TBSPG Bovine TB Eradication Strategy

Appraisal of TBSPG Recommendations – Composite Report of Three Independent Reports:

- Cost Benefit Analysis against Baseline of Draft Strategic Recommendations, PACEC, December 2016;
- Behavioural Appraisal of the Recommendations of the TB Strategic Partnership Group, Dr. Philip Robinson, Harper Adams University, September 2016; and
- Review of Science and Epidemiology – Northern Ireland’s Bovine Eradication Programme proposals by the Tuberculosis Strategic Partnership Group (TBSPG), Dr. Cecil McMurray & Dr. George McIlroy and associated scientific peer review, Simon J. More, University College Dublin, September 2016.

Final Report (v2.0)
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## Abbreviations and acronyms

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<thead>
<tr>
<th>Abbreviations</th>
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<tr>
<td>AFSB</td>
<td>Agri-Food Strategy Board</td>
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<tr>
<td>AHT</td>
<td>Annual Herd Test</td>
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<td>AHWI</td>
<td>Animal Health and Welfare Inspector</td>
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<td>AVS</td>
<td>Approved Veterinary Surgeon</td>
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<td>bTB</td>
<td>Bovine Tuberculosis</td>
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<td>DAERA</td>
<td>Department of Agriculture, Environment and Rural Affairs (Northern Ireland)</td>
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<tr>
<td>DRT</td>
<td>Disease Response Teams</td>
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<td>EADRA</td>
<td>Emergency Animal Disease Response Agreement</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<td>ERAD</td>
<td>Eradication of Animal Disease Board</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FMD</td>
<td>Foot and Mouth Disease</td>
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<tr>
<td>GB</td>
<td>Great Britain</td>
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<tr>
<td>GHG</td>
<td>Greenhouse Gas(es)</td>
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<tr>
<td>HMT</td>
<td>Her Majesty’s Treasury</td>
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<tr>
<td>IFNG</td>
<td>Gamma Interferon Test</td>
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<tr>
<td>NI</td>
<td>Northern Ireland</td>
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<tr>
<td>NPC</td>
<td>Net Present Cost</td>
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<tr>
<td>OIE</td>
<td>Office International des Epizooties (World Organisation for Animal Health)</td>
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<tr>
<td>OTF</td>
<td>Officially Tuberculosis Free</td>
</tr>
<tr>
<td>OTFW</td>
<td>Officially TB Free Withdrawn</td>
</tr>
<tr>
<td>PVP</td>
<td>Private Veterinary Practitioners</td>
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<tr>
<td>Abbreviations</td>
<td>Acronyms</td>
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<tr>
<td>ROI</td>
<td>Republic of Ireland</td>
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<td>TBEP</td>
<td>TB Eradication Partnership</td>
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<td>TBSPG</td>
<td>TB Strategic Partnership Group</td>
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<tr>
<td>TVO/VOT</td>
<td>Temporary Veterinary Officer/Veterinary Officer Testing</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom of Great Britain and Northern Ireland</td>
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1 INTRODUCTION & BACKGROUND

1.1 Introduction

Bovine Tuberculosis (bTB) is an infectious disease of cattle. It is caused by the bacterium Mycobacterium bovis (M. bovis), which can also infect and cause disease in many other mammals including humans, deer, goats, pigs, cats, dogs and badgers. In cattle, it is mainly a respiratory disease but clinical signs are now rare. TB in humans is usually caused by a very closely related infectious agent, Mycobacterium tuberculosis, but may also be caused by M. bovis.

bTB is a very complex, multifactorial and challenging disease that has proven difficult to eradicate worldwide. It has an adverse impact on affected farm businesses due to the interruption to market access and the additional disease control measures that are required. It is widely regarded as the most difficult animal disease problem currently facing government, the veterinary profession and the farming industry in these islands and it is widely accepted that eradication of bTB will require the use of a range of measures aimed at addressing the infection in cattle and preventing its spread to and from wildlife and between cattle.

DAERA has responsibility for food, farming, environmental policy and the development of the rural sector in NI. It provides a business development service for farmers and growers, and a veterinary service with administration of animal health and welfare. DAERA is responsible to the Department of the Environment, Food and Rural Affairs (Defra) in Great Britain for the administration of schemes affecting the whole of the UK. DAERA also oversees the application of EU agricultural and rural development policy to NI.

The Animal Health & Welfare Policy Division within DAERA exists to develop policies that promote the welfare of animals, reduce and eradicate animal diseases which have significant economic or public health consequences and secure the effective traceability of livestock through identification, registration and movement controls.

1.2 The TB Eradication Strategy

On 17 September 2013 the then Department of Agriculture and Rural Development Minister, Michelle O’Neill MLA, announced a plan to establish a government/industry strategic partnership group, which would review the ongoing bovine tuberculosis (bTB) eradication programme and develop a long-term strategy/implementation action plan to eradicate bovine TB from NI’s cattle population.

The TB Strategic Partnership Group (TBSPG) was established in September 2014. The TBSPG operates independently from the Department, although the Chief Veterinary Officer and the Director of Animal Health and Welfare Policy Division are ex officio members of the Group. The Chair of the Group is independent, as are the external members of the group consisting of two former Presidents of the Ulster Farmers’ Union plus two experts in the scientific and veterinary fields.

