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9th November 2018

Herd Improvement
Agriculture, Marine and Plant Policy
Ministry for Primary Industries
PO Box 2526
Wellington 6140

By email to info@mpi.govt.nz

RE: Dairy Herd Improvement Industry – Review of Regulation (MPI Discussion Paper No: 2018/10)

Please find **attached** Livestock Improvement Corporation's submission in respect of the above Discussion Paper.

The issues covered in this Discussion Paper are extremely important to the New Zealand dairy industry, the interests of LIC shareholders and the future of LIC.

Should you wish to follow up on our submission, please contact:

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Yours sincerely

Murray King
Chairman - Livestock Improvement Corporation

Enc.

LIVESTOCK IMPROVEMENT CORPORATION
SUBMISSION TO
THE MINISTRY FOR PRIMARY INDUSTRIES
ON
THE DAIRY HERD IMPROVEMENT INDUSTRY
REVIEW OF REGULATION

(MPI Discussion Paper No. 2018/10)

9th NOVEMBER 2018

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EXECUTIVE SUMMARY

LIC is pleased to present this submission to the Ministry for Primary Industries (MPI). The issues covered in the Discussion Paper (2018/10) are extremely important to the New Zealand dairy industry, the interests of LIC shareholders and the future of LIC.

LIC is a New Zealand dairy farmer-owned co-operative with an absolute focus on the sustainable productivity gains of our dairy industry and ensuring that the sector keeps its innovation-led edge.

Our shareholders, New Zealand dairy farmers, have through LIC invested hundreds of millions in research and development to ensure that the productivity and innovation of New Zealand dairy farming remains the very best in the world.

As recognised in MPI's Discussion Paper, the herd improvement industry involves a number of different services, all of which are supported by data. It is therefore critical that any change in approach to regulation of that data is carefully considered in light of the herd improvement industry as a whole (and the nature of any impact on any individual services).

Broadly, we are of the view that the current herd improvement model supports and incentivises investment, albeit acknowledging that minor adjustments could be made to improve the regulatory framework further. We think the current core (regulated) data, supplemented by the voluntary arrangements for certified herd testers to provide additional data for animal evaluation, achieves the optimum balance between ensuring accessible core data while promoting industry innovation in data collection, analytics and use.

Wholesale reform as represented by options (ii) and (iii) in section 5.1 of the Discussion Paper, would undermine the stated intent and objectives of the Review, stifle innovation, increase costs for farmers, and ultimately be detrimental to the long-term interests of New Zealand dairy farmers.

This is because these options would introduce significant uncertainty as to whether innovators would retain the ownership / benefits of their innovation, with the consequential decrease in attractiveness of vital long-term research. It would also prejudice those who have invested in existing, new and novel datasets and analytics only to have those innovations expropriated and made publicly available for others to use to their commercial advantage.

From a data perspective, we are prepared to continue to invest deeply in innovation of data-generating activities to underpin decision making in artificial breeding. If others were permitted to use non-core data for their commercial gain, there would be less motivation to invest in the data-related innovation and less motivation to continue to participate in activities that benefit the wider industry.

LIC commissioned Sapere Research Group to provide an expert independent public policy analysis; please see Appendix 1 for their report. Sapere conclude that an expansion of the core data fields as proposed in options (ii) and (iii) of section 5.1 of the MPI Discussion Paper would give rise to free-rider problems within the industry, threaten systemic innovation, establish an overly bureaucratic structure and not be of public benefit. Further, the expansion of core data would represent a regulatory taking which could not be justified on the basis of either significant public benefit or necessity. These outcomes would completely undermine the objectives of the Review and undermine the critical success factors of the dairy herd improvement industry.

As a farmer owned co-operative, we have a clear mandate not to just return profits through dividends, but to invest them in new products and services and R&D that ultimately benefits the broader New Zealand dairy industry. Our vision and purpose, as a co-operative, drive our behaviour:

- *Purpose: LIC is a dairy farmer owned co-operative which empowers livestock farmers through the delivery of superior genetics and technology*
- *Vision: to improve the prosperity and productivity of our farmers*

Dairy herd improvement is core to our business. We understand the intent of the Review and in particular ensuring that the herd improvement industry supports increased productivity and innovation, that regulatory mechanisms are flexible and future-proof, and that the regulatory framework remains well aligned with the dairy industry's current and future animal evaluation needs.

In our view, the system and structure that has served NZ dairy farmers for over a century is not broken. The Discussion Paper does not present sufficient evidence of structural problems with the existing regulatory regime to justify taking such a risky gamble (i.e. changes to the Regulations) on the future of the New Zealand dairy industry.

Finally, we remain concerned by the on-going restrictions and costs associated with industry oversight of LIC's database, particularly given the transition to DairyNZ of the core database management, NZAEL operating animal evaluation and the contestable and changing nature of herd testing. LIC should not be constrained unnecessarily in its ability to use and transact the data generated by its own contributing shareholders and this is without prejudice to the industry. LIC continues to supply data required for animal evaluation (at no cost) and non-core data on request to competing herd recorders (subject to agreement on pricing, which is excluded from this Review), and has delivered and complied with everything the existing legislation requires. LIC strongly believes therefore that it should be unshackled from all regulation imposed on it under the Dairy Industry Restructuring Act 2001 and its associated regulations.

INTRODUCTION TO LIC

LIC is a New Zealand dairy farmer-owned co-operative specialising in herd improvement and farming solutions. It has been in the business of optimising genetic gain since pioneering herd testing in New Zealand over 100 years ago. LIC is owned by 10,377 NZ dairy farmers (as at 1 November 2018).

LIC has a long history of innovation and investment in R&D with the overall aim of improving the profitability and productivity of dairy farming in NZ. In the past 5 years, LIC has invested close to $77M of shareholder funds in research and development.

In the 1940s and 1950s, LIC pioneered artificial insemination of dairy cattle and went on to establish a progeny test scheme in order to breed bulls with superior dairying performance. Both these innovations significantly enhanced the rate of genetic gain for the industry. When combined with the revolutionary invention of liquid semen technology in the 1970s, and the extensive adoption of electronic herd recording services and a standardised breeding index in the 1980s, LIC has delivered unprecedented rates of genetic gain.

It has been estimated that genetic gain contributes around $300M per annum to the NZ dairy industry[1]. LIC significantly delivers this value each year through inseminating 3 out of 4 cows, testing over 10M milk samples, despatching 5M straws of fresh semen for insemination, analysing over 800k samples for disease identification and parentage verification and capturing and delivering data and information through MINDA® to over 90% of dairy farmers. These delivery mechanisms are the means by which significant value is left on farm by LIC.

LIC continues to invest in and push the technological boundaries to deliver genetic gain to the dairy industry through the next wave of innovative genetic technologies, including genomic selection. This legacy of successful innovation and technology extension has been at the heart of productivity improvements and genetic gain in the dairy industry since the first herd tests were conducted. Without such investment and focus, New Zealand's dairy industry would be at a significant disadvantage, and could over time fall behind its international competitors.

THE CURRENT HERD IMPROVEMENT MODEL

Innovation is essential to, and a major commercial advantage of, the NZ dairy industry and commercial incentives that encourage innovation have worked extremely well to date. Indeed, the rate of genetic improvement in the New Zealand dairy herd is world leading. It is recognised that feed alone does not deliver better production and that genetic gain contributes over 60% of the annual productivity improvements on NZ dairy farms.

The current balance of core-data regulation and intra-industry agreements that support the sharing of data and research programmes are delivering the outcomes and outputs expected by NZ farmers, and those that significantly improve the quality of the NZ dairy herd. On-going development can continue to be maintained and enhanced under the current model with only moderate tweaks to the regulatory framework.

Sufficient competitive tension exists between the current participants in the industry to drive the innovation that enhances herd improvement. For example, investment in world leading genetic research resulting in the introduction of new DNA technologies, from genomic selection to testing for deleterious genes in the wider dairy population. LIC and CRV Ambreed have invested in and developed genomic selection technology and have both applied this in the NZ market.

There are further examples of the industry benefiting from these intra-industry agreements to drive commercially funded research. Examples include enhancements made to the National Breeding Objective to take into account Calving Difficulty and Gestation Length traits. These traits were developed by LIC for its farmer shareholders before becoming part of animal evaluation. LIC is currently working with NZAEL around the provision of Walk-Over Weigh data and on future proofing Body Condition Score events to include source and certification. Both areas of research are being led by LIC.

The success of these commercially driven initiatives and the current model in delivering genetic gain has been predicated on a value exchange between farmers and service providers. This reciprocal exchange has ensured farmers receive valuable, up to date herd improvement information, while the service provider has remained focused on generating value added information and services that meet the needs of NZ farmers. The existence of these market forces has therefore created the conditions for the establishment of key industry assets such as the core database and the National Breeding Objective.

[1] P Amer (2012) "Cost benefit implications of a NZ Breeding Objective for the NZ dairy industry"

However, this value exchange is not immune from disruption. Herd testing (which underpins herd improvement) is a highly discretionary activity and is easily impacted by on-farm cost pressures, including a fall in milk price. As a result, the contribution of data through herd testing and recording is vulnerable to changes in costs, technology and compliance/regulation. For example, in the 2015/16 dairy season, we saw a reduction of 1,408 herds undertaking herd testing (approx. 16%) as a result of the reduction in milk price, noting that when the milk price rises, participation in herd testing recovers. The reaction to participation levels similarly falls when herd testing charges are increased.

Given the sensitivity of herd testing to any change, be it increased costs or effort to collect the data (whether directly or indirectly incurred) as a result of unnecessary regulation, in our view would diminish the free flow and volume of data captured, with a resulting value dilution in the outcomes.

Furthermore, decentralisation and fragmentation of the elements of the herd improvement cycle will lead to inferior results, reduced synergies and inevitably slow down decision making, which in turn ultimately will slow down the speed of genetic gain.

The key risks to the herd improvement industry that currently exist are:

- Increased regulation with increased costs of compliance and enforcement will reduce participation
- Fragmentation of the herd improvement cycle causing inefficiency in the processing and delivery of integrated data/information and less cohesive research investment
- Divergence of objectives by players in the Industry, especially with added participants through technology
- Regulatory requirements slowing agile developments that respond to farmer needs
- Innovation becomes less beneficial to individual organisations and opportunities are lost, especially where those players are focussed only on part of the industry
- The ongoing accuracy and relevance of source data, the validity of analysis and reporting
- The devaluing of proprietary IP will stifle investment by the commercial participants in herd improvement.

Investment in R&D requires a critical mass and scale to both fund the research (short and long term) but also to deliver the high value outputs to farmers at the lowest commercial cost. It is this need for scale that is driving amalgamations of international breeding companies and makes them more of a competitive threat to NZ. Two recent examples of amalgamations are Alta Genetics and CRI in the USA and Sexing Technologies' purchase of Cogent in the UK.

In a similar analogy, the drug companies of the world need scale to fund the size and the long term horizons of R&D and also to assure the wide scale of distribution to recover that investment. It would be very unlikely that these companies would then freely divulge their recipes or IP without control or recompense. Likewise LIC wants to collaborate and cooperate across the industry but we have an obligation to our farmer shareholders to protect, and not cede control of, our proprietary IP and not to dilute their accumulated shareholder value.

It is important to recognise that, for optimum outcomes, all the elements of the herd improvement model have to integrate and flow. Herd testing is the start of the process and essential to the progressive productivity cycle but it, in and of itself, does not deliver the majority of the herd improvement benefits. It is the monitoring, measuring, and continuous innovation / R&D (in existing, new and novel data collection and analytics and its subsequent delivery) that enables farmers and suppliers of genetics to make choices and decisions to improve the quality of the NZ herds. The

relentless and focussed pursuit of herd improvement is what keeps NZ ahead of the global competition.

LEADERSHIP

There are two key factors that underpin the success of dairy herd improvement in New Zealand:

- Dairy farmers' willingness to improve their herds through detailed records and support the industry's use of that data for both their individual benefit and the collective benefit of fellow farmers.
- The passion, vision and drive of the individuals and governing bodies in the industry. The fact that the herd improvement "movement" was farmer led and governed throughout its history is undoubtedly a cornerstone of the success of the dairy industry in NZ.

The Discussion Paper for this submission describes the Herd Improvement Industry as encompassing dairy herd testing, herd recording, animal evaluation, artificial breeding and database services (the five contributing elements to herd improvement).

