitive, the method is not sufficiently specific or robust. Laboratory work by the developers of the original method is underway to test Weidner et al as a basis for refining the method, if required. This is the real-time evolution of detection capabilities at work.

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[23] This is well documented in the case of the SU Canola case and German fedearl agencies difficulties in obtaining genetic material from the developer, Cibus.

[24] Observations at the March 2023 conference, GMO Analysis and New Genomic Techniques. https://www.bfr-akademie.de/gmo2023/ SIMON, I'm refering to Fran's notes here

[25] Weidner C, Edelmann S, Moor D, Lieske K, Savini C, Jacchia S, Grazia Sacco M, Mazzara M, Lämke J, ·Eckermann K N, Emons H, Mankertz J and L Grohmann. 2022. Assessment of the Real-Time PCR Method Claiming to be Specific for Detection and Quantification of the First Commercialised Genome-Edited Plant. *Food Analytical Methods*. https://doi.org/10.1007/s12161-022-02237-y.

[26] Chhalliyil P, Ilves H, Kazakov S A, Howard S J, Johnston B H and J Fagan. 2020. A Real-Time Quantitative PCR Method Specific for Detection and Quantification of the First Commercialized Genome-Edited Plant. *Foods* 2020, *9*, 1245, doi:10.3390/foods9091245.

Regulation of biofermentation

Where there appears to be scope for changes to HSNO without reducing or dispensing with the high-trust regulatory regime are the rules governing commercial-scale biofermentation.

The Plan refers to a press report on companies that have not been able to commercially scale up their production due to HSNO settings.[27] It is important to note that not all companies have faced these issues: for example, even a relatively small startup, Daisy Lab, cleared HSNO approval hurdles and secured significant funding for such work.[28] Nevertheless, it is important to ensure that commercial scale biofermentation does not face undue regulation and we welcome options analysis targeted at this, consistent with the HSNO Act's existing principles. In particular, focus should be on the extent to which any unnecessary hurdles can be remedied by way of the regulations that sit under the Act.

Relationship with International Regulation

Harmonisation with other countries' regulations is not an ultimate good and the benefits do not seem to outweigh the costs. A global marketplace with different regulatory regimes for GMOs has been the operating reality for New Zealand over the last thirty years. It has not created any great impediments for New Zealand exporters.

This includes Transtasman arrangements and the position that FSANZ has taken with respect to gene edited foods: New Zealand's environmental and food safety laws have defined and treated GM foods differently for at least two decades with no meaningful restriction on the ability of food producers to trade.

In closing

The Sustainability Council supports MPI's efforts to assist the food and beverage sector meet the significant, converging challenges via a strategic transformation plan.

The Plan at present relies a great deal on innovation for achieving change, with (undue) emphasis on gene editing as an innovation method. At the same time, remedying the underperformance in environmental standards, necessary under any scenario, does not seriously feature in the draft action points. In consequence **the Plan looks to reduce regulatory barriers to one form of environmental and market risk (where the gains are speculative), while presenting as optional the tightening of environmental regulation that it is clear will be needed to preserve access to premium markets for existing products**. A better balance of regulatory focus will be in the long-term interest of the sector and the nation.

We are open to assisting MPI with further information and analysis as required.

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[27] https://www.stuff.co.nz/environment/128185542/is-this-the-technology-to-win-kiwis-over-to-genetic-engineering

[28] https://www.epa.govt.nz/database-search/hsno-application-register/view/APP204409
https://www.stuff.co.nz/business/prosper/130062728/nz-firm-wants-to-help-world-rely-less-on-milk-protein