The TBSPG was tasked to act in the public interest to develop a long-term strategy to eradicate bTB, to produce an associated action plan to implement the strategy, to provide advice on how the strategy and outcomes can be achieved, and to engage with a wide range of stakeholders and gather evidence to support their final recommendations.

Following extensive and detailed evidence gathering, the TBSPG produced an Interim Report in June 2015, which was the subject of a 10 week public consultation. In December 2016, the TBSPG launched its bTB Eradication Strategy which includes a series of recommendations that they feel, if implemented, would lead to the eradication of the disease in the future.

The recommendations presented within the bTB Eradication Strategy are structured within seven thematic areas. An overview of each theme and associated recommendations are provided in Table 1.1.
Table 1: TBSPG Recommendations by Theme

<table>
<thead>
<tr>
<th>Theme</th>
<th>Associated Strategic Recommendations</th>
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<tbody>
<tr>
<td><strong>Existing tools and processes</strong></td>
<td>• Expand use of severe interpretation of skin test</td>
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<td></td>
<td>• Increased use of gamma interferon testing</td>
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<td></td>
<td>• PVP to DNA tag on farm when they detect a reactor.</td>
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<td></td>
<td>• DAERA to expand use of molecular techniques to eliminate bTB from cattle</td>
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<td></td>
<td>• Ensure any PVP contracts align with TBSPG recommendations</td>
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<td></td>
<td>• Depopulation should be considered in herds with multiple reactors and partial depopulation should be considered when reactors represent a significant proportion of a particular group</td>
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<td></td>
<td>• Measures to resolve or minimise impact of chronic herds</td>
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<td></td>
<td>• Herd test prior to restocking after TB breakdown</td>
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<td></td>
<td>• Reducing the number of NVL reactor animals required for a herd to be considered OTW to 2 or more</td>
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<td></td>
<td>• Rigorous inspection to detect lesions at slaughter plants</td>
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<td>• Consider limited moves with specific conditions from bTB breakdown herds to approved rearing / finishing herds or 100% housed and met strict biosecurity conditions.</td>
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<td></td>
<td>• GIS resource to be developed for use of DAERA, PVPs and governance groups</td>
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<td></td>
<td>• Introduction of an additional 6 month test for derestricted herds</td>
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<td></td>
<td>• Design and implementation of a field trial of counter fraud measures</td>
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<td><strong>Herd Health Management</strong></td>
<td>• Encouragement of herd keepers to improve herd health management and take responsibility for herd health management on individual holdings.</td>
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<td></td>
<td>• Development of bio-security self-assessment checklist</td>
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<td></td>
<td>• Provision of advice to farmers about on farm practice and herd health management measures specific to that farm by PVPs and DAERA staff.</td>
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<td></td>
<td>• Farmers should use a biosecurity self-assessment checklist to be developed by DAERA</td>
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<td></td>
<td>• Consideration to be given to the development of statutory ‘Improvement Notices’</td>
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<td></td>
<td>• Awareness raising actions on “informed purchasing” should be put in place as an integral part of an overall communications strategy</td>
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<td></td>
<td>• Farming industry should adopt an informed approach to the purchase of stock</td>
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<td></td>
<td>• Encouragement of livestock markets to display information to better inform prospective purchasers</td>
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<td>• DAERA to undertake a review of existing farm fragmentation data to establish whether it adversely impacts on the control of TB following a breakdown</td>
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<td></td>
<td>• Introduce segregation notices to protect those herds that are at risk of disease spread from high risk groups within bTB breakdown herds.</td>
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<td></td>
<td>• TBEP should keep under review the potential benefits of the use of herd</td>
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<tr>
<td>Theme</td>
<td>Associated Strategic Recommendations</td>
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<td>--------------------</td>
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<tr>
<td>Theme</td>
<td>classification and purchasing based on herd bTB history as operated, for example, in New Zealand</td>
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<td></td>
<td>• Industry leaders should actively encourage farmers to use the “TB Advantage” genetic index</td>
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<td></td>
<td>• Farmers should thoroughly clean and disinfect vehicles and disinfect and equipment after transportation of farms animals</td>
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<tr>
<td>Wildlife</td>
<td>• Implementation of badger vaccination strategy along with the strategic removal of badgers. Each main intervention area will comprise a central area, where badgers will be removed, the core zone, and a surrounding buffer zone where badgers will be captured, tested, removed if tested positive and vaccinated and released if tested negative. An intervention area will usually cover at least 100km².</td>
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<td></td>
<td>• Implementation will be from two/three areas in first year increasing to up to ten areas. The intervention will be for a minimum of four years and following this four year period, vaccination of badgers will continue in the core zone for a minimum of three years or as long as deemed necessary. The longer term use of vaccination, including the development of oral bait vaccine, to be kept under review.</td>
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<td></td>
<td>• The position with regards wild deer and camelids to be kept under review.</td>
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<td>• The Road Traffic Accident (RTA) Survey to be expanded.</td>
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<td>Governance</td>
<td>Establishment of new bTB governance structures to include:</td>
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<td></td>
<td>• NI level oversight body – the TB Eradication Partnership (TBEP);</td>
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<td>• A small number of sub-regional eradication partnerships;</td>
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<td></td>
<td>• Responsive local Disease Response Teams (DRTs). DRTs will be formed on an ad hoc basis and have the objective of providing local direct involvement in disease control.</td>
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<tr>
<td>Culture and</td>
<td>• Development and implementation of a robust publicity and communication strategy</td>
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<tr>
<td>communication</td>
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<tr>
<td>Finance</td>
<td>• Cap in compensation levels of £1,500 for non-pedigree bovine animals and £1,800 for pedigree animals. A herd-keeper will be permitted to receive compensation up to a cap of £3,500 for one pedigree stock bull per year with no carry-over from one year to the next.</td>
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<td></td>
<td>• TBEP to consider a percentage reduction in the level of compensation paid.</td>
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<tr>
<td>Research</td>
<td>• Integration of targeted research projects commissioned by DAERA into TB Eradication Programme with research results used to facilitate future policy development and new innovations to help tackle the disease with TBEP recognised as a significant stakeholder and a TBEP representative to sit on the steering group.</td>
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1.3 Reports informing the bTB Eradication Strategy