LIC, and its predecessors, is unique in being the leader of the NZ industry in all these activities for more than 100 years. LIC established ancestry, mating and health event recording; it introduced and developed a significant proportion of the gains in the efficiency and productivity of the NZ dairy herd; it developed national standards for animal indices and evaluation; and led the creation of the national database of dairy animals.

This integration of all five contributing elements within LIC, positions LIC to make a valuable and compelling commentary on the status of the industry and indeed this submission. It would be counter-productive to a key source of ongoing innovation for the industry if the ongoing significance of this contribution was not recognised in the context of this Review.

INDUSTRY GOOD

A feature of the regulatory framework is to enable data to be used for "Industry Good". Industry good is a term often referred to in dairy circles but is not very well defined. It would be hard to find a more apt definition of "Industry Good" than the combination of LIC's vision and purpose statement.

Another view of what is industry good could be the current aim of the National Breeding Objective, which is "the breeding of dairy cattle which are the most efficient converters of feed into farmer profit".

While there may be many well intentioned contributions to industry good, we are not aware of any significant genetic gains emanating from parties other than the existing data providers.

LIC invests significantly in research and development, well above NZ and OECD averages for the agri-sector. The average over the past 7 years has been 6.9% of revenue. (See Table 1 below for the level of recent investment in R&D by LIC). No one else in the NZ dairy industry invests anything like this and LIC is the real engine room of that continuous improvement NZ dairy farmers enjoy. Despite the recent changes to the structure of the industry, LIC remains the main driver behind herd improvement in NZ.

Table 1

	2017/18	2016/17	2015/16	2014/15	2013/14	2012/13	2011/12
Investment in R&D ($000)	13,000	14,000	17,200	16,900	14,900	12,800	10,800
R&D (%age of revenue)	5.50%	6.88%	8.39%	7.40%	7.18%	6.61%	6.18%

LIC constantly supports the industry through sponsorship of key events, and is actively involved in responding to unexpected incidents, crises and challenges in the wider dairy industry. It continues to be a key support to DIGAD and maintains collaborations, relationships and dialogue with key stakeholders in the dairy industry in relation to new opportunities for the herd improvement industry. Key stakeholders include the Universities, Breed Societies, NZAEL, DairyNZ, CRV Ambreed and dairy processors/organisations.

NZ OWNED & OPERATED

The farmer owners of LIC are committed to this extraordinary investment into genetic gain. Over 90% of NZ dairy farmers own shares in the LIC co-operative and they understand the importance of keeping NZ ahead of the game internationally and in keeping NZ generated data, information and knowledge secure for the future benefit of dairying in NZ.

While LIC generates revenue from charging commercial prices for all of its products and services, it is important to understand that 100% of the surplus from its operations is either paid out as dividends to the contributing farmer shareholders or re-invested into research and development of products and services that will continue the growth in productivity, profitability and sustainability of the NZ dairy industry.

More than 75% of NZ farmers, as participants in national herd testing, volunteer to share their core data along with that of their peers, for the betterment of the industry within NZ. They do this understanding the value of the outcomes in terms of on-farm productivity. They are prepared to pay for the data collection, analysis and reporting regardless of regulation and compulsion. Moreover, LIC shareholders are prepared to contribute a significant proportion of business surpluses to re-investment into research and development of further genetic gain.

COMMERCIAL FOCUS

LIC is a co-operative and maintains a targeted commercial focus. Everything we do has to make sense to our customers, who are also our shareholders, and to the NZ dairy industry. This ensures not only efficiency of operations but also the effectiveness of investment decisions, particularly in respect of key elements of research and development. Bold initiatives into automation (including in-line milk meter technology), diagnostic testing (including parentage verification), genomics, Long Last Liquid Semen, animal evaluation, Sire Proving, artificial intelligence (SPACE™) and complex databases have delivered huge returns to NZ Inc.

NZ farmers fully understand that it is necessary to charge for the valuable information that comes from the herd improvement process and that this cost ensures future funding of the innovation needed to maintain the cycle of improvement. An update of Amer's 2012 paper (referenced above)

estimates LIC's contribution to genetic gain is currently $330M per annum; this is generated by $92.9M of farmer purchases in LIC genetics (2017/18).

It is acknowledged that LIC makes extensive use of industry data to improve existing, and create new, products and services, but those products and services are available to all NZ farmers. Ultimately much of the value attributable to products and services that promote genetic gain fall to the farmers' pocket and NZ's GDP.

Markets where solely commercial returns (as opposed to subsidies) have been expected to fund the provision and enhancement of ostensibly industry good activities (or activities that enable value further along the supply chain), have not proved to be sustainable and lead to poorer quality services and acceptance of sub-optimal outcomes. In situations where effective regulation and self-governance by users of the services exists, (such as in the co-operative model), efficiencies can be delivered through economies of scale and a genuine desire to meet the needs of the shareholders.

In our view, the system and structure that has served NZ dairy farmers for a century is not broken and no evidence has been provided that it is. The unique horizontal integration and industry collaboration can continue to serve the industry well, with minimal regulation required. It is important for the good of the New Zealand dairy industry that a well-functioning regulatory model is not disregarded because of well-intentioned but incorrect views on the need for increased competition.

THE FUTURE

In 20 years the average cow will probably be cross-bred, produce an extra 40kgs of protein, 40kgs of fat and 900 more litres with similar fertility and live-weight to today's cow. She will be a more efficient converter of feed into milk and will be measured for new traits possibly selected for lower methane and nitrogen output.

Consumer concerns and demands will become stronger and will drive breeding programmes to further focus on traits such as methane production, nitrogen excretion and healthy animals. New phenotypes will need to be generated that can be measured at scale or at least on the breeding stock of interest. Collaboration within the NZ industry and also internationally will be important to allow progress in these traits. The response to this has already commenced and is demonstrated by the recent LIC and CRV international research investigation into breeding for methane in dairy cattle on behalf of the New Zealand Agricultural Greenhouse Gas Research Centre.

Genomic data will be integral to the future of dairy cattle herd improvement through the ability to assess an animal's genetic merit before phenotypic information has been collected. LIC and DairyNZ have recently submitted a joint proposal to the Primary Growth Partnership fund which will deliver genomic breeding values in the national genetic evaluation system. This proposal will see the intellectual property of LIC's investment into genomics being retained by LIC whilst the outputs will be visible to and utilised by the wider industry. This demonstrates that the industry can find commercial constructs that satisfy both commercial and industry good drivers without the need for further regulation.

Undoubtedly, technology, science, the environment and demographics, will create new challenges and opportunities for the industry. It is important therefore for a relatively small trading nation that we retain the cohesiveness and collaboration of a co-operative approach to herd improvement without the distraction and constraints of too much self-imposed regulation.

Global trends are towards amalgamations across herd improvement/genetic companies, notably in Holland and USA, and therefore increased strength and competition can be expected to extend to the NZ market from these global companies. Accordingly, the NZ industry cannot afford to slacken the pace and thereby relinquish its global leadership of pastoral dairy genetics.

Technology will also play an increasing part in the future of data collection, storage and analysis. While this will undoubtedly reduce costs, these developments will also raise the risk/challenges in the form of disruption, speed of response and security. It is important that the industry is able to continue to maximise the data that it collects so that it can benefit from greater use of automation, Artificial Intelligence and new IT infrastructures.

THE DATA USED FOR ANIMAL EVALUATION

Q1 Have we correctly described the issue? (If not, please provide detail)

We believe the focus should be on how best to drive genetic improvement, as it is the key component to productivity improvement in the dairy industry, rather than a narrow focus on whether the right data fields are regulated. As we have highlighted above, considering a limited aspect of the industry risks negatively disrupting the model that has delivered consistent value over the long term.

The industry benefits from the use of improved genetics supplied by LIC alone, is currently estimated to be $330M per annum, with an average gain in value left on farm of over $30K per farm. It is therefore misleading to imply that the economic benefits are generated from the industry-good aspect of genetic improvement (ie the operation of animal evaluation).

Genetic improvement is generated through the selection of animals through four different pathways as outlined by Rendel and Robertson (1950)[2].

i) the selection of cows to generate the future bulls (the cow to bull pathway),
ii) the selection of sires to generate the future sons (sire to sire pathway),
iii) the selection of sires to be used commercially to generate the future cows (sire to cow pathway), and
iv) the selection of cows to breed the future cows (cow to cow pathway).

The first three selection pathways are controlled by the breeding organisations and generate at least 95% of the genetic improvement that is realised in the industry. The fourth pathway, the cow to cow pathway, is under the influence of the farmer, who makes these decisions.

The role of the industry-good aspect of genetic improvement is specifically to provide unbiased evaluations to enable farmers to have confidence in the evaluations when they make the purchasing decisions for the sire to cow pathway. This is the function undertaken by NZAEL currently.

The herd improvement industry's cost structure is multi-layered. Costs are incurred in:

- Creating the products and services that generate the data
- Collecting the data by the Certified Herd Testers/Herd Record Providers
- Cleansing, validating and accumulating the data
- Transmitting the data to NZAEL/DairyNZ for use in animal evaluation and industry good research
- Transforming the data into information by NZAEL that is up to date and valuable to farmers and to the breeding companies (ie into the breeding values and indices used by the industry)
- Delivering that valuable information via products and services to farmers (for example through MINDA software and apps and DataMATE®).

It should be noted that in transforming the raw data used in Animal Evaluation, NZAEL utilises IP developed by LIC. LIC, DairyNZ and NZAEL reached agreement in 2013 as to the parties' rights to use the outputs from the Animal Evaluation process. In particular, cow indices (BW, PW and LW) are owned exclusively by LIC.

[2] Rendel and Robertson, Estimation of Genetic Gain in Milk Yield by selection in a closed herd of dairy cattle (Journal of Genetics, 1950)

Commercial/industrial breeding companies such as LIC and CRV invest significantly, on a per annum basis, in breeding programmes and research that underpin genetic improvement. For example, LIC invests approximately $8-10M per year in the development of its breeding scheme and a further $3-4M per year in research and development specific to genetic improvement. In addition, the cost of collecting the core data and processing it and the supporting infrastructure is borne by the Certified Herd Testers and, by default, the dairy farmers themselves. It has been calculated that the cost of collecting and processing the core data is approximately $25M per annum for LIC, which is the herd record provider for over 90% of NZ dairy farmers. Cost of collection, processing and support of *non-core* data is a significant additional cost of approximately $80M per annum. In contrast, the investment from industry i.e. DairyNZ, is approximately $1.8M per annum (DairyNZ 2017/18 annual report). DairyNZ's investment is into the operational and research activities undertaken by NZAEL.

It is also worth acknowledging that a genetic improvement system utilising an industry-good body to undertake evaluations on behalf of the industry is not the only genetic improvement model. Pig and poultry sectors internationally are heavily, if not nearly solely, reliant on industrial companies undertaking genetic improvement and the evaluation of their stock and selling germplasm to the producers. This has been a very successful model as demonstrated by the improvements in the rate of finishing for both broiler chickens and pigs. For example, 40 years ago it took 72 days for a broiler chicken to reach slaughter weight of 2kg, in comparison to now where it takes 35 days to reach the equivalent weight.

While not supporting a change in the model for animal evaluation in New Zealand, there are different genetic improvement models that could operate successfully for the New Zealand dairy herd.

Q2 Of options (i), (ii) and (iii) which do you prefer? Please provide reasons for your preference.

LIC strongly supports option (i), which most clearly meets the objectives and intent of the Review. The NZ dairy industry's success relies on innovation and investment, and the current model carefully balances competition, participation rates and appropriate returns on investment. Any change in approach to regulation of data would have to carefully consider the herd improvement industry as a whole, as opposed to any individual service. The 46 core data fields currently regulated provide the fundamental information for both animal evaluation and industry good research. The list of core data fields is not out of date for the purposes of genetic improvement. It is important to note that these fields are routinely recorded by the majority of farmers during the season as part of good farm management practice. For example calving information, the tagging of new animals, mating information and milk production values.

LIC's provision of the additional data fields for animal evaluation is made available to NZAEL and DairyNZ via long term (effectively perpetual) contractual arrangements for the limited purpose of animal evaluation; the recording of these additional fields is currently discretionary for the majority of farmers and should remain so. If they were to be made core, it would require the Certified Herd Tester to collect the data from all herds and animals participating in herd testing, at a significantly increased cost, which would ultimately be borne by the farmer.

