

# Review economic basis of AgResearch FFP Business Case

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## Background

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## 1 BERL Review

Dunedin City, on behalf of a number of stakeholders has requested BERL to review and analyse the AgResearch Future Footprint Business Case, and the resulting proposal. BERL is requested to review how the treatment of the Future Footprint Business Case (FFBC) aligns with Government practice, and the economic basis for the FF Business Case and the resulting FF proposal (FFP).

There are two documents of the Business case available to BERL to carry out this review:

*AgResearch Future Footprint Business Case*, 40pp. 31st October 2012, and the resulting *Future Footprint Proposal*, 15pp. 30 July 2013.

### 1.1 Business Case Options

The FFBC document reported on three options that were modelled for the Business case;

- The Future Footprint Preferred (FFP) Option;
- Business as Usual BAU Option One; and
- BAU Option Two.

The **FFP option** described is based on re-locating staff from two regional campuses (Invermay and Ruakura) to two existing agricultural innovation centres (Lincoln and Palmerston North) over the next five years. The description is to achieve collocation and improved collaboration. It would be funded by disposing of AgResearch's under-utilised assets, use cash surpluses and some minimal debt. The capital cost is estimated at \$100 million.

The FFP Option is reported in detail, following the five case structure of the Treasury guidelines for Better Business Cases. These cases are the Strategic Case, the Economic Case, the Financial Case, the Commercial Case, and the Management Case.

The Strategic Case derives two objectives:

- Improving infrastructure quality and utilisation, and
- Catalysing agriculture innovation centres.

The Economic Case shows collocation would result in greater collaboration with New Zealand researchers and an increase of 1.6% in the total number of citations of research papers. A logic chain is used to estimate that this would increase agriculture's multifactor productivity by 0.24% in the long term. Given a figure of \$8.3 billion GDP per year for agriculture, the 'improved quality of R&D would increase GDP by \$20 million per year in the long term.'

The Economic Case described does not show

- the opportunity costs of the disruption to existing research programmes, and of disruption and degrading of relationships with existing stakeholders;
- the potential loss of contribution to outputs from loss of existing, operating research staff, although there is some budget apparently for staff transition costs; and
- the opportunity costs of loss of access to assets disposed of.

The Financial Case outlines funding of \$99.5 million by sale of farm land, sale of campus facilities and balance from future profits and debt. (The breakdown is erased.)

The Commercial Case outlines staff changes, property configuration and options for the four campuses. (All relevant numbers and options erased.)

The Management Case outlines planning for successful delivery of the Future Footprint project. (Numbers of employees and timeframe erased.)

**BAU Options** are based on retaining staff across the current campuses.

**BAU Option One** includes the required refurbishment to upgrade existing facilities to an acceptable standard if staff were not re-located to Lincoln and Palmerston North.

There is no detail given on the components of refurbishment such as communications that may increase the capabilities for improved collaboration among scientists from the existing campuses with each other and with other players in the agri-sector.

**BAU Option Two** includes the minimum required refurbishment and upgrade programmes needed at AgResearch in the short term.

The BAU Options are reported only in that level of detail.

Strategic Case and Economic Case: The BAU Options are stated to not deliver the innovation centre objectives and economic benefits.

**Assessment: 1. BERL has seen no evidence to provide a basis for estimating the extent to which the innovation centre objectives and economic benefits could or could not be delivered with either of the BAU Options.**

**2. We believe that there is a high level of risk involved in AgResearch proceeding to prepare a proposal for a project costing \$100 million, relocating valuable staff, and selling farm land and campus facilities when the magnitude is not known of the relative costs and benefits of this option compared with an option that retained staff and obtained some collaboration benefits through other means.**

## 1.2 FFP Business Case and Government practice

The AgResearch 'Future Focus' Preferred option centres around disposing of a significant amount of property and relocating the majority of staff around two innovation centres.

The full impact, both economic and social, of the preferred option in addressing the identified objectives of improving quality and utilisation of existing infrastructure and increasing collaboration are unclear in the business case.

The opportunity cost, in terms of alternative options to address the objectives identified, along with alternative uses for the property to be disposed of, is neither presented nor quantified.

Proposals that require Cabinet approval must align with Treasury's Better Business Case (BBC) guidelines. BBC guidelines have been developed from what is done by Governments in other jurisdictions and make sure that decision making is improved by ensuring that business cases are fit for purpose. They focus on presenting and assessing all possible options to achieve stated objectives and are designed to prevent information asymmetry.

The AgResearch business case is not aligned with BBC guidance and did not require Cabinet approval. The FFP Option proposal is stated to follow the BBC five case structure, but this is of very limited use when the same cases are not presented for the other Business Case options.