In developing the bTB Eradication Strategy, the TBSPG was informed by a review of the science and epidemiology of the TBSPG proposals by its members Dr. Cecil McMurray and Dr. George McIlroy\(^1\), as well as a number of independent reports, namely:

- "Cost Benefit Analysis against Baseline of Draft Strategic Recommendations", PACEC, December 2016 (herein referred to as the Economic Analysis);
- "Behavioural Appraisal of the Recommendations of the TB Strategic Partnership Group", Dr Philip Robinson, Harper Adams University, September 2016 (the Behavioural Appraisal);

The following sections outline the approach adopted by each of the independent reports in assessing TBSPG recommendations and identifies the constraints / limitations associated with the analyses (as highlighted by each of the authors).

1.3.1 Scientific Review

The report reflects a review of the scientific elements of TBSPG recommendations relating to the thematic areas of “Existing Tools and Processes”, “Herd Health Management” and “Wildlife”. This report also briefly considers two alternative approaches i.e. the ‘do nothing’ and ‘status quo’ options and assesses scientific basis and the likely impact of such approaches on disease incidence levels.

Drs McMurray and McIlroy assessed the recommendations contained in three thematic areas namely;

- Tools and Processes
- Wildlife and Vaccination
- Farm Practice and Biosecurity

These are the thematic areas that relate to epidemiological principles and will exert the most direct influence on infection levels. The other thematic areas, for example governance and finance & funding, will be critical parts of the Group’s final report and to the success of the eradication programme, but they cannot be individually assessed from a scientific / epidemiological perspective and are therefore beyond the scope of this review. However, they are taken into account in the evaluation of the potential effectiveness of the implementation of the full package of recommendations.

This work was conducted as a narrative review, based on detailed reference to relevant international peer-reviewed scientific literature. International benchmarking offers a further opportunity to identify programme strengths and weaknesses. To date, the approach to benchmarking has relied on the development of agreed summary measures of performance, separate country-level calculation of these measures, then the sharing of measures to allow country-level comparisons. The report highlights that there are limitations in international literature and that more detailed analyses are possible to facilitate sophisticated country-level comparison of programme progress, but that this would require the sharing of raw data across borders.

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\(^1\) “Review of Science and Epidemiology – Northern Ireland’s Bovine Eradication Programme Proposals by the Tuberculosis Strategic Partnership Group”, Dr. Cecil McMurray & Dr. George McIlroy
1.3.2 Behavioural Appraisal

The Behavioural Appraisal provides an analysis of the potential attitudinal and behavioural responses to the recommendations of the TBSPG, and an assessment of their likely impact on the overall bTB eradication programme premised on their adoption.

It presents an assessment of the behavioural impact of TBSPG recommendations profiled under six of the strategy’s seven themes (i.e. ‘Research’ recommendations were not assessed) and also considered the attitudinal/behavioural implications of the following options: a ‘Do Nothing’ option; a ‘Status Quo’ option, full implementation of TBSPG recommendations; partial implementation of TBSPG recommendations; and staged / phased implementation of TBSPG recommendations.

The analysis is given with the caveat that attitudes and behaviours in relation to disease and disease control are linked to a complex multiplicity of factors, and it is often challenging to separate these interwoven strands for analysis in isolation, or indeed as an integrated package. For example, research has shown that attitudes and behavioural responses to animal disease may be influenced by risk perceptions, sociocultural background, psychology, economic considerations, uptake of scientific advice, and previous experiences of the disease.

In addition, the Behavioural Appraisal states the following in relation to the analysis of options:

“There is limited evidence on which to base the likely attitudinal and behavioural responses to ... option packages,..., given the unique combination of measures which the TBSPG are proposing, for which there is no direct comparison in N. Ireland or elsewhere”. (Page 62)

1.3.3 Economic Analysis

The Economic Analysis involved the review of three programme options, namely:

- A ‘Do nothing’ option, which would see no government testing or bTB programme;
- A Status Quo’ option, which represented the current bTB programme employed by DAERA to tackle the disease; and
- Full implementation of TBSPG recommendations.