It is our view that the current voluntary arrangements provide the necessary flexibility and agility to ensure the provision of required data for animal evaluation, now and into the future, without requiring formal regulatory amendment. The transfer of the core database to DairyNZ in 2014 effectively removed any perceived barriers to competition. Furthermore, option (i) does not increase the cost of compliance for the certified herd testers or the farmers participating in herd testing.

Options (ii) and (iii) present significant challenges that make them unworkable from an industry perspective while not meeting the objectives and intent of the Review. The reasons for this are set out below. Further, all the risks highlighted on page 6, *The Current Herd Improvement Model,* are only likely to be further exacerbated if option (ii) or (iii) was adopted:

Option (ii):

- This would increase the cost of participation for farmers and certified herd testers (assuming that the Regulations would be unchanged in that **all** additional core data would have to be collected from **all** farmers participating in herd testing).
- Currently certain data fields are provided for animal evaluation by means of intra-industry agreements. If regulated, the provision of these additional data fields to the core database would have to meet industry agreed timeframes and quality standards (eg within 15 working days of receipt by the certified herd tester). Additional real time transmission systems for the extra fields may need to be developed or existing systems enhanced, and there would need to be standards agreed relating to the certification of the equipment used to collect the data (eg weigh scales) and data quality. These costs, together with the ongoing operational costs of data collection, cleansing, validation and transmission would add significant costs to the Certified Data Providers for no clear benefit over the status quo.
- The compulsion to provide this data may also result in increased costs to the farmer with resultant reduction in herd test participation.
- If regulated, it will introduce uncertainty as to what would be the next Regulatory Taking. This uncertainty is likely to discourage associated innovation.

Option (iii)

- This will undermine the incentives for commercial companies to invest in existing, new and novel datasets. The uncertainty as to future IP ownership rights and rights to use the outcomes of their investments will decrease the attractiveness of long term research and investment in new and existing data collection activities. It will also create an imbalance of power within the industry that does not reflect the relative contributions made by the key participants in the herd improvement industry.
- Genetic improvement in dairy cattle is a long-term endeavour and thus commercial research and development investment requires long-term certainty of the IP landscape. An example of this is LIC's investment in genomics that commenced in 1992. This investment, which totals over $50 million of LIC shareholder funds, has been undertaken on the basis of additional on-farm contribution through enhanced genetic gain and LIC achieving a commercial return for its dairy farmer shareholders from improved and differentiated semen products.
- While an increase in regulated data could increase innovation outside of the current core data providers, it would be minimal compared to the potential significant decrease in innovation currently generated by the current core data providers which are incentivised to take a longer term approach to the growth of the industry. We are not aware of any significant genetic gains emanating from innovation by parties other than the existing data providers. To add value, the providers of this innovation would also have to have mechanisms to deliver the value to farmers.

Q3 Under option (ii) are you able to provide an indication of costs or possible loss of revenue to herd testers?

Costs to the industry would be incurred in a number of areas under option (ii). The cost of the collection, validation, storage and transmission of data to DIGAD would increase if the additional core fields are mandatory for all herd testing participating farmers. We are unable to provide an indication of costs to be incurred by LIC; they are however likely to be in the hundreds of thousands, not tens of thousands of dollars. By way of reference, LIC has to date invested close to $3M in establishing the systems and processes that support the transfer of data (both core and non-core) to DairyNZ for inclusion in DIGAD and for use in animal evaluation.

The proposal that access to all regulated data would be determined by the Access Panel, that the price for all regulated data be determined by DairyNZ and that the certified herd testers would no longer be able to charge for that data would seriously undermine the viability of the industry and create an unreasonable monopoly in the supply of data.

The core database was created to ensure there was a secure, national database for the purpose of animal evaluation and industry good research in a competitive herd improvement market. Ensuring the Manager of the core database had a monopoly over determining the use and sale of core data was never required to achieve these core purposes. CRV Ambreed has never been constrained in the use to which it puts its copy of core data. Furthermore, the role of the Access Panel has meant that LIC has had no monopoly over core data sales or access. The majority of the costs of supplying core data to DIGAD will still be borne by the providers of that data. Freedom to independently determine how to commercialise those assets and/or offset those costs through collaborations and third party data transactions is essential to promote long-term economic benefits and to continue to innovate and collaborate for the benefit of their shareholders and the industry.

It is indicated in MPI's Discussion Paper that only 87 applications have been successfully made to the Access Panel since its inception in 2001. As indicated later in this submission, the nature of those applications is unknown and it is also not known whether the change in management of the core database has made any difference to the nature and rate of applications and whether those statistics support in any way the creation of a monopolistic supplier of data.

If regulation were to grant the Manager of the Core Database the monopoly on the sale and distribution of core data, then an equitable model would suggest that data contributors be financially compensated for the substantial costs incurred in creating and transferring data to DIGAD, and compensated for the IP which would be transferred.

The provision of current regulated data by LIC to third parties is not a significant source of revenue at this point in time but it is significant in terms of the provision of products and services to our farmer shareholders and to third parties with whom LIC has commercial, collaborative and other contractual relationships that benefit NZ dairy farmers.

Q4 Are there other options that could be considered?

One other option that could be considered is the removal of all regulations. This would generate a breeding system that would be similar to that seen in the pig and poultry industries i.e. where selection and evaluation is undertaken in-house (within company) and are not comparable or shared at an industry level. LIC does not see significant benefits of the de-regulated system to the current system. It may also remove confidence from farmers in participating in genetic improvement due to the lack of transparency of evaluations. However, if the costs and compliance of participating in industry

evaluation becomes too onerous, or the system is no longer seen to be fit for purpose and delivering outputs of value to farmers, this could potentially be a system that may be attractive in the future.

HERD TESTING TECHNOLOGIES ARE CHANGING

Q5 Have we correctly described the issue? (If not, please provide detail)

The issue has been described well with the exception that the requirement for workable herd test standards for on-farm systems is required now rather than in the future. LIC has been working with NZAEL for the last 12-18 months to try to accelerate herd test standards change. Over the last 2-3 months we have seen positive action from NZAEL in putting processes in place that may allow inline milk meter data to be accepted into the core database from June 2019. This key issue should be addressed now rather than being deferred.

Farmers currently use herd testing for a number of reasons:

- management decisions i.e. mastitis treatment, culling and drying off;
- making breeding decisions from the resultant BW information; and
- enhancing the resale value of their stock by having current animal indices.

Farmers voluntarily use herd testing for the direct benefits, as outlined above, and the industry captures the indirect benefits through genetic improvement. We are experiencing farmers with inline milk meters wanting to capture the value from having up to date indices from animal evaluation. The value of inline milk meters will be enhanced if the milk measurements are part of the core database and therefore included in animal evaluation, on the basis that animal evaluation continues to run efficiently and BW continues to be important within the industry. There is a natural incentive for herd testing businesses to provide the data necessary for AE, whether they are core fields or not.

Q6 Under Option (ii), are there any arrangements that could provide for a new class of persons to provide data? If so, please outline details and provide reasons for your proposal.

We see no need for a new class of persons to provide data.

Q7 Are there other options that could be considered?

An option that MPI may wish to consider in connection with technology developments, is to revisit the definitions of regulated herd testing activity and a certified herd tester as set out in the Regulations. We consider that, as currently drafted, there is risk of “cross contamination” for certain companies that could offer both inline milk meter testing and traditional herd testing. If there was a failure to meet the standard for an emerging milk meter, this should not impact the certification of the mature traditional herd testing business; the current regulations do not provide for such a scenario. There are benefits to be had to be able to clearly define who the certified herd tester in each scenario is and what their responsibilities and obligations are.

This delineation is similar to the current scenario where a farmer may use LIC MINDA, (LIC as the herd record provider) but uses CRV herd testing. CRV provides the herd test data to LIC (as the farmer’s herd record provider) who then provides that data through to DIGAD. The responsibility for the quality of the data resides with the certified herd tester i.e. in this case CRV and not with the herd record provider.

THE CRITERIA FOR ACCESS PANEL DECISION-MAKING

Q8 Do you consider that the statutory criteria by which the Access Panel determines applications for access to data should be retained or amended? Please give reasons for your views.

LIC supports the retention of statutory criteria by which the Access Panel determines whether to grant access to data. However the second leg of the test, (the "do no harm" test) is a low threshold and LIC recommends a raising of the bar with the removal of this second leg of the current statutory criteria.

Q9 Which of the above options do you prefer and why? Please give reasons for your views.

LIC supports a combination of options (ii), the retention of the current criteria with the addition of published guidance, and option (iv), replace the criteria. Published guidance will provide greater transparency as to the Panel's decision making process and guidance for those wishing to access the data. The ability of the Panel to revise the published guidance to reflect changes in the industry and in uses to which the core data is put, will maintain that increased level of transparency. For changes to the criteria, please see LIC's response to question 8.

Q10 If the criteria were amended or added to, what factors could be useful criteria to assess applications for access against.

LIC's proposed change to the current statutory criteria as set out above would require the Panel only to grant access to data where it is satisfied that access to the data will be beneficial to the New Zealand dairy industry. Published guidelines as to what is beneficial should align with the purpose of the regulations (ie to support industry good research and animal evaluation). Any further detailed definition of "beneficial" in the regulations is only likely to anchor the Panel to what is considered beneficial today and would not future proof the regulations.

Q11 Are there any other options that should be considered? Please outline any other in detail and provide reasons for your views

Please see the combined option outlined above.

ACCESS PANEL FUNCTIONS

Q12 Do you consider that the Access Panel should carry out additional functions? Please give reasons for your views.

LIC does not support the proposal that the Access Panel should carry out any additional functions.

Q13 Which of the options above do you prefer? Please provide reasons in support of your preference.

LIC supports option (i) based on our earlier response that there should be no expansion in the number of, or changes to, core data fields.

Q14 Are there any other functions that should be considered? Please outline any other functions in detail.

LIC does not support any further Access Panel functions.

In particular, the Panel should have no rights, statutory or otherwise, to control the access to current non-core data held in DIGAD. Access to, and use of this data, is subject to commercial agreements between the contributing parties and DairyNZ/NZAEL. The practice of screening applications for access to non-core data should not be undertaken by the Panel without the agreement of the data providers and, where appropriate, DairyNZ/NZAEL.

ACCESS PANEL MEMBERSHIP

Q15 Do you consider that the current membership and appointment arrangements should be retained? Please provide reasons to support your preference.

LIC supports changes to the Panel's membership and appointment arrangements (see our response to question 16 below).

Q16 Do you consider that the membership and appointment processes should be changed? If so, do you support the any of the approaches listed in (ii) above?

It is critical that the Panel remains independent and fit for purpose and therefore LIC supports the following changes to the Panel's membership and appointment arrangements:

- An addition of one Panel member who is knowledgeable and skilled in areas of information technology, big data and data mining.
- The appointment process should be led by DairyNZ and the core data providers together but without the need for the involvement of the Minister. As indicated in this submission, the contribution that the commercial companies make to herd and genetic improvement cannot be ignored particularly when key decisions (such as the appointments to the Panel) are made. It should not be left to DairyNZ alone to make these decisions. It is questionable whether, as Manager of the core database, DairyNZ would not have a conflict of interest when selecting candidates to sit on the Panel.
- Membership of the Panel should be refreshed on a regular basis. In the same way that best practice board governance recommends limiting the length of time an individual can serve on a board, it is recommended that consideration be given to Panel memberships being limited to no more than two terms of three to four years each.

Q17 If you support Option (ii) variant (c) do you have views on what additional skills or experience might be included?

See the response to question 16.

Q18 Do you consider that there are other variants? Please provide reasons in support of your views.

N/A

CONTINUED ACCESS PANEL OVERSIGHT OF LIC'S COPY OF THE CORE DATABASE

Q19 Do you prefer Option (i) or (ii)? Please provide reasons to support your preference.

LIC does not support either option (i) or (ii) as set out in the Discussion Paper. LIC supports the removal of Panel oversight of LIC's copy of the database as soon as CRV has transitioned to providing core data direct to DIGAD. At this point in time, DIGAD and LIC's proprietary database will begin to diverge.