While not aligned to BBC guidance, it is important to note that it is increasingly becoming best practice for Crown entities and State Owned Enterprises that are not required to align with BBC guidance to do so in order to both protect their own credibility and provide their Minister with a greater level of assurance of the information on which they are making decisions.

The robust BBC guidelines benefit the Minister's decision by:

- Presenting the benefits and risks associated with achieving the proposal objectives in a recognised, defensible format;
- Enabling fully informed decisions on where to redirect the proceeds of the disposal of assets;
- Creating a level playing field for decision making. They prevent bias by making sure that a decision made is not unduly influenced by a preconceived outcome.

**Assessment: 3. Given the monetary value of the property to be disposed of and the lack of information contained in the Business Case, we believe that it is extremely risky for the Minister for Science and Innovation not to have required AgResearch to develop their Business Case in accordance with Treasury's Better Business Case (BBC) guidelines.**

### 1.3 Economic impact of FFP Proposal

The estimation of the economic impact of the FFP proposal is completed on the basis of a logic chain and assumptions along the way.

**The logic chain** proposed in the Business Case is as follows:

Collocation with other research staff:

- a) Leads to greater collaboration with other researchers, which
- b) Leads to qualitatively and quantitatively better research results which
- c) Lead to more innovation in the sector, which
- d) Leads to more economic growth.

The logic is that this chain leads to 'greater, better and more' good things, but the measure of net impact suffers because there is no comparator to measure the relativity, no Option to test it against.

**Estimation along the Logic Chain** in the Business Case (October 2012) at Pages 12 and 13 proceeds by giving a high-level description of the analysis to show how science increases will increase agricultural GDP.

1. The analysis of share of publications co-authored with New Zealand collaborators shows:

Invermay and Ruakura 50%                      Ag.Centres, Grasslands, Hopkirk, Lincoln 60%

Comment: Numbers not given, nor international collaborations.

2. The citation rate for papers without any collaborators was consistently lower than those with New Zealand collaborators.

Comments: The level of the difference in citation rates not given.

Again New Zealand collaborators specified. Do we have information for international collaborators?

3. On this basis better collocation would result in NZ collaborators being involved in 10% more papers being produced by current Invermay and Ruakura staff.

Comments: Does not give the current number of papers.

Again specifies NZ collaborators.

Assumes that current Invermay and Ruakura staff will re-locate to the two centres.

4. This would result in an increase by 1.6% in the total number of citations (217 citations).

Comments: Does not give the relevant citations per paper; assumes historical relationship holds.

Note this implies total annual citations of over 13,000 per year.

5. The increase in citations by 1.6% per year will eventually increase the knowledge stock by 1.6%

6. Quoting Hall & Scobie, *the elasticity of output with respect to domestic knowledge was estimated at 0.148 by Hall & Scobie, (2006)*<sup>1</sup>. In other words for a 1% increase in the stock of knowledge, the value of output from the agricultural sector will increase by 0.148%.

This is not what Hall & Scobie say at page 22. They say that *...the elasticity of MFP with respect to domestic R&D is 0.148*. The label for their 'domestic R&D' variable in their equations is "Domestic knowledge stock". The MFP they refer to is Multi Factor Productivity. So what they are saying is that a 1% increase in the domestic knowledge stock will result in an increase by 0.148% in Multi Factor Productivity.

At this point the discussion becomes even more technical:

Multifactor productivity is a measure of the level of output per unit of all factor inputs, namely land, labour and capital.

It is necessary to assume that the combination of factor inputs remains the same, then an increase in multifactor productivity by 0.148% will result in an increase in value of output by 0.148%.

7. The next assumption is that the increase in 'research quality' by AgResearch affected all of their collaborators, and so all agriculture-related R&D increased by 1.6%, and the total stock of domestic knowledge is raised by 1.6%.

8. Their next statement is that *raising the stock of domestic knowledge by this amount would raise multifactor productivity by 0.24% in the long term*.

So on the assumption that the combination of factor inputs remains the same, the value of output of the agriculture sector will increase by 0.24%. Interpreting this as an 'elasticity of output with respect to the stock of domestic knowledge' in FF Business Case in the footnote 5. on the bottom of page 11, they then apparently use it to multiply by the annual agricultural GDP of \$8.3 billion to arrive at an annual increase in agricultural GDP of \$20 million per annum.

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<sup>1</sup> Hall, Julia and Grant M Scobie. *The role of R&D in productivity growth: The case of agriculture in New Zealand: 1927 to 2001*. New Zealand Treasury Working Paper 06/01. Wellington March 2006.