The ‘Do Nothing’ option was assessed in qualitative terms, using a narrative approach. The Status Quo option and Full Implementation option were assessed both quantitatively and qualitatively as described below (and as highlighted in Figure 1.1):

- Quantitative Analysis - involving the development of discounted cashflows for a 40 year period, identifying quantifiable economic costs / benefits and Net Present Cost (NPC) associated with each option. This process involved estimating:
  - The cost to farmers of a bTB breakdown – the total cost of breakdowns to farmers varies in direct proportion to the level of disease incidence;
  - The costs to government of a bTB breakdown – the total cost of breakdowns to government varies in direct proportion to the level of disease incidence;
  - Ongoing costs associated with the current bTB Programme, some of which vary as disease incidence levels change; and
  - Additional costs incurred by government in implementing TBSPG recommendations.

- Where applicable, the projected impact of each option on future bTB herd incidence levels was extrapolated using bTB incidence trends from the Republic of Ireland (RoI). Experience in the RoI has features that make it the best available predictor of how the level of bTB in Northern Ireland would respond to a package of eradication interventions. These are:
  - The presence of a wildlife reservoir of infection (primarily the badger);
- Comparable badger ecology;
- Similar in farm structures, production systems and farm practices;
- A comparable physical landscape;
- The existence of a long standing ongoing bTB control programme that has shown strong signs of success; and
- Its development of a multi-faceted and integrated control programme, including the national roll-out of a wildlife intervention.

- Risk Assessment – incorporating assessment of key areas of risk to programme implementation, identification of risk mitigation strategies and carrying out a range of sensitivity analyses on NPC calculations.
- Assessment of Qualitative Costs and Benefits - a weighting and scoring exercise has been adopted to illustrate in quantitative terms how each option performs against identified non-monetary criteria. The criteria being:
  - Contribution to improved perception of product quality, enhanced industry reputation and international trade;
  - Improvement in animal health;
  - Improvement in the health and welfare of farm workers and farm families;
  - Reduction in negative long term impacts on farm businesses; and
  - Enhanced benefits associated with government’s partnership working with stakeholders.

The results of each of the above strands of analysis were used to assess the balance of advantage between the options and to select a preferred option. An analysis of affordability and funding of the Preferred Option has also been profiled.

The Economic Analysis highlights a number of constraints/limitations that mean that the results of the analysis should be considered as being indicative and treated with a degree of caution. These constraints include the following:

- Estimates of cost and benefit are underpinned by projected reductions in bTB levels, but there is a medium to high risk that the projected reductions in bTB will not be achieved;
- The analysis utilises average herd data across all herd types and does not reflect cattle population change by herd. Estimates of costs and benefits of bTB can be influenced by a wide range of factors including herd numbers, size and type (i.e. dairy and non-dairy) and changes in these variables will impact on economic costs and benefits;
- Estimates of costs and benefit have used NI specific cost data wherever possible, however, much of the analysis of farmer costs has been carried out by DEFRA and GB derived values have been used where no NI specific value is available; and
- Estimates of future compensation levels reflect the type and value of animals for which compensation was paid in 2015. Compensation values will vary throughout the appraisal period and therefore, the identified savings are considered to be highly indicative.

1.4 Purpose and Structure of this Report

The aim of this report is to provide a single composite report which summarises the key findings of each of the independent appraisals outlined previously, in terms of the ‘Do nothing’ option, the Status Quo’ option and full implementation of TBSPG recommendations. In doing so, this report provides a summary detailing the rationale and risks of the adoption of the strategy outlined by the TBSPG from an economic, scientific and behavioural perspective. As such, the remainder of the report is structured as follows:

- Section 2 - Analysis of the ‘Do Nothing’ Option;
- Section 3 - Analysis of the ‘Status Quo’ Option’;
- Section 4 - Analysis of Full Implementation of TBSPG Recommendations; and
- Section 5 - Conclusions Arising from Independent Analysis.
Figure 1:1: Overview of Economic Analysis

Quantitative Analysis

Modelling of:
- Rate of reduction in bTB incidence associated with TBSPG recommendations

Assessment of:
- Cost to Farmers of bTB breakdown
- Cost to Government of bTB breakdown
- Ongoing costs of bTB control programme

Profiling:
- Costs of implementation of TBSPG recommendations

Qualitative Analysis

Weighting & Scoring of Qualitative Criteria

Net Present Cost & Sensitivity Analysis – Sensitivity analysis incorporating variations in key assumptions relating to:
- Herd size
- Farmer and government costs of bTB breakdown
- Cost of implementing TBSPG recommendations

Risk Analysis

Identification of Risk Factors/Assessment of Probability & Impact

Selection of Preferred Option
2 ANALYSIS OF THE ‘DO NOTHING’ OPTION

2.1 Option Description

This option represents the removal of all compulsory field cattle control measures and would, in theory, return NI to the situation prior to the introduction of the compulsory bTB eradication scheme in 1959. Previous to its introduction, a voluntary bTB eradication scheme was in place from 1949 but even with this, an estimated 2,000 tonnes of meat was condemned due to bTB and a 10% reduction in milk yields in infected animals was suggested\(^2\). During the 1940s, there was an average of more than 400 clinical bovine cases detected per year and the dairy cow animal incidence was estimated at 33%\(^3\). This was during a period when the total cattle population in NI was approximately half of present cattle numbers and much less intensive cattle management systems were in place.