LIC considers the risk that third parties would approach LIC to try to circumvent the Access Panel is overstated and therefore the continuance of Panel oversight an unnecessary cost to the industry and to LIC. In any third party data relationship, LIC acts in the best interests of the co-operative and its 10,377 dairy farmer shareholders. As a result, LIC meets the intent of the current criteria for access to core data as set out in the Regulations.

LIC meets its regulatory requirements by providing core data to DIGAD in accordance with the Herd Test Regulations. It also meets its contractual obligations by providing non-core data to DIGAD to support Animal Evaluation under the terms of the Formal Agreement and various Data Supply Agreements with DairyNZ, NZAEL. LIC's obligations following the transfer of the Core Database and the operation of Animal Evaluation to DairyNZ/NZAEL are therefore being met.

Q20 With regard to Option (ii), should Access Panel oversight of LIC's copy of the Core Database be removed 12 months or 24 months after DairyNZ has established the necessary IT capability to receive core data direct? Please provide reasons to support your preference.

LIC requests the removal of Panel oversight of LIC's copy of the database as soon as CRV has transitioned to providing core data direct to DIGAD.

ACCESS PANEL ANNUAL REPORTING

Q21 Which of the above options do you prefer and why?

LIC supports MPI's recommendation that a combination of options (i) and (ii) is preferable to retaining the status quo. There is a strong need for much greater transparency as to the use of core data for industry good and animal evaluation purposes and on the activities of the Access Panel. Greater information (including access guidance and the use that data is put to) will enable regulators to monitor the effectiveness of the Panel, the Core Database and the regulations that govern them. It will also provide the parties that contribute data to the core database/DIGAD with comfort that their contributions are not being misused.

Q22 Are there any other options that should be considered? Please outline any other options in detail and provide reasons for your views.

LIC supports the external audit of the functions and activities of the Access Panel (and by association the functions and activities of the Manager of the Core Database) to be extended and made public to ensure complete accountability and transparency of both bodies. In particular, the adherence to published access criteria and pricing and the decisions to sponsor applications are areas that should be available publicly.

Q23 What type of information do you consider should be included in the Annual Report?

In addition to the audit findings referred to above, LIC supports the public release of information relating to:

- The types of organisations that have accessed data (eg universities, industry good bodies, vets, commercial companies)
- The extent of data provided (eg number of fields, whether complete datasets or subsets)
- Number of applications sponsored (ie data provided at no charge)
- The costs of running the Panel, the Core Database (both operational and investment funding)
- Revenue received from provisioning data through the Panel.

MANAGER OF THE CORE DATABASE ANNUAL REPORTING

Q24 Which of the above options do you prefer and why?

In the absence of improved Access Panel reporting, LIC supports option (ii). Our preferred approach is that the Manager of the Core Database be required to report to key stakeholders and to publish useful information to the dairy industry. LIC appreciates that defining "key stakeholders" and "the dairy industry" may be problematic from a regulatory perspective and would therefore recommend that the information and report be put in the public domain. LIC is agnostic as to whether this reporting is independent of any reporting by the Panel or is included in the obligations on the Panel.

It should be noted that, currently, trends in animal evaluation are provided on the NZAEL website and in the joint LIC/DairyNZ annual publication "New Zealand Dairy Statistics". LIC does not require further reporting of trends in animal evaluation, particularly in relation to trends within the female cow population. We are unable to comment, however, whether the current level of reporting adequately provides MPI with the information it needs to be able to monitor the effectiveness of the Panel, the Core Database and the regulations that govern them.

Q25 Are there other options that should be considered for monitoring and reporting? Please outline any other options in detail and provide reasons for your views.

N/A

Q26 If Option (ii) is decided on, what information should DairyNZ

a) be required to provide confidentially to MPI; and

b) be able to make publicly available, including to levy-payers?

LIC supports the option that information reported on by the Manager of the Core Database should be made publicly available, as detailed in our response to question 24.

CERTIFICATION OF HERD TESTERS AND ASSOCIATED OBLIGATIONS

Q27 What are your view on Options (i), (ii), and (iii) suggested above?

Options (i), (ii) and (iii) are acceptable to LIC. We support an increased level of transparency for the appointment and revocation of certification bodies. LIC has no issues with the current certification body (Telarc) – the current auditor is very thorough, competent and constructive.

Q28 If you consider that there are other issues arising in relation to the current certification processes and requirements please outline them and provide reasons for the matters you raise.

LIC considers that there are other issues arising from the current certification framework that could usefully be addressed as part of this Review:

Clarification of the Certified Herd Tester
As indicated above, LIC does not see a need for a new class of persons to provide data to the core database as this could lead to the fragmentation of data and information supply from both a DIGAD and farmer perspective. We do not see responsibility for ensuring the integrity of the data sitting with the farmer.

The definition of a certified herd tester and regulated herd testing should be clarified as outlined above.

Herd Test Standard
LIC supports greater reliance on independent verification of performance for companies providing a herd testing service. The use of ISO9001 and ISIO7025 ensures good practice and value is gained by the company and those using their services.

While noting that the content of the Standard is out of scope for this Review, LIC believes that issues relating to the Herd Test Standard need to be addressed. The current arrangements are unwieldy, time consuming and very costly to the industry (in terms of engaging with Standards NZ, the time spent by DairyNZ and others on meetings, travel, and considering and redrafting drafts produced by the committee.

LIC strongly supports that change be made to the Regulations to enable the Standard to be more dynamic and fit for purpose and able to be amended more readily:

- The review process be streamlined to facilitate more regular reviews that keep up with changes in farming practices which are not covered under the existing Standard; and/or
- Rewrite the Standard to be considerably less prescriptive, and detailed in terms of what is allowed or not, so the Standard becomes about the intent and use of the output, not control of the inputs. An example is the list of allowable combination of milking regimes (which does not cover all scenarios currently practiced on farm).

Report prepared for Livestock Improvement Corporation

Economic frameworks to apply to the regulatory review of the dairy herd improvement industry

Sally Wyatt, David Moore, Rohan Boyle

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sapere research group

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Sapere Research Group is one of the largest expert consulting firms in Australasia and a leader in provision of independent economic, forensic accounting and public policy services. Sapere provides independent expert testimony, strategic advisory services, data analytics and other advice to Australasia's private sector corporate clients, major law firms, government agencies, and regulatory bodies.

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Executive summary

The LIC herd information database is a knowledge club good, with a benefit to farmers. Maintaining the database has an on-going cost. The Regulations provide the rules for others to access part of the knowledge club, the core data.[1] The core data is held in the core data database DIGAD, which is managed at present by Dairy NZ. LIC frequently collaborates with universities, industry groups and others who are undertaking research of benefit to the industry providing access to the database at marginal (or no) cost. Commercial companies are also provided access to the data on commercial terms. This demonstrates the value of the data to a variety of users.

We examine the economic consequences of expanding the set of fields that comprise the core data held in DIGAD. Expanding the number of fields would allow others to access the data without being members of the knowledge club or paying a market price. We examine the impacts on innovation and investment. We also consider whether there is sufficient justification for the expanding the core, which constitutes a regulatory taking.

Impact on innovation

We conclude that an expansion of the core would:

- Threaten the excludability of private data, and therefore give rise to free rider problems and threaten systemic innovation, leading to sub-optimal levels of investment;
- Replace LIC as the institution managing the data with one with an external bureaucratic panel, and as such would replace the ideal corporate structure for generating systemic innovation with a less-than-ideal structure;
- Threaten the development of spontaneous orders, in particular, threaten the emergence of natural knowledge clubs, which manage and distribute data and knowledge in different ways.

Regulatory taking

We conclude that an expansion of the core would represent a regulatory taking. A regulatory taking refers to a situation where regulation reduces the value of private property to its owner. Regulation that results in a taking may be justified where the regulation gives rise to a significant public benefit that would otherwise not be available.

An expansion of the core data is likely to be of industry rather than public benefit and there is no evidence that LIC is restricting access to the non-core data unreasonably. Expanding the core data is therefore not justified on the basis of either of the two conditions for a regulatory taking: significant public benefit or necessity.

[1] Dairy Industry (Herd Testing and New Zealand Dairy Core Database) Regulations 2001

De-regulation

We would argue that de-regulation should be considered as an option (if not with this review of the Regulations then at some point in the future). In the absence of regulation, membership of the knowledge club(s) would be voluntary (a stand-alone club); or may be tied to other membership in the industry (where membership is a consequence of being part of other industry rules or codes). The players in the industry could manage their own data collection and provision: they are closest to the people supplying and using the data (and are thus able to connect with the demands of the market) and they suffer the impacts from a decline in data quality and/or coverage (and are thus incentivised to control the quality and supply risks).

1. Introduction

We were asked by Livestock Improvement Corporation (LIC) to comment on economic issues when considering the regulatory regime for herd improvement. LIC is preparing a submission to MPI in response to its call for a review of the regulation of bovine evaluation data held in the New Zealand dairy core database, DIGAD (Core Database).

1.1 Context for the Core Database

The dairy herd improvement sector is heavily reliant on a reliable and comprehensive supply of data to support evaluation of breeding values, productivity and environmental impacts. The data is used by researchers, artificial breeding companies and farmers.

The regulatory regime, which is set out in the Dairy Industry (Herd Testing and New Zealand Dairy Core Database) Regulations 2001 (the Regulations), covers the methods for collecting herd breeding data for the Core Database, making it accessible to users and reporting on its use.

The context for the review is set out in the MPI discussion paper *Dairy Herd Improvement Industry Review of Regulation* (No: 2018/19) (the MPI Discussion Paper). That paper states that the regulatory regime providing for the collection of data, management and protection of the Core Database has not been comprehensively reviewed since it was put in place in 2001.[2] As such, MPI wishes to ensure that regulation of the Core Database has kept pace with changing needs and technology.

The relationship between herd testing and productivity dates back to the 1934 Royal Commission into dairying, which determined that the collection analysis of dairy cattle production data was fundamental to improving collective dairy farmer profitability. The first testing regulations were enacted in 1936, and the data collected pursuant to these became the national dairy core database. The core database allows users to relate information on the characteristics and performance of a particular animal to information on the genetic lineage of that animal.

MPI has identified the key issues to address in the regulatory review as:

- The list of regulated (core) data is out of date, covering only part of the data needed for animal evaluation, with supply of the remaining data relying on voluntary arrangements which MPI feels could risk a decline in the availability or quality of data the industry needs.

[2] While the Regulations have not been comprehensively reviewed since 2001, there have been substantive developments to the industry arrangements. Developments have included an amendment to the Regulations to remove a requirement for LIC to provide nationwide herd testing services at uniform prices. Management arrangements for the Core Database have also changed. In 2014, LIC transferred a copy of the Core Database to Dairy NZ, and the management function for the database was transferred to Dairy NZ.

- The mix of regulated and unregulated data increases complexity for people accessing data (and potentially compliance costs).
- Herd testing technologies are changing: on-farm automated and in-line systems for data collection are becoming more common (however not that common that automated and in-line systems have begun to displace certified herd testing services). On-farm systems are currently not subject to a standard and the data collected is not automatically provided to the Core Database.
- The settings for the administration of the regime may be out of date, such as the criteria for approving or restricting access to the core data, the regulated functions of the Access Panel or its membership.

1.2 Questions

LIC has asked us to articulate the economic frameworks relevant to the review and describe how changes to the current regulatory regime may impact LIC, the dairy sector and the wider public interest. Of particular interest are the three options proposed in the MPI Discussion Paper to address the key issue around the scope of the regulated core data:

(i) Keep things as they are, retaining the regulated core dataset of 46 data fields, and relying on herd tester to provide additional data to the Core Database voluntarily.

(ii) Expand the regulated dataset to include the additional fields currently needed to calculate breeding values and animal evaluation indices.

(iii) Provide a more broadly focussed mechanism that allows the regulated fields to be updated without requiring amendment to the Act or the Regulations.

The essential questions are where to draw the line between private data, club-data, industry-good data and public data? And, is regulation required to do this?

We have been asked to consider the commercial and economic perspectives that may be required to answer these two essential questions. Key to this is highlighting the drivers of effective innovation and investment, and how regulation can impact these. In other words, we describe how the current regime impacts economic efficiency in the dairy industry, and how regulation could alter this – for better or worse.

1.3 Our approach is based on detailed knowledge of the relevant literature

In preparing this paper for LIC we have applied multiple lenses from the fields of business, policy and economics. We have used a legal and regulatory lens, and have taken insights from traditional economics (for example looking at the differences between club goods, public goods and private goods, and considering the incentives associated with each).