The value of output can be thought of as the value of sales. The GDP is the sum of the value added to the inputs or factors used in producing that output. As an order of magnitude, GDP generally comprises about 40% of the value of gross output.

9. An increase by 0.24% in the value of gross output may result in an increase by 0.24% if the ratio of GDP to gross output in the marginal production is the same as the average in the existing production.

This however is yet another, and final assumption.

**Summary:** The track through the AgResearch logic chain moves from collocation driving an increase in science citations and then requires a large number of sequential assumptions before deriving an increase in agricultural GDP per year of \$20 million.

Each step requires a number of assumptions in order to complete the chain.

**Findings:** Taking an overall view, we should apply a reality check:

1. Do we believe that increasing the number of times papers published by AgResearch scientists are cited (by their peers here and overseas) will be a causal factor in increasing agricultural GDP by \$20 million per year?
2. If we do believe that this is the case, do we think that this increase by 0.24% per annum of agricultural GDP will contribute significantly to government's Business Growth Agenda to lift exports from 30% to 40% of GDP by 2025?
3. On AgResearch numbers, agricultural GDP is \$8.3 billion, and by 2025 the increase at 0.24% per annum will have compounded up by a value equivalent to 1.7% of current agricultural GDP. Given the fluctuations in annual agricultural GDP, a compounded value equivalent to just 1.7% of agricultural GDP after 12 years must be seen as within the margin for error.

**Assessment: 4. The assessment is that the convoluted and at times confused path from collocation of scientists to increases in agricultural GDP does not engender confidence that the re-structuring proposed will result in greater contribution of AgResearch to achieving government's goals than continuation of the status quo, or implementation of another option to generate greater collaboration with value chain stakeholders and researchers.**

## 1.4 Scientist recruitment imperative

The FFP states that *..New Zealand does not currently produce enough capability to meet AgResearch's needs and we expect to continue to recruit in excess of 70% of our scientists from overseas. In the Proposal: Our capability needs will significantly increase given our staff age profile and expected retirements. Our workforce demographics in the next 5-10 years will see significant numbers of science roles to be filled: 14% of AgResearch scientists are over 60 years of age, and a further 26% are aged 50-59 years, meaning 40% are 50+ years of age.*

This statement is worth giving some consideration. In the first instance a key aspect of present government policy is to increase science capability to meet New Zealand's needs.

The age profile question is even more important. For example taking the AgResearch figures of 26% for 50 to 59 years scientists, in each 5-year age group there would be an average of 13% of the AgResearch scientists. If the 'normal' retirement age is 65 years, there are 14% over 60 years, so

then in an age-balanced work force there would be only 1% aged over 65. That is by no means a 'Grey Tsunami' of impending retirements.

Could the AgResearch current scientist workforce be age balanced? Well if 40% are over 50 years, 60% are under 50 years. If the normal recruitment age of a scientist is 25 years there are 5 age classes of 5 years each between recruitment and age 50. Thus in an age-balanced workforce, there would be 60% divided by 5, namely 12% in each five-year age class, and it follows that every five years a number equal to 12% of the workforce would have to be recruited. The five year age groups from 50 years to 65 years have only about 13% of the workforce in each. The current level of retirements appear likely to be little more than this level of 12% every five years.

What would be very informative is whether in fact AgResearch has maintained this level of recruitment and in-service scientist training in recent years. If they have not, and have a predominance of scientists in the 35-50 age classes, these may well be less likely to re-locate than those at a younger age, not yet fully settled with their families in the present location.

This highlights that the reality of the impacts of the Options will be dependent on obtaining a sound assessment of the actual staff age profile, and the likely profile and roles within key programmes of those who would re-locate and those who would not, under each Option.

## 1.5 Specifying An Alternative Option

The AgResearch FFP Business Case began from the objectives:

- Improving infrastructure quality and utilisation, and
- Catalysing agriculture innovation centres.

It took as a given:

*Research across many countries shows that "clustering" supports better research outcomes.*

### **Alternative focus for Centres of Excellence**

We suggest that AgResearch may have come to a different specification had they considered the specific nature of their existing research centres, the roles of key researchers and their existing collaboration, and means to increase this collaboration.

The nature of Centres of Excellence has recently been well-defined by an author who AgResearch quote in their Business Case. Maryann Feldman is widely published on the economics and infrastructure of science, research, technology and related areas. A recent paper by Feldman addresses Centres of Excellence among other aspects of research programmes.<sup>2</sup> This research analyses how 50 state governments over 30 years in the US have experimented with programmes that fund university research, attract talented scientists, and encourage partnerships with industry in an attempt to create conditions conducive to economic development and prosperity. The research finds that there were three main initiatives: Eminent Scholars programme, University Research Grants programme, and the Centre of Excellence (CE) programme.