2.2 Scientific Review

The Scientific Review highlighted that the TBSPG rejected the “do nothing” option for reasons that are scientifically sound.

The Scientific Review stated that current meat hygiene inspection processes and the continuation of pasteurisation of milk would continue to effectively protect the vast majority of the human population from any increased zoonotic threat posed by increases in bTB incidence in cattle. However, the Review also highlighted that there would be a potentially serious increased risk to those working in close contact with cattle or those that continue to consume unpasteurised milk. Some measures could be instigated in an attempt to minimise this risk e.g. BCG vaccination, bulk milk or cattle testing on risk farms.

Although the impact on human health may be marginal if live cattle bTB testing was stopped, such a step would threaten export markets. The Review stated that the Northern Ireland cattle industry relies heavily on its trade in meat and milk as well as live cattle movements for its economic viability and, as such, is dependent upon a reputation for safe meat and milk. Indeed, the threat of Britain prohibiting cattle exports from the island of Ireland was a main driver for the instigation of the compulsory bTB eradication scheme both north and south of the border.

It also identified that:

“It is not possible to predict the ‘post-Brexit’ future with respect to the trade in cattle and associated commodities. Nonetheless, there is little doubt that trade of animals and animal products into the EU will continue on the basis of equivalence, that is compliance with current EU legislation, in particular Council Directive 64/432\(^4\).” (Page 25)

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2.3 Behavioural Appraisal

The benefits of implementing the “do nothing” option were identified within the behavioural appraisal as being:

- Removal of a major part of the regulatory burden from farmers which they view as an impediment to farming;
- Farmers would no longer be forced to test cattle, a measure which they often resent due to the time taken and the potential injuries and loss of production in their cattle; and
- Some vets may welcome the reduction of their bTB testing burden, an activity which some find monotonous and a distraction from other veterinary disease control activities on farm.

However, the disbenefits of implementing the “do nothing” option were identified as:

- Processors and exporters may anticipate the loss of valuable export markets due to no assurance of freedom from disease in cattle and cattle products, with very serious knock-on effects on producers;
- Farmers and consumers in N. Ireland may become fearful of bTB once again as a zoonotic disease which is not being controlled; and
- Many private vets would fear job losses through the reduction in veterinary workforce required, and the reduction of their practice viability due to a business model built around bTB testing income in many (particularly smaller) farm animal practices.

The Behavioural Appraisal concluded that the disbenefits outweigh the benefits, that this option would have catastrophic implications for NI's future export capability and that the reductions in bTB incidence since the 1950s would be lost and nearly six decades of effort could potentially be wasted, leading to further demoralisation of stakeholders.

2.4 Economic Analysis

The economic analysis assess the “Do Nothing” scenario in qualitative manner. It highlights that in a “Do Nothing” scenario, current meat hygiene inspection processes and the continuation of pasteurisation of milk would continue to effectively protect the vast majority of the human population from any increased zoonotic threat posed by increases in bTB incidence in cattle. However, there would be a potentially serious increased risk to those working in close contact with cattle or those that continue to consume unpasteurised milk.

Although the impact on human health may be marginal if live cattle testing was stopped, a significant increase in bTB would have serious negative implications for animal health, impacting on the health of both cattle and wildlife in contact with cattle, causing a general state of illness, coughing and eventual death.

The costs and disruption associated with bTB would also have a negative impact on the productivity of farm businesses. Furthermore, it would threaten export markets. The current NI bTB testing programme complies with European Directive 64/432 (as amended) and the OIE (World Organisation for Animal Health) Terrestrial Animal Health Code, thereby enabling NI to trade internationally in cattle products. A ‘Do Nothing’ scenario would inevitably fail to meet EU / OIE standards, and consequently, meat, milk and live cattle exports from NI would be avoided by other countries and potentially banned within the EU single market.

The NI cattle industry relies heavily on its trade in meat and milk as well as live cattle movements for its economic viability. Indeed, the threat of Britain prohibiting cattle exports from the island of Ireland was a main driver for the instigation of the compulsory bTB eradication scheme, both north and south of the border.

Additionally, as the UK is leaving the EU, it will most likely have to negotiate future trade arrangements and the incidence of bTB and the level of controls applied to it are very likely to be a factor in negotiations. Again, failure to meet these standards would ultimately prevent international trade occurring and would have a severe detrimental impact on the NI agri-food sector.
2.5 Summary

Under the European Directive 64/432 (as amended), each country is required to implement a bTB eradication programme. Due to Brexit, the UK will most likely have to negotiate trade arrangements and the incidence of bTB and the level of controls applied are very likely to be a factor in negotiations. Similar international bTB control standards are also set out in the OIE (World Organisation for Animal Health) Terrestrial Animal Health Code that permits trade to occur between countries. Failure to meet these standards again would ultimately prevent international trade occurring.

This may not significantly impact the NI agri-food sector in the short term if Britain continued to accept beef and milk from Northern Ireland, as Britain remains the sector's largest market outside of Northern Ireland\(^5\). However, an increased reliance on a single export market would increase the local industry's exposure to a reduction demand and/or margins derived from within that market.