We looked to the innovation and growth literature. In particular, we have referred to the innovation and growth work of former colleague David Teece[3] and also the early work of Friedrich Hayek of the Austrian school of economists. Hayek opened economists' eyes to the fact that they were setting the economic problem too narrowly when he noted that the essential economic problem was not solving scarcity, but rather aggregating dispersed knowledge.[4]

We also scanned the economic literature around data and software networks, and how innovation arises in data and software markets. These fields owe a lot to several lawyer-economists, in particular to the writings of Reichman[5] and Weiser,[6] but also Samuelson, Scotchmer and others,[7] and to the industrial organization literature, in particular to the contributions of Farrell, Tirole and Rochet.[8]

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3 Teece (2000) and Teece (2009).

4 In particular, Hayek, Friedrich (1945) The Use of Knowledge in Society, and Hayek, Friedrich (1973) Law Legislation and Liberty.

5 Reichman (1994).

6 Weiser (2002) and Weiser (2003).

7 Samuelson et al (1990) and Samuelson et al (2002).

8 See, in particular: Farrell, Joseph (2003), and Rochet, JC and Tirole, Jean (2003).

2. Framing the problem

The essential questions are where to draw the line between private data, club-data, industry-good data and public data? And, is regulation required to do this?

To answer these questions it is essential to start with who owns what, and who values what. Only when the values associated with herd improvement data are understood can we understand the purpose and function of regulation in relation to it.

There is no doubt herd testing data is valuable; it has both private values and values to the collective. Some of these collective values are values that arise as a consequence of data being aggregated into a 'club good'. A club good is a good where there is excludability but not rivalry. In the case of herd testing data, for example, the parties that collect and aggregate data into sets in New Zealand (LIC and CRVAmbreed) currently have the ability to exclude others from accessing and using the data set.

The decisions to exclude are framed differently according to whether the data set is core data or not. Specifically,

- **If it is core data,** the exclusion rules are set according to the Regulations. The Regulations establish an Access Panel, and instruct the Access Panel that it *must* grant access to the data if it is satisfied its beneficial to the New Zealand dairy industry; and *may* grant if it is satisfied that it is not detrimental to the New Zealand dairy industry.
- **If it is not core data,** the exclusion rules are set according to the private decisions of the parties that own the data. LIC owns by far the largest database of herd testing data for New Zealand (LIC herd information management system): LIC's data is collected from, and collectively owned by, over 90% of New Zealand's dairy farmers.[9] CRVAmbreed also owns and maintains non-core data, albeit a smaller set. Thus the exclusion rules for non-core data are set by the farmers who provide the data into these competing databases and who pay to maintain them, but also benefit directly from the depth and quality of the data.

2.2 Data users demonstrate data value

Examining who uses the core and non-core data gives an idea about who values it (acknowledging that the demand for the core data is skewed by the regulations which require Access Panel approval, which might pose a use barrier for some potential users). At present, the core data in DIGAD is used by Dairy NZ researchers, universities, NZAEL and CRVAmbreed. It is not known how international researchers use the data, if at all.

Meanwhile, LIC's database (which contains a combination of core and non-core data) is used by farmers and researchers, both internal and external. LIC frequently works with students

[9] LIC estimate. The LIC cooperative has 10,500 cooperative members, out of 11,600 dairy farmers.

and researchers at Massey, Lincoln, Otago and Auckland Universities, providing data at little or no cost. The areas of research are varied. LIC has also worked with the University of Waikato in areas of machine learning and computer science.

LIC works with a number of commercial companies, supplying both core and non-core data. LIC charges for the data service in the majority of these collaborations, unless the data is being provided as an in-kind contribution to a joint venture or subsidiary. Where a company is undertaking research of that will be made available to the industry (for example through a vet practice) LIC may not charge, or only charges the cost of extracting the data.

LIC also shares core and non-core data with Breed Societies, AgResearch, DairyNZ and NZAEL for a variety of purposes, mainly industry-good. LIC may not charge for this information or charge the cost of data extraction.

LIC does not restrict access to its non-core data from its competitors and Dairy NZ, partly because the ability to link datasets leads to better herd information outcomes for the industry and partly because the existing regulatory structure makes accessing the different sets too complicated. The demand for non-core data shows that this data has value to people who are not part of the LIC cooperative.

2.3 A knowledge club owned by 90% of the industry

The private value of herd testing to farmers is that it provides genetics and information to create superior livestock. The herd testing data farmers have done helps them make management decisions e.g. mastitis treatment, culling and drying off; making breeding decisions from the resultant BW information; and enhancing the resale value of their stock by having current animal indices.

LIC operates as a knowledge club.[10] So does CRVAmbreed, LIC's competitor. In each case the club members benefit from genetic improvement activities and research that leads to improved commercial value for their herd. The data is valuable to the club because it has been verified and certified as accurate. The data is also valuable to the club due to scale: the data set is wide and deep. The deeper and wider the data set, the more valuable to the club the data set will be. We talk more about the economic characteristics of a knowledge club in the following section.

The knowledge clubs do not cover or represent the entire dairy industry. The LIC cooperative is owned by 90 percent of the industry, while herd testing data is collected from 75 percent of farms. The farmers who have elected not to join the LIC cooperative are part of the dairy industry but not part of the 'club'. Due to the 2012 regulatory requirement to share the a copy of the core data (and LIC's willingness to voluntarily share parts of the non-

[10] We did not invent the term "Knowledge Club", we read about it in Cameron Neylon's blog post http://cameronneylon.net/blog/the-limits-on-open-why-knowledge-is-not-a-public-good-and-what-to-do-about-it/

core data) these non-club industry participants still benefit from the data but do not incur any costs in relation to it.

LIC estimates that the 'on farm' value its activities create for the farmers in the cooperative is very substantial. The private value of livestock testing is summarised in table 1 below. The values in this table demonstrate the value of superior livestock and improved decision-making to enable superior livestock performance. Values associated with LIC International and environmental data are not included in the table.

Table 1 Estimated on farm value

Value stream	Value on farm 2018/19
Genetic merit	$334 million
Nutrition	$58 million
Health	$3 million
Reproduction	$30 million
Other information	~$200 million

Source: Livestock Improvement Corporation

The figures in Table 1 demonstrate that herd improvement through genetic gain is a powerful tool for lifting productivity of the national dairy herd and developing industry comparative advantages. Recent industry studies have shown significant growth in milk solids per cow, and that about two thirds of the improvement in cow performance over this period can be attributed the genetic improvement in cows. This is equivalent to approximately 1.3 percent growth per year in milksolids, attributable to genetic gain.[11]

The LIC cooperative spends a total of $104 million per year on operating its knowledge systems. Table 2 provides an estimated break down of this expenditure (which represents a combination of spending on core and non-core data).

[11] MPI Discussion Paper No: 2012/26 (p. 3)

Table 2 Estimated LIC data operating costs (core and non core data)

	2017/18 operating expenditure
Data collection activities	$50.3 million
Data processing	$22.9 million
Data R&D	$9.9 million
Related overheads	$20.7 million
Total	**$104 million**

Source: Livestock Improvement Corporation

3. Impact of a change in the core fields on innovation

We have described all the information in LIC's herd information database as a knowledge club good, with a benefit to farmers but an ongoing cost to maintain. We have also described the core data in DIGAD as a knowledge club good with both benefits and costs, but in contrast to the non-core data the ability to exclude is set according to regulations.

3.1 Excludability and rivalry are important notions

An economic good is considered non-rival if the cost of providing it to an additional individual is zero. Thus, a perfectly non-rival good could be consumed simultaneously by an unlimited number of people, without any loss to any of the people involved in the sharing. Perfectly non-rival goods — neither consumable nor subject to congestion — are rare in the analogue economy. Many analogue goods that were once thought to be non-rival (e.g., suburban highways, the air we breathe, the fish stock in ocean waters, etc.) tend to become precarious or congested with more intensive usage. The digital economy, on the other hand, is rich in non-rival goods — from tweets and MP3 files to Angry Birds games and Spotify playlists. Digital goods, with the notable exception of proof-of-work cryptocurrencies, have negligible reproduction and distribution costs. They are infinitely shareable, enjoying ever-constant returns to sharing, regardless of the scale of sharing.

An economic good is excludable if it is possible to stop people (or firms) who have not paid for the good from having access to it. Public goods are non-rival and non-excludable.

Club goods (also artificially scarce goods) are a type of good in economics, sometimes classified as a subtype of public goods that are excludable but non-rival. The cost of providing the good to another consumer is very low because of that low rivalry in consumption characteristic: club goods have essentially zero marginal costs. Knowledge clubs are a type of club good that provide data or information or other types of knowledge or creative input. This type of good is easily copied and used again and again. So it is considered to be non-rival (and in some cases, anti-rival).[12]

[12] See discussion at footnote 14 for an explanation of anti-rival goods.

3.2 Knowledge clubs need excludability to prevent the free rider problem, and under-investment

To the extent that knowledge, a) requires sunk investment, and b) is non-rival, there will a disincentive on the private owners of the data to publish research and data unless there are access regulations or some other means of providing for exclusion. The ability to exclude turns knowledge from a public good (under-supplied by private markets) to a club good (supplied for the benefit of the club's members). Exclusion rules may be in the form of property rules or rules that provide for a first mover advantage.

All investments that are not protected by exclusion suffer from what is known in economics as the 'free rider problem'. The specificity of an investment in research and innovation (the sunk costs that go into creating something new or making a new way of doing things) gives rise to the free rider problem. Free riders are able to use research without paying for it or the benefits it provides. The free rider problem means that incentives to invest in research and innovation are lowered, so there will be under-investment.

In the world of herd improvement research, some types of research involve sunk costs, for example a firm like LIC would consider the cost of testing and validating data as a sunk cost if there was a risk that the data collected might not be able to be used by the firm for other research.

In a world without protection for investment in intellectual property, 'late comers' would be allowed to simply duplicate or 'pirate' data or research findings. New entries would occur as long as there was a profit to be made, so that the recoupment of the original innovator's sunk costs could take place only if they were particularly lucky or skilled in exploiting the short lead-time. If piracy was allowed the lead-time would be very short because digital copying is an almost instantaneous process.

In a world where this investment in intellectual property was protected (for example through rules that prevented duplication of the data and allowed for complete exclusion of non-payers or the exclusion of non-payers for a sufficiently long time to allow for a first mover advantage), the free rider problem is lessened. The investment decision becomes less risky, and more data collection and research is likely to be undertaken.

3.3 New herd testing fields are a systemic innovation

Increasingly the innovation literature is recognising the difference between:

- autonomous innovations, which are innovations that exploit competencies or capabilities already present in the system, and which reinforce the existing standards in the system; and
- systemic innovations, which are innovations that require coordinated adjustment throughout a system to realize the gains from innovation. Systemic innovations are innovations that require entirely new capabilities for the innovation's potential to be realised.

Systemic innovations provoke changes to the established ways of doing things. They need many different parts of a system to work together to adopt the new standard. Systemic innovations are what changed the video player to the DVD player to the data-streaming services we have today.

In herd testing, including genomic testing fields and new ways of measuring genomics was a systemic innovation. The investment in developing on-farm hardware and systems to improve decision-making was a systemic innovation. The value of the investment by LIC in these innovations since 2012 has been substantial. For example LIC invests approximately $8-10 million per year in the development of its breeding scheme and a further $3-4 million per year in research and development specific to genetic improvement.[13] Undermining LIC's ability to exclude others from these new fields will lesson LIC's incentive to undertake systemic innovation (for example by adding more or different fields) in the future.

The degree of data protection required for each type of innovation (autonomous and systemic) to flourish is different:

- Autonomous innovations exploit information already available in the system. This type of innovation will pick up existing data, and use it to create a newer or more efficient way of doing the same thing. From a societal perspective, some degree of free riding on existing data may be acceptable because making information available to autonomous innovators will make society (or the industry) more efficient and effective.
- Systemic innovations, on the other hand, are at high risk of under-investment as a result of free riding and as such, should be protected by rules that allow for a reasonable degree of exclusion, to prevent free-riding. To not provide for exclusion would result in an under-investment in research, know-how and changes which improve the system as a whole.

To allow for autonomous innovations, there must be a balance struck between encouraging competition and protecting intellectual property. Autonomous innovations thrive where there is competitive pressure to use existing data and information in better ways.