The CE programmes have four common features identified: a directed research mission focussed on basic and applied research; emphasis on graduate training; collaboration between universities and industry; and a strong research orientation directed towards a specific sector of technology.

<sup>2</sup> Feldman, Maryann , L. Lanahan, and I. Lendel. *Experiments in the laboratories of democracy: State scientific capacity building*. 26 pp. Economic Development Quarterly. 2013, forthcoming.

**Given these four features, the individual CEs have either a greater emphasis on partnership with industry, or with the research programme.**

This could imply two possible Centres of Excellence options for AgResearch with a different focus:

1. an enhanced BAU Option with four existing Centres of Excellence with a greater emphasis on partnership with industry; or
2. the Future Focus Preferred Option of two Centres of Excellence, having a greater emphasis on the research programme *per se*, focussed on increasing the citation rate of papers.

### **Converting Knowledge creation into innovation performance**

The Treasury paper quoted by the AgResearch Business Case by Blakeley et.al.<sup>3</sup> at page 8 shows that innovation performance can be driven by *knowledge creation*, as long as it is associated with capacity for *knowledge absorption*, leading to *knowledge accumulation*, which together with *knowledge application* can drive innovation performance.

To better understand whether the postulated increased knowledge creation in the FFP case would result in improved innovation performance in that case, we would have to assess the differences in the capacity for knowledge absorption, knowledge accumulation and knowledge application as between the FFP and the specification of an alternative option, for example an enhanced BAU.

The fact that the capacity of the other three factors will all be increased in the FFP would seem to be an heroic assumption, especially where the research informs production practices at different particular places, geographic and on the pastoral value chain.

### **Comparing like with like**

The cost of the FFP option is given as \$100 million. Were a costing of implementing the refurbishment under BAU Option One given, presumably it would be significantly less than \$100 million. This would show the opportunity to invest further to achieve a better level of collaboration and communication with all stakeholders within the present structure. If this included elements of improved IT communication, it could well achieve most of the benefits of co-location and collaboration with centralised industry stakeholders, while maintaining and improving communication and collaboration with dispersed stakeholders as at present.

A concentration on IT rather than geographic co-location may improve research outcomes also, as found in a recent paper by Chris Forman et.al.<sup>4</sup> Studying the geographic concentration of innovation in counties in the US, they found that the internet could act as a broad force for weakening the links between the geography of inventive activity and spatial patterns of downstream use of it.

### **The reality of scientist re-location and collaboration**

The actual rather than theoretical opportunities for and outcomes from scientist collaboration must be addressed in the options analysis. This area has some very useful international work showing that remote collaboration can be very productive and also the importance of key researchers. One such article is titled *Collaboration, Stars, and the Changing Organization of Science: Evidence from Evolutionary Biology*.<sup>5</sup>

<sup>3</sup> Blakeley, Nic, Geoff Lewis and Duncan Mills. The economics of knowledge: Waht makes ideas special for economic growth? 23pp. New Zealand Treasury Policy Perspectives Paper 05/05/ Wellington. November 2005.

<sup>4</sup> See Forman, Chris, Avi Goldfarb, Shane Greenstein. *Information technology and the distribution of inventive activity*. 28pp. At Page 18. In NBER *The Changing Frontier: Rethinking science and Innovation policy*. August 2013

<sup>5</sup> Agrawal, Ajay, John McHale and Alexander Oetti. *Collaboration, Stars, and the Changing evidence from evolutionary biology*. 21pp. In NBER *The Changing Frontier: Rethinking science and Innovation policy*. August 2013.

The comparison of an FFP outcome whereby some 'Stars' from the AgResearch team are lost because they refuse to re-locate, compared with an enhanced BAU could have significant impacts on specific programmes and outcomes.

The AgResearch experience in re-locating research away from Wallaceville in the Hutt Valley, some programmes of which shifted to Invermay could give some indications for outcomes of this aspect.

**Assessment: 5. The FFP Option Business Case can only be safely assessed in comparison with full documentation of another option which also aims to increase AgResearch performance consistent with its stated purpose, outcomes and operating principles. This strategic context could be represented as the provision of research and transfer of technology and knowledge in partnership with key stakeholders, including industry, government and Maori, to enhance the value, productivity and profitability of New Zealand's pastoral, agri-food and agro-technology sector value chains to contribute to economic growth and beneficial environmental and social outcomes for New Zealand.**