Given the above, the “do nothing” option was firmly rejected in each of the three independent reports, as the authors considered the negative trade and farm productivity impacts associated with the removal of compulsory bTB control measures to be much greater than any potential benefit.

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\(^5\) The GB market accounted for 76% of NI's external sales in 2016 (£782.5 million) - DAERA
3 ANALYSIS OF THE ‘STATUS QUO’ OPTION

3.1 Option Description

The ‘Status Quo’ reflects the baseline option i.e. the continuation of DAERA’s current bTB control measures.

DAERA has an EU Commission approved bTB eradication programme which is based on testing to detect infected cattle, removal of infected animals, and reducing the risks of spread through movement controls and other biosecurity measures.

Disease surveillance comprises two elements, namely:

i. Post mortem inspection of all animals slaughtered for human consumption; and

ii. Live animal surveillance based primarily on the skin test, which is carried out by directly employed DAERA vets (VOTs) or Private Veterinary Surgeons (PVPs) that test under contract. All cattle herds must be tested at least once a year but some are tested more frequently if they are considered to be at increased risk of infection. Animals that react positively to the skin test are called reactors and the herd is called a bTB breakdown herd.

Disclosure of disease leads to compulsory slaughter of reactors with compensation at full market value. The valuation is conducted by a DAERA valuation officer. A DNA tag is applied to the reactor immediately when it is detected by a DAERA vet, or at valuation if it was detected by a PVP. Therefore, if a PVP finds a reactor, there is a delay in the application of the tag. The DNA tag produces a tissue sample and the purpose of the tag is to allow a comparison to be made with a sample taken at slaughter to check that the reactor animal on the farm is the same animal that is slaughtered.

Every bTB breakdown is subject to an epidemiological assessment by a DAERA veterinary officer and specific public and animal health advice is provided. In addition, disease control measures are instigated to prevent the spread of bTB to and from other herds, mainly by prohibiting the movement of animals between herds. The epidemiological assessment will result in the identification of herds or animals that are at higher risk of infection because of previous exposure. These herds and animals are then tested and the tests are categorised as risk tests.

The breakdown herd is also subject to additional testing categorised as restricted herd tests. The herds may also be blood tested and severe interpretation of the skin test employed to detect and remove as many potentially infected animals as possible. To further control the disease animals within the breakdown herd that have had significant exposure to infected animals may be removed as negative contacts (NICs), even if they do not give a positive skin test result.

Compulsorily slaughtered animals are subject to post mortem examination which along with further laboratory diagnostic work provides further information to the programme. Strain typing of the causal agent, Mycobacterium bovis (M bovis), is carried out in all cases where it is confirmed by laboratory culture. Post mortem and laboratory test results, including strain type information, are provided to the farmer during the course of a confirmed bTB breakdown, as well as biosecurity advice and advisory leaflets.

3.2 Scientific Review

The Scientific Review stated that the TBSPG rejected the Status Quo option on the basis of reasons that are scientifically sound.

It highlights that the current bTB eradication programme is effective in that it is approved by the EU and meets OIE standards, allowing trade to continue across the EU and further afield, as other countries cannot boycott meat, milk and cattle movements while approved animal health standards are being met. However, it also
states that whilst the current programme meets all the required standards and meets the primary objective of maintaining open trading routes, there is no evidence that bTB eradication is achievable with the current programme, with the infection incidence staying fairly level over the last decade.

The Scientific Review highlights that the argument for maintaining the status quo is predicated on the assumption of existing costing arrangements, namely the taxpayer covering all costs and most disease risks. The cost of the current eradication programme is substantial, approaching £30 million annually, and given the ongoing restrictive public sector funding environment, coupled with a lack of progress towards eradication, it is unlikely the current funding regime will be sustained.

However, the Scientific Review notes that other cost-sharing models are available, including the exacerbator-pays approach to cost allocation, as applied in New Zealand\textsuperscript{6} and that the status quo could continue, but under a different cost-sharing model.

### 3.3 Behavioural Appraisal

The Behavioural Appraisal found the key benefits of maintaining the status quo were:

- Farmers, vets and the state veterinary services are accustomed to the current programme and roles, responsibilities and working relationships are well established;
- The current programme is viewed as robust and has been accepted by the European Commission; and
- bTB is not feared as a zoonosis due to the operation of the N. Ireland programme, and consumers purchase milk, beef and other bovine food products nationally and internationally.

The report identified the following disbenefits associated with this option:

- Farmers and vets have become disenfranchised from the current programme due to decades of testing and removal of reactors without the achievement of eradication;
- There is widespread pessimism that bTB will ever be eradicated from NI; and
- Repeated bTB breakdowns continue to cause severe stress and frustration for many herd-owners.

The Behavioural Appraisal concluded that the disbenefits of maintaining the status quo outweigh the benefits, highlighting that although the current programme is successful in keeping herd incidence below 10% and allows consumer confidence in national and international markets for NI bovine products, there is little evidence that proceeding with the current policies will achieve the objective of eradication of the infection from cattle and wildlife hosts.

The report draws reference to previous research which found that the majority of farmers and vets thought that bTB would never be eradicated unless radical changes were made to the current programme\textsuperscript{7}.