However, what is needed to successfully develop and commercialise systemic innovations is different. Teece (2000) states that systemic innovations are best spurred on when there are institutions with relatively low-powered incentives (i.e. firms, rather than contracts), where information can be freely shared without worry of expropriation (i.e. protection of IP rights), where entities can commit themselves and not be exploited by that commitment (i.e. no first-mover disadvantages), and where disputes can be monitored and resolved in a timely way.

Thus there is a policy balance to be struck in setting the boundary between core and non-core data, and that balance differs according to the different types of innovation. While a highly competitive model might suit autonomous innovations, it may undermine systemic innovations. So if the policy objective includes wishing to provide for systemic innovations which provoke changes to standards and established ways of doing things throughout the whole industry, then rules that provide for a reasonable degree of excludability (and

[13] Livestock Improvement Corporation, pers comm.

particularly for new or emerging fields where the research requires large up-front investments in new ways of doing things) will be preferable.

3.4 Aligned incentives work best for systemic innovation

Teece (2000) asserts that systemic innovations are best incentivised in industry structures where incentives can be aligned between the users of the innovation and the inventors and communication between the two can be achieved without hold-up problems. This ideal corporate structure has been adopted in LIC's corporate form. Its farmer cooperative structure (with the end-users of its products in the dairy industry) achieves an innovator to end-user feedback loop.

Similarly, there is a balance to be struck in determining how research is conducted in the industry, and by extension, who has access to what information. If the goal is to allow for the creation of knowledge and know-how through long-term, private commitment from multiple parties throughout the dairy industry (i.e. systemic innovation) then research conducted using loose network arrangements among unaffiliated enterprises will be unlikely to achieve that goal. What would likely work best to promote systemic innovation is an arrangement where incentives can be aligned between innovator and end-user. Teece (2000) argues this can be easier within a firm as compared to across firms (up to a point, the firm shouldn't be so big as to create bureaucratic barriers to the flow of information). Further, systemic innovation will be unlikely to be served well under a set of institutions where access to information or knowledge is blocked by bureaucratic or political decision-making. In that sense, if access rules have to be applied, then they should be applied only when necessary. By default, therefore, if it is accepted that access to the core data is to be granted by way of bureaucratic or political rules then these rules should only apply in the narrowest possible set of circumstances.

3.5 Knowledge clubs as "spontaneous orders" not regulated organisations

The internet is massively changing the scaling problem associated with club goods. (We traverse some of the ways the world is changing in Appendix 1). Previously, the scaling problem associated with knowledge or creative labour was that once it is shared by the creator, it is available for copying and use with no impact on the quality of the good. Hence there is an incentive for everybody to use it, scaling its use rapidly and diminishing the inventor's ability to profit from its originality.

This scaling problem was a late 20th Century problem. Economists and policy makers were keen to ensure that the incentive to create or publish research was not eroded. So in the mid to late 20th Century the scaling problem was addressed through taking knowledge club goods (knowledge, creativity, data) and privatising them, corporatising their management in the process. Copyright in scholarly work and the whole apparatus that surrounds scholarly content as a private asset, was essentially invented in the 1950s. This now sits as private capital, largely in the hands of, but very unevenly spread between scholarly publishers. This

was a positive development overall. That capital is what made it possible for scholarly communications to move online in what is in retrospect a staggeringly short time.

Today we have new options for managing the scaling problem, for example, the ability to make information only available on shared networks, or with a password, or upon payment of a subscription. The change in the economics of club formation, discovery and costs of communication, provide new models for managing knowledge. It is not strictly necessary to corporatise knowledge ownership or keep creative content locked down. Small clubs or open libraries may be better ways for content to be shared. Examples of these include voluntary co-ops, consortia or open libraries like Wikipedia, the Open Library of Humanities and Knowledge Unlatched; membership models that look more club-like such as PeerJ; and cooperative support mechanisms. The web has made these natural knowledge clubs viable.

In some cases it may be in a private innovator's own best interest to make his innovations or data 'open'[14] instead of keeping it private. Crucially, however, where private innovation is concerned it has to be a private decision to make the innovation open, not one imposed by a rule or regulation.

To allow natural knowledge clubs to grow, the regulatory system needs to provide the room for club infrastructures to emerge spontaneously. Regulation cannot mandate these systems or force them into organisations, they are spontaneous orders. In section 5, we discuss why we think de-regulation of herd improvement industry will allow for natural knowledge clubs to emerge. This discussion is important because knowledge clubs are (or should be) spontaneous orders. Spontaneous orders provide fertile ground for innovation; the opposite can be said for regulated organisations. Spontaneous orders provide the infrastructures that continue to drive costs down while connecting clubs together in new ways. These infrastructures drive discovery, interaction, and at some level make those cultures more inter-operable. These infrastructures will have politics, and that politics will be one of openness and porous borders.

New regulatory thinking recognises that spontaneous orders can reach degrees of complexity much higher than those reachable through an organisation. Only by relinquishing control of a phenomenon can this phenomenon become more complex. This is what has happened in our modern society, in which each member of society is more dependent on the knowledge possessed by other members. "Civilisation," said Friedrich Hayek, "comes from the fact that we all benefit from knowledge we don't have."[15]

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[14] The term 'open' refers to the open characteristic sought by the open source software movement. This movement coined a new term, "anti-rival" (Weber, 2004). While most people thought, and still think, of digital tools and creations as non-rival — i.e., infinitely shareable — some types of data and research are subject to increasing returns to scale. For example software can be subject to positive network externalities. In simpler language, it means that the value of a piece of software to any user increases as more people use the software. The anti-rival characteristic of some types of knowledge provides a private incentive for sharing it publicly or within a club.

[15] Hayek (1973) Law, Legislation and Liberty.

3.6 Expansion of the core would have a material impact

In our view, both Option (ii) and Option (iii), as described in the MPI Discussion Paper, would have a material negative impact. Such an expansion of the core would:

- Threaten the excludability of private data, and therefore give rise to free rider problems and threaten systemic innovation, leading to sub-optimal levels of investment;
- Replace LIC as the institution managing the data with one with an external bureaucratic panel, and as such would replace the ideal corporate structure for generating systemic innovation with a less-than-ideal structure;
- Threaten the development of spontaneous orders, in particular, threaten the emergence of natural knowledge clubs, which manage and distribute data and knowledge in different ways.

These effects may be larger in Option (iii), given that more and more non-core data could be required to be included in the core database over time, exacerbating the impacts on innovation.

Option (i) should not perversely change the current incentives for innovative activity in the dairy herd evaluation industry.

4. Increasing the core amounts to a regulatory taking

At present, the LIC database includes in excess of 1000 tables, each containing between five and fifteen fields. The total number of fields is therefore in the many thousands. Of this total, around 100 fields are data relating to relating to animal evaluation. Other fields are a mixture of derived fields and observational fields. Forty-six of the data fields are the prescribed 'core fields'. The boundary between core and non-core is a historical artefact. If one was to design the regulatory system again, one might not set the boundary between core and non-core the same way. Suffice to say, however, while LIC has invested significantly in the core data, it has done so on the understanding that it is industry-good information, not private. So the core data is not owned, nor private, nor does LIC have control over it.[16]

The non-core fields represent a combination of phenotypic evaluation fields and genomic fields. The non-core fields are a consequence of private investment in collection, processing, research and related overheads. In theory at least, LIC can commercialise this data and recoup some of its private investment. That is, LIC can sell it or keep it closely held as part of a future research plan which will turn it into knowledge, know-how and private intellectual property. Equally, LIC could voluntarily share this data or even make it open, should it consider that sharing it is in the best interests of its cooperative members.

4.1 The boundary question is a property question

The question about where to set the boundary between core and non-core data is really a question of the allocation of property rights. Any change to the definition of core data represents a change to the ownership rights in the non-core. This affects LIC and CRVAmbreed, and any other party who might wish to collect or aggregate non-core data in the future.

LIC has invested substantially in growing its non-core dataset. An expansion of the list of core data would represent a reduction in LIC's ability to generate a future return from data it has invested in collecting and maintaining. This could be viewed as a regulatory taking.

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[16] The 2001 regulations make it clear that the core data was owned collectively as an industry good, not a privately held good. The core data was never intended to belong to LIC, or government, or Dairy NZ, nor New Zealand Inc (although LIC is allowed to use it). The intention was for it to belong to the industry, as a collective good. The clear intention for the data to be an industry good – and managed for the benefit of the industry as a whole – is evidenced in the access criteria in s18 which include the phrase "so is likely to be beneficial to the New Zealand dairy industry." The fact that the core data was not - and is not - owned as a private good by LIC is further illustrated in Part 2 of the Regulations, which "prohibits LIC and the manager of the core database from entering into exclusive arrangements for access to data in the core database:" Access to the data is managed by the Access Panel, which is a regulatory body and is not controlled by LIC. The Access Panel rules provide for data to be accessed extensively by researchers. Furthermore, while the Access Panel is able to set the terms and conditions for access to the core data, it cannot set a 'price' for it – the price charged is a pre-determined administrative fee of $200 (s17 of the Regulations).

Regulatory taking is a situation in which a government regulation limits the uses of private property to such a degree that the regulation effectively deprives the property owners of economically reasonable use or value of their property to such an extent that it deprives them of utility or the value of that property, even though the regulation does not formally divest them of title to it.

In New Zealand, compensation is normally required only for physical takings, such as the acquisition of land, and is not available for regulatory takings.[17] That does not mean that regulatory takings are justifiable, however. For example Bryce Wilkinson (2008) argued that:

> *"Uncompensated regulatory takings are discriminatory taxes. They often occur without proper examination of whether they conform with sound taxation principles. Moreover, the special interest groups that lobby for these takings achieve benefits without being confronted with the costs to the community of providing them…*
>
> *… Whatever the range of acceptable circumstances, taking should be a last resort. In all situations the preferred option is to achieve the public interest by obtaining the consent of the rightful owners. This stricture is necessary if the government is to deliver on its key role of ensuring that citizens are secure in person and property. After all, this behaviour is exactly what the law of the land requires from every citizen and private organisation."*

The primary means of ensuring that governments do not abuse their takings power (for example by imposing unjustified regulatory takings) is by way of the regulation process itself. In New Zealand, the Legislation Advisory Committee (LAC) guidelines set out a process that the Cabinet Manual requires the executive to follow when making new laws or regulations. The guidelines ask if the legislation complies with fundamental common law principles, and specifies that one of these is the principle of compensation.

The most basic principles of private rights and public needs form the arguments for and against regulatory takings. Arguments for limiting the ability of governments to carry out takings usually focus on two main aspects, constitutionality (common law, natural rights and liberty, democracy) and efficiency (Wilkinson, 2008 and Epstein, 1999). These are fundamental principles in our democracy and are well articulated in Wilkinson (2008).

The argument for allowing regulatory takings is that in their absence a significant public benefit would be frustrated. This requires that the activity cannot be progressed without use of that right, it is unavailable without state coercion and there is a net social benefit from the activity. For a justified regulatory taking these conditions mean that:

- A significant public benefit exists from the property (the public benefit condition); and
- This benefit would be frustrated if the regulation was not used to force the taking (the necessity condition).

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[17] Kevin Guerin (2002)

4.2 Public benefit condition not met

Expanding the definition of core data would meet the first condition (significant public benefit) if the additional fields could be shown to provide a benefit to New Zealanders as a whole, rather than a small group. In reality, taking the additional fields from LIC and putting them in the core set would only benefit the parts of the herd improvement industry that are not represented in the LIC cooperative. That is approximately 10 percent of the dairy farmers in New Zealand and LIC's competitors. This group of beneficiaries could possibly be described as a vested interest group rather than the 'public'.

Further, it is questionable whether dairy herd information has a public value *beyond* the industry itself. Certainly in 2001 the Regulations were drafted in a way that suggests that the government equated public benefit with industry benefit.

4.3 Necessity condition not met

Expanding the definition of core data would meet the second condition (regulation is needed to force the transaction) if it could be shown that the additional fields would always be restricted and unavailable.

Typical situations in which the power to compulsorily acquire, or restrict use or disposition is considered to be necessary are those in which unreasonable hold-out by an owner or prohibitively high transaction costs might otherwise thwart the provision of some essential part of the region's infrastructure, such as an airport or flood control scheme, or the achievement of necessary locational links for a network industry, such as public roads, piped water and sewage, or an electricity grid. The construction of such assets traditionally came under the heading of 'public works'. In the case of regulatory takings, typical situations might be where there are matters of urgent public necessity, such as the forced destruction of an entire herd, with or without the owner's consent, in the event of a foot and mouth disease outbreak. While genomic information and the various other fields in the non-core set is valuable to the industry, it is not of such critical and urgent importance that it could be considered a public necessity to take it.

Alternatively, in some instances regulatory takings might be deemed essential because the transaction costs of arranging the transaction are so high as to preclude a voluntary exchange – this could be due to a market failure such as imperfect competition or imperfect information (Miceli and Segerson, 1998), or simply due to the number of people that would be involved if the government had to individually negotiate contracts with each. For example, it might be argued that a taking is essential in the case of LIC's aggregated set of herd data because it would be too difficult for government to negotiate with each farmer who provides data to sell it for the public good.

We do not believe the necessity condition can be applied to the additional fields that have been added to the non-core. These additional fields are indeed owned in an aggregated set, which makes it easier to acquire for the public good, but there is nothing to preclude a voluntary exchange to acquire the data for any public good purpose. In fact, LIC commonly shares the data from these additional fields with competitors and researchers at low or no cost. It does this voluntarily, without government compulsion. LIC recognises that providing data (core and non-core) to researchers will further the long-term interests of its

farmer-owners. While LIC may not want to always make its data free to competitors and others, it has a strong incentive to sell it to entities that demand it to help fund its own costs.

So making data available on a voluntary basis is a legitimate and profitable activity for LIC. In fact, the open source movement has shown that in some cases it can further the interests of a knowledge club like LIC to build platforms and infrastructures that tip the balance towards discoverability, interactions and openness. This is particularly the case when scale is valuable, as it is with herd improvement data.

In summary it is not necessary to force LIC to share non-core data. LIC's position in the market, as it is both owned by, and contributed to by farmers, means that it is in a unique position to focus on data sharing strategies that maximise the benefits of research to farmers. Therefore in our view the necessity condition for a regulatory taking is not met.

4.4 Conclusion on regulatory taking

Adding more fields to the core data would represent a regulatory taking. An expansion of the core data is likely to be of industry rather than public benefit and there is no evidence that LIC is restricting access to the non-core data unreasonably. Expanding the core data is therefore not justified on the basis of either of the two conditions for a regulatory taking: significant public benefit or necessity.

Neither Option (ii) nor Option (iii) is tenable on these grounds. Option (i) does not require a regulatory taking to implement.

5. Why regulate the core?

In this chapter we examine the rationale for regulatory intervention.

We start with an assertion that regulation should be fit for purpose — it should be used only when necessary, but when used it should be effective for that purpose (including by minimising unintended costs). MPI's Discussion Paper has not stated why MPI thinks regulation might be necessary, or where regulation is not necessary, for achieving its purpose. MPI assumes a paternalistic approach is needed (i.e. that the industry cannot maintain its data by itself), without justifying this.

The options presented in the MPI Discussion Paper (in sections 5.1 and 5.2) in relation to the data used for animal evaluation all assume that the prevailing arrangement will be a regulated core dataset. There is no option presented to de-regulate the core dataset. We consider that there are possibilities for maintaining herd improvement data that do not require regulatory control of what is in the core, who it is collected from or how it can be accessed: it is worthwhile considering a no regulation option.

5.1 If there was no regulation, what might happen?

Currently the regulations provide for the compulsory acquisition of data from certified herd testers (and consequently data from all farms with a large herd), testing standards, access arrangements and data management arrangements.

If none of these provisions existed the database would be managed in accordance with intellectual property law. In New Zealand, the law of copyright applies; there is no sui generis property protection for data in databases. We are not qualified to set out the exact legal test but in short, the database and the data would be protected by copyright as long as there was an element of creativity or investment applied to it. So, any party that collected herd data, cleaned it and applied some sort of algorithm over it would have that data *prima facie* protected by copyright. Furthermore, as a basic principle of equity, party that creates data should have rights in the collective or algorithmic value associated with it.

We imagine that what might happen if there was no regulation would be that LIC would continue to operate as a knowledge club, as would CRVAmbreed. Over time other natural knowledge clubs (perhaps of smaller scale, or with different testing regimes) would emerge. The competitive aspects of the industry would be subject to oversight under the existing competition regulatory regime. The various knowledge clubs would operate on a voluntary membership basis. In some cases, membership of the club might be tied to participation in the industry or the willingness to submit test data.

An example of a similar club is the Real Estate Institute of New Zealand (REINZ) which collects real estate sales data from all of its members, then aggregates the data. REINZ makes data analysis available to club members, who pay a subscription. It also makes its database (or parts of it) available to analysts and others to generate their own information and knowledge. REINZ widely publishes its own analysis. REINZ members sign up to a Code of Practice that includes requirements for the provision of sales data. There are

numerous other participants in the real estate data industry; and multiple indexes including indexes which use sale price data or quotable value data. Hundreds of analysts use some or all of these datasets to create information reports and websites, with a huge range of options for making this data available for end users (for example Homed, Trademe Property, QV.com). The real estate sales data example shows what is possible when clubs are left to form and manage themselves. The result is a more complex, natural system. Club members pay a subscription and sign up to providing data. In return, they get information which aggregates all the other subscribers' data.

Like the real estate data industry, the herd data industry is affected by network externalities and scale effects, such that the database's value increases when more data is added to the database, and when additional subscribers to the club yield data**.** These network effects mean that LIC and other entities that emerge to collect herd data and provide it through knowledge clubs of all scales will be incentivised to attract as many subscribers as possible. One way to attract subscribers is to offer a product that has the largest number of users and contributors: a strategy that invites lots of different uses for the data and the best research outcomes will attract users and contributors. This is a network effect. The herd industry may look like a series of knowledge clubs, each with their own data collation and distribution methods; each connected and using others' data.

In the absence of regulation, farmers and herd testers would not be compelled to supply data. Membership of the knowledge club(s) would be voluntary (a stand-alone club); or may be tied to other membership in the industry (i.e. where membership is a consequence of being part of other industry rules or codes).

We are not of the view that the LIC herd information database will collapse or fragment if there was no regulation. The size and quality of LIC's dataset after 16 years of regulation has now reached critical mass. The contributors and users of LIC's database would be self-sustaining as long as there was some sort of club conditions to prevent free-riding. Typically one would expect some sort of two-part tariff which involves a cost of membership and some sort of marginal price tied to the use of the information generated by the club (Buchanan, 1965). Perhaps a condition of membership would be a contribution of herd testing data, for example, or a subscription.

5.2 The 2001 Regulations are an artefact

The 2001 Regulations are an artefact from a time (17 years ago) when New Zealand's dairy industry looked quite different to what it looks like today. At the time, instant data collection and widespread 'big data' analysis did not exist. In 2001, the majority of New Zealanders did not have the internet. Most people got online using dial up connections. No-one had heard of R or R-Shiny, or collaborative online research portals.

In 2001, the herd industry database was a static data collection, fed into by farmers who participated in a commodity-product industry. The dairy industry was on the cusp of a massive change (the creation of Fonterra), and the government of the day was worried about what that would mean for farmers.

A look behind the 2001 Regulations reveals the government probably had the following motivations for making sure the core data was regulated and compulsorily available for industry good purposes:

- The government recognised that some sort of exclusion would be needed to prevent a free rider problem, and establish the database as a club good.
- Due to concerns about the competitive nature of the herd testing industry, the government of the day felt that there would be an under-supply of data, information and knowledge for industry good purposes. The government felt that data, information and knowledge was at risk of being under-supplied if the club was left to self-manage.
- Some types of data are useful for industry good research. This data has potential to be used by others to advance the industry. The government of the day felt this data might be under-provided for research purposes if the club was left to self-manage.
- The government recognised the value of scale: herd data is valuable when kept together as a set, and gains value with additional scale. The government felt that the set was at risk of fragmentation, particularly if it was managed by a single commercial owner who could sell it off (perhaps to an overseas interest) or if farmers or testers decided that providing data provided less benefit to them than the cost. The government was concerned that a set that was split between different owners would pose an aggregation problem for New Zealand farmers wishing to use it.
- The government recognised the value of data quality: herd data is valuable when the practices for data collection ensure standardisation and quality. The government felt that the data was at risk of de-standardisation or low quality if the club was left to self-manage. The government was concerned that New Zealand farmers would lose competitiveness if the data lost quality.

These concerns seem to have been tied up with concerns about how the owner of the new data-monopoly would wield its market power and restrict access. The prevailing concern seemed to be about market power and competition, which is understandable given that the Regulations were passed alongside the original DIRA.[18]

The motivation for the Regulations was to prevent any commercialisation of the dataset (by a firm with a dominant position in the market) that would work against dairy farmer interests. For example, a failure to maintain the core data, or sell it on, or a failure to make it accessible to parties who would apply it for the benefit of the industry as a whole. This objective is reflected in the access arrangements for the dataset. For example the dataset is designed to be maintained and made available as long as it promotes industry good.

The Discussion Paper from 2012[19] also gave some insights into the government's motivation for regulation. It suggests a paternalism: even if the industry voted with its feet and decided to stop funding it (for example by winding up the industry good organisation) the government would want it funded anyway. So policy-makers felt there was something fundamental in the core data that was so important to government that it should be maintained even if the industry did not agree to provide for it itself.

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[18] The DIRA regulatory scheme from 2001 is one of safeguarding the dairy industry against monopsony power. The various safeguards in the DIRA were designed to promote the efficient operation of New Zealand dairy markets by ensuring: contestability for the supply of milk from dairy farmers, and competition in the wholesale supply of domestic consumer dairy products.

[19] MPI Discussion Paper No: 2012/26 (p.4)

"On one hand, the provisions could be overly prescriptive in the context of DairyNZ ownership. As an industry good organisation, accountable to levy payers, DairyNZ has the mandate and incentives to operate for the good of the dairy industry. It could therefore be a reasonable assumption that the core database would be maintained, developed, and protected without the need for regulatory safeguards.

On the other hand, the fact that DairyNZ is a levy funded body under the Commodity Levies Act means that it could be wound up by industry agreement. It may therefore remain as important as ever to ensure regulatory safeguards remain in place to ensure the ongoing maintenance of the core database."

As the Terms of Reference for the Government's review of the DIRA notes it is timely to think about whether the DIRA regulatory regime (and by extension, the data regime) is still valid.

5.3 Passing back control of the database is low risk

Regulations can be justified on the basis that they control for a risk to society. The Victorian Competition and Efficiency Commission released guidelines and a supporting paper on risk-based regulation in 2015, which outline why a risk-based approach is useful when considering regulations.[20] As the Commission's work highlights, clarifying the government's objectives — particularly its attitude to risk and how this risk can be decided — is important when deciding which risks will be regulated. Because the government's attitude to risk may not be explicit, policy officers should prepare a risk statement that, at a minimum, clarifies:

- the problem or risk the government is seeking to address
- that the government does not expect risk to be eliminated, but the regulator is to adopt a risk-based framework that allows it to set and explain its priorities based on evidence of risk
- whether the policy should prioritise harm reduction or avoiding overregulating.

A risk statement should include consideration of who is best at managing the risk. Usually three parties can potentially manage a risk:

- the people or businesses whose activities create the risk (who can reduce the consequences or likelihood of the risk occurring)
- the people or businesses who are affected by the risk (who can reduce their exposure or manage the consequences)
- the government (who can use regulation or other policies to either help reduce the size or likelihood of the risk or manage its impact).

As the Victorian guidance note recognises, the government may not be the best party to manage a risk. Businesses better understand their operations and may have a greater capacity

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[20] Victorian Competition and Efficiency Commission (2015)

to control risk than the regulator. This is because the value of the innovation should be seen as the NZ dairy industry *as a whole* competing with/keeping pace with other global players. In other words, a business like LIC is in a position to understand what developments are going on on a global basis, and where to focus innovation to ensure it has a net benefit for the New Zealand dairy industry. By comparison, a regulator may be slower and lack this contextual insight. In short, a regulated environment leads to less focused and less effective innovation, and would result in New Zealand potentially falling behind its global competitors.

Because businesses like LIC have strong commercial incentives to control risk, prescriptive regulation may be unnecessary. A business with private accreditation or that sells to a major buyer who requires it to meet quality standards has commercial incentives to meet those standards, for example. In such cases, government regulation can be unnecessary or even undermine the effectiveness of the private controls.