\textsuperscript{6} An illustration of the use of this approach in the context of bTB eradication in New Zealand is presented in Bovine TB Strategy, Review of Costs, 2010. 

3.4 Economic Analysis

3.4.1 Quantitative Analysis

In profiling the costs and benefits associated with the status quo option, the economic analysis made the following assumptions:

- There will be no significant implementation of TBSPG recommendations over and above those already actioned by DAERA;
- There will be no significant change in the level of activity and expenditure related to the bTB programme i.e. programme activities and costs will remain at 2015 levels, see details in Table 3.1 and Table 3.2 below; and
- There will be no significant change in the incidence of bTB. DAERA forecasts suggest that maintaining the ‘status quo’ will result in an average herd incidence rate of 6.4% over the next 40 years (the 2015 baseline being 7.15%).

Table 3.1 provides a summary of the bTB programme’s incidence rate and rate of testing undertaken in 2015. The expenditure associated with the implementation of the status quo is reflected within Table 3.2.

**Table 3.1: bTB Programme Incidence and Testing (2015)**

<table>
<thead>
<tr>
<th>bTB Incidence Rates</th>
<th>Herd Incidence (2015): 7.15%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Animal Incidence (2015): 0.66% (11,004)</td>
</tr>
<tr>
<td></td>
<td>Number of new herd breakdowns (2015): 1,688</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Cattle Slaughtered and number of Lesions at Routine Slaughter (LRS)⁸</th>
<th>Cattle Slaughtered Overall: 413,383</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number with LRS: 1,459 (0.353% of slaughters)</td>
</tr>
<tr>
<td></td>
<td>Cattle Slaughtered (excluding direct imports): 383,544</td>
</tr>
<tr>
<td></td>
<td>Number with LRS: 1,362 (0.355%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skin Tests</th>
<th>Number of Herd Level Skin Tests (2015): 34,110 consisting of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6,391 restricted tests;</td>
</tr>
<tr>
<td></td>
<td>11,506 risk tests;</td>
</tr>
<tr>
<td></td>
<td>16,213 routine tests</td>
</tr>
<tr>
<td></td>
<td>Number of herds completed a herd test: 23,980</td>
</tr>
<tr>
<td></td>
<td>Number of Animal skin tests (2015): 2,322,451 for 1,652,601 animals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IFNG (Gamma) Tests⁹</th>
<th>Number of IFNG herd tests (2015): 198 in 177 herds.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of IFNG animals IFNG tested (2015): 15,873</td>
</tr>
</tbody>
</table>


⁸ Sometimes lesions suggestive of bTB are found in animals at routine slaughter. When this occurs the herd will be put under restriction pending further investigation

⁹ Gamma interferon (IFNG) is a diagnostic blood test used alongside the tuberculin skin test, to improve the sensitivity of the testing regime and identify infected animals more quickly. Using both tests in this way can help to speed up the resolution of confirmed bTB breakdowns by identifying as many infected cattle as possible at the earliest opportunity.
Table 3:2: DAERA bTB Programme Costs (2015)

<table>
<thead>
<tr>
<th>Programme Activity</th>
<th>2015 Cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation for 12,116 animals (includes reactors, negative in contacts and voluntarily slaughtered interferon gamma positive cattle)</td>
<td>£15,450,011</td>
</tr>
<tr>
<td>Haulier expenses</td>
<td>£323,913</td>
</tr>
<tr>
<td>PVP Tuberculin testing (excluding travel)</td>
<td>£6,393,423</td>
</tr>
<tr>
<td>TVO/VOT tuberculin testing (excluding travel)</td>
<td>£1,633,697</td>
</tr>
<tr>
<td>Tuberculin</td>
<td>£617,293</td>
</tr>
<tr>
<td>Laboratory analysis for interferon gamma and culture</td>
<td>£657,819</td>
</tr>
<tr>
<td>RTA analysis</td>
<td>£141,000</td>
</tr>
<tr>
<td>Veterinary and Administrative Staff (including policy)</td>
<td>£5,808,478</td>
</tr>
<tr>
<td>Salvage monies</td>
<td>£-2,523,440</td>
</tr>
</tbody>
</table>

*Source: DAERA Annual Report (provided to the European Commission)*

The economic analysis highlights that continuance of the Status Quo would incur a total cost to government of c£1,055 million over the next 40 years (including compensation payments), at an average annual cost of £26 million. At the end of the 40 year period, it is projected that the annual cost to government would be c£28 million, reflecting a bTB herd incidence level of 6.63%.

From a quantitative perspective, the ‘Status Quo’ option emerges as the most expensive option across when discounted by a factor of 3.5%. Figure 3.1 highlights that the total annual economic cost of maintaining the status quo ranges from £33.9m in Year 1 to £8.9m in Year 39. The average annual cost over the 40 year period is £18m. The observed reduction in annual NPC for this option (over the 40 year period) is largely due to the application of a 3.5% discount rate.

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10 The costs over a 40-year period have been discounted to present the total costs in 2017 prices to account for future inflation. A discount rate of 3.5% has been applied in accordance with HM Treasury “Green Book” guidance.
Figure 3.1: Status Quo Forecast Herd Incidence (%) and Economic Costs Levels

Forecast Herd Incidence (%), Secondary Axis) and Cumulative Expenditure (£, Primary Axis) reflecting Status Quo, 2017 - 2056. Discount rate of 3.5% applied to expenditure figures.
3.4.2 Qualitative Analysis

Not all costs and benefits can be measured in monetary terms, as no market value exists for them. Therefore, the Economic Analysis considered the non-monetary costs and benefits associated with each of the short-listed options. The analysis reviewed each option’s contribution towards the following criterion:

- Contribution to improved perception of product quality, enhanced industry reputation and international trade;
- Improvement in animal health;
- Improvement in the health and welfare of farm workers and farm families;
- Reduction in negative long term impacts on farm businesses; and
- Enhanced benefits associated with government partnership working with stakeholders.

Table 3.4 identifies the weightings allocated to each criterion and the rationale for each weighting. These criteria and weightings were derived via discussions with both TBSPG and DAERA representatives.

Table 3.3 details the scores allocated to the Status Quo option for each criterion.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weighting</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to improved perception of product quality, enhanced industry reputation and international trade</td>
<td>28</td>
<td>5 (140)</td>
</tr>
<tr>
<td>Improvement in animal health</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Improvement in the health and welfare of farm workers and farm families</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Reduction in negative long term impacts on farm businesses</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>Enhanced benefits associated with government partnership working with stakeholders</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>5 (140)</strong></td>
</tr>
</tbody>
</table>

The Status Quo option was assessed to only contribute towards one of these impacts – an improved perception of product quality, enhanced industry reputation and international trade – as the current bTB testing programme underpins NI’s ability to trade internationally.

The Status Quo option was found to not contribute towards an improvement in animal health as maintenance of the current testing / control programme will not change behaviours or practice in relation to disease control and will therefore not generate benefits relating to the management / control of other related diseases. Furthermore, maintenance of the current testing / control programme would not be expected to deliver a marked change in bTB incidence and consequently comparable numbers of farmer workers / families will be exposed to the stress and anxiety caused by bTB outbreaks.
Table 3: Weighting of Criteria

<table>
<thead>
<tr>
<th>Criteria and Description of Issues being assessed</th>
<th>Weighting</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Contribution to perception of enhanced product quality, improved industry reputation and favourable international trade position</td>
<td>28%</td>
<td>The importance of the Agri-Food industry to the NI economy is profiled in Section 3 of this report and is recognised in a wide range of government strategy and policy documents, including the Programme for Government (PIG) 2011-15, the Economic Strategy 2012 and the draft PIG (2016-21). These documents highlight that the agri-food sector is a major contributor to the local economy and strategically important to future growth of the economy. The sector includes £1,000 million plus export dependent trade in livestock and livestock product. The industry’s Strategic Action Plan (i.e. the Agri-Food Strategy Board’s “Going for Growth”) has established ambitious growth targets for the year 2020 in relation to sales, employment, sales outside NI and added value. This strategy also recommends bTB eradication, in order to strengthen perceptions of the NI agri-food brand. Given the strategic importance of the agri-food sector to the local economy, this criteria has been allocated the highest weighting.</td>
</tr>
<tr>
<td>2 Improvement in animal health</td>
<td>25%</td>
<td>A key goal articulated within the former Department of Agriculture and Rural Developments Strategic Plan (2012-2020) is to “to enhance animal, fish and plant health and animal welfare”. DAERAs stated purpose is to assist the sustainable development of the agri-food,</td>
</tr>
</tbody>
</table>
Criteria and Description of issues being assessed | Weighting | Rationale
---|---|---
Improve the health of badgers in the medium to long term. Options that have the potential to achieve a reduction in bTB incidence will contribute positively to improved animal health and will therefore score higher than those that have no/limited impact. The greater the potential reduction in bTB, the higher the score allocated. Options involving the ‘wildlife and vaccination’ interventions (i.e. badger vaccination strategy and strategic removal of badger) provide the potential to improve the long term health of the badger population and therefore score higher than options that do not contain these interventions. | 22% | environmental, fishing and forestry sectors of the NI economy, having regard for the needs of the consumers, the protection of human, animal and plant health, the welfare of animals and the conservation and enhancement of the environment. Given the importance of animal health to the performance and competitiveness of the agri-food industry, this criterion has been allocated the second highest weighting.

3 Improvement in the health and welfare of farm workers and farm families

Numerous reports have highlighted the negative health impacts associated with bTB on farmers and farm families. For example:

- Skuce et al (2011)\(^{11}\) noted that bTB impacts negatively on the welfare of affected farming families;
- Michel et al (2010)\(^{12}\) also noted significant risk for farm workers; and
- A report by the Farm Crisis Network (2009)\(^{13}\) found that bTB caused distress and anxiety, sometimes leading to physical illness, in farmers and their families following a bTB breakdown together with pressures on relationships.

Options that have the potential to achieve a reduction in the number of bTB breakdowns and therefore reduce farmer/ farm family exposure to associated negative health impacts will score higher than those options that have no/limited impact on disease incidence. The greater the potential reduction in bTB, the higher the score allocated.

22% As highlighted above, DAERA’s stated purpose involves assisting the sustainable development of the agri-food industry whilst, among other things, having regard for human health. The delivery of positive physical and mental health outcomes for farmers, farm workers and farm families is important in terms of