Regulation is prone to error. Overregulation imposes undue costs on those who have to comply (such as regulated businesses or individuals). But under-regulation increases the risk of imposing harm on the community. These errors are known as type 1 and type 2 errors. Given the possibility for regulatory error, policy-makers need to clarify their priority: avoiding overregulation or minimising adverse events.

- ***Type 1 error —*** regulation is imposed when it should not be. That is, regulation is introduced even though it is not needed or will be ineffective, or inefficient. This error leads to over-regulation and a higher regulatory burden.
- ***Type 2 error —*** regulation is not introduced when it should be. That is, a problem is not addressed by regulation when it would efficient or effective to do so. This error leads to under-regulation, so the risk of harm is higher than it should be.

Whether the government is more concerned about type 1 or type 2 errors depends on the impact of the risk and the people it affects. If the consequences are small, or the economic cost of regulation is high, then the government may err on the side of a type 2 error. For example, deciding not to make the provision of private test results compulsory (nor requiring corresponding regulation to make the test results available to others) on the basis that the cost imposed on the parties required to give data are too high relative to the risk of not having the data in the pool.

Conversely, if the consequences of a harm are large or the group affected is vulnerable or disadvantaged, then the government may err on the side of a type 1 error. Regulators may prefer to be conservative in vetting people who calibrate test results, for example, even if the process occasionally disqualifies someone who is not a risk to the quality of the data they collect.

So, sometimes it may be better for those affected by a risk to control their exposure or manage the impact. Often, regulation cannot account for individual circumstances. It may therefore unnecessarily constrain individuals and businesses. Such constraints can undermine people's resilience and capacity by creating an expectation that governments or their agents will protect them so they do not need to protect themselves.

In the context of a good which is managed for the benefit of New Zealand dairy farmers, and from which they benefit (both directly and indirectly), who is best placed to manage risk? We would argue that any such risk is best managed by the various players in the industry

itself, with the ability to control the quality and scope of the data collection without the need for regulatory intervention. The various knowledge clubs in the industry should manage the data they collect, because they have a direct connection with the people supplying the data (and are thus able to control the supply risk), a direct connection to the people who use the data (and are thus able to control the demand risk) and they suffer the impacts from a decline in data quality and/or coverage (and are thus incentivised to control the standards and fields).

In our view, each of the type 2 risks we have suggested in the appendix are low impact risks. That is, if you consider the risk of de-regulation in terms of its consequence and the associated probability, there are no highly risky impacts from de-regulation. Looked at through a risk lens, there is less of a justification for managing the risks using regulation and more of a justification for delegating the risks to parties closer to the risk to manage.

5.4 Conclusion on de-regulation

If regulation that defines access to and use of core data is to continue, it should be justified by regulators. For example we would expect MPI to articulate the type 1 and type 2 risks that the amended Regulations are intended to balance, in line with regulatory best practice. We would expect consideration to be given to who is best to manage each type of risk, and we would expect that the default position should be a management arrangement where the industry self-manages its data and data quality.

If such a detailed policy process is not possible for the immediate future then perhaps consideration could be given to a sunset clause in the revised regulations.

6. Conclusion

Regulation is not costless. It therefore should be continuously justified by regulators on the basis of risk or in the case of a taking, on the basis of significant public benefit that would otherwise not be available.

We conclude that an expansion of the core would:

- Threaten the excludability of private data, and therefore give rise to free rider problems and threaten systemic innovation, leading to sub-optimal levels of investment;
- Replace LIC as the institution managing the data with one with an external bureaucratic panel, and as such would replace the ideal corporate structure for generating systemic innovation with a less-than-ideal structure;
- Threaten the development of spontaneous orders, in particular, threaten the emergence of natural knowledge clubs, which manage and distribute data and knowledge in different ways.

We conclude that an expansion of the core would represent a regulatory taking. A regulatory taking refers to a situation where regulation reduces the value of private property to its owner. Regulation that results in a taking may be justified where the regulation gives rise to a significant public benefit that would otherwise not be available. An expansion of the core data is likely to be of industry rather than public benefit and there is no evidence that LIC is restricting access to the non-core data unreasonably. Expanding the core data is therefore not justified on the basis of either of the two conditions for a regulatory taking: significant public benefit or necessity.

Furthermore, we would argue for consideration of a no regulation option, perhaps not now, but at some defined point in the future. An unregulated option would be each of the knowledge clubs (LIC and CRVAmbreed) managing the herd improvement data they each collect for the good of the club and following the rules of the club; and private interests managing their own private data according to the rules of property.

Appendix 1 Risks associated with a herd industry database

Risk considered in 2001 regulation	Risk assessment	Who is best to manage risk
The government recognised that some sort of exclusion would be needed to prevent a free rider problem, and establish the database as a club good. It decided that it would reflect the compulsion to provide core data into the database with free availability of data from the database.	Free rider problems can be managed by other rules which provide exclusion. E.g. intellectual property rules or rules which promote a first-mover advantage. If there is no regulated compulsion to provide data into the database then there should equally be no regulated requirement for open access to it. Equally, a voluntary contribution of data to the database should be met with access to its benefits.	The rules of exclusion are best managed by the club(s), as there are incentives to set the rules to maximise the number of participants and minimise the costs of participation. Regulation is not the only means of making testers and farmers share data. Voluntary arrangements are possible.
Due to concerns about the competitive nature of the herd testing industry, the government of the day felt that there would be an under-supply of data, information and knowledge for industry good purposes. The government felt that data, information and knowledge was at risk of being under-supplied if the club was left to self-manage. (Type 2 risk)	The relative scales of the club(s) may create barriers to entry and remain as a natural monopoly so if price/access is not regulated there may be a societal cost as a result of the natural monopoly; but on the other hand regulation may create or perpetuate barriers to competition. In practise the core data has been shared since 2001; meanwhile the non-core data is shared and made available to the industry participants without compulsion. Developing knowledge and know-how is a legitimate competitive tool, and the ability to benefit from one's own innovations provokes further innovations.	To the extent that there may be competitive concerns it might be possible to regulate the competitive aspects of the industry using the existing competition regulatory system.

Risk considered in 2001 regulation	Risk assessment	Who is best to manage risk
	The barriers to entry are changing, as the tools and practises for collecting, aggregating and disseminating data are changing. The metering industry, for example, is international in scale and promotes rapid adoption of new data collection methods.	
Some types of data are useful for industry-good research. This data has potential to be used by others to advance the industry, and may be under-provided for these purposes if the club is left to self-manage. (Type 2 risk)	This risk has to be balanced against the risk of dis-incentivising systemic innovation. The marginal cost to provide info is small and falling, with in-line systems becoming more prevalent. The marginal cost to farmers/testers is the cost of ensuring data is up to a high quality standard. Only 10 % of industry is not represented by the LIC cooperative; so LIC can be seen as a voice for industry research needs.	LIC and other knowledge clubs will have a more dynamic future-focus than regulations which are static. The 2001 Regulations provide for access rules, access prices, data retention, data restrictions, and monitoring. In our view, all of those requirements could be determined as a set of access rules, which are determined by the industry but are made public.
The government recognised the value of scale: herd data is valuable when kept together as a set, and gains value with additional scale. The government felt that the set was at risk of fragmentation, particularly if it was managed by a single commercial owner who could sell it off (perhaps to an overseas interest) or if farmers or testers decided that providing data provided less benefit to them than the cost.	There will always be some fragmentation of data if there is a distinction made between core and non-core, with different proprietary arrangements attached to each. The LIC data has reached critical mass; practices have become so embedded that data collection is the norm in the industry. Regulation creates a compliance cost burden for those	As the industry benefits from a data set with scale and depth, it is best to manage this risk itself

Risk considered in 2001 regulation	Risk assessment	Who is best to manage risk
The government was concerned that a set that was split between different owners would pose an aggregation problem for New Zealand farmers wishing to use it. (Type 2 risk)	using the data by making barriers between core and non-core difficult to negotiate. Access Panel arrangements give rise to a cost; if data is unregulated there is no compliance cost. Regulation distorts incentives to innovate with new fields or ways of collecting information. New fields are systemic innovations, and regulation should not discourage them.	
The government recognised the value of data quality: herd data is valuable when the practices for data collection ensure standardisation and quality. The government felt that the data was at risk of de-standardisation or low quality if the club was left to self-manage. The government was concerned that New Zealand farmers would lose competitiveness if the data lost quality. (Type 2 risk)	Intervention may be needed to maintain data standards but this intervention may not need to be regulatory in nature Standards for field information and standards for certified herd testers have been enforced under the existing Regulations, but better standards or standard setting processes may be found elsewhere. As in-line systems become more prevalent than certified testers, the human error aspects of testing may be reduced. The risk to be managed is technical failure, rather than human failure. Technical compliance requires different management tools than human compliance. Technical compliance is less likely to need a regulatory approach than human compliance.	The industry suffers from lowered quality standards, so the industry is best at choosing which standards suit them best.

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7. References

Academic references

Buchanan, James (1965) An Economic Theory of Clubs, Economica, New Series, Vol. 32, No. 125, pp. 1-14.

Cooter, Robert and Ulen, Thomas (2008). Law and Economics. Fifth ed. Pearson.

Epstein, Richard (1985). Takings – Private Property and the Power of Eminent Domain. Harvard University Press.

Farrell, Joseph and & Weiser, Philip (2003), Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age, 17 Harvard Journal of Law & Technology, 85.

Guerin, Kevin (2002) Protection against Government Takings: Compensation for Regulation? New Zealand Treasury Working Paper 02/18 < treasury.govt.nz/publications>

Hayek, Friedrich (1973) Law Legislation and Liberty.

Hayek, Friedrich (1945) The Use of Knowledge in Society.

Rogers, Everett (1995) Diffusion of Innovations. Fifth ed. Free Press.

Rasmus, Daniel W. A Quick Overview of Data, Information, Knowledge and Wisdom. Blog post <www.seriousinsights.net/what-is-data-information-knowledge-and-wisdom>

ReichmanC, JH (1994) Legal Hybrids Between the Patent and Copyright Paradigms, 94 Columbia Law Review, 2432.

Rochet, JC and Tirole, Jean (2003) Platform Competition in Two-Sided Markets, 1 Journal of the European Economic Association, 990—1029.

Rochet, JC and Tirole, Jean (2006) Two-Sided Markets: A Progress Report, 37 RAND Journal of Economics, 645—667.

Samuelson, Pamela (1990) Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions, 39 Emory L.J., 1025.

Samuelson, Pamela, et al. (1994) A Manifesto Concerning the Legal Protection of Computer Program, 94 Columbia Law Review, 2308—2431.

Samuelson, Pamela (2002) The Law and Economics of Reverse Engineering, 111 Yale Law Journal, 1575—1663.

Shirky, Clay (2010), Cognitive Surplus. Penguin Group.

Teece, David. (2000) Managing Intellectual Capital. Oxford University Press.

Teece, David (2009) Dynamic Capabilities and Strategic Management – Organizing for Innnovation and Growth. Oxford University Press.

Tirole, Jean (1998), The Theory of Industrial Organization, MIT Press, Cambridge.

Weiser, PJ (2002), Law And Information Platforms, 1 J. Telecomm. & High Tech. L.

Weiser, PJ (2003), The Internet, Innovation, and Intellectual Property Policy, 103 Columbia Law Review, 534—613.

Wilkinson, Bryce (2002) A primer on property rights, takings and compensation / prepared for Business New Zealand, Federated Farmers, the New Zealand Business Roundtable and the New Zealand Chambers of Commerce by Bryce Wilkinson ; with an introduction by Richard Epstein. ISBN 978-1-877394-22-5.

Victorian Competition and Efficiency Commission (2015) Smart regulation: Grappling with risk — Supporting paper, <www.vcec.vic.gov.au>

Other references

Dairy Industry (Herd Testing and New Zealand Dairy Core Database) Regulations 2001.

Ministry for Primary Industries. Dairy Herd Improvement Industry – Review of Regulation. MPI Discussion Paper No: 2018/10 October 2018

OECD/Eurostat (2018), Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg, <doi.org/10.1787/9789264304604-en>

Open data charter <opendatacharter.net/principles/>

Open data standards and guidance < www.data.govt.nz/open-data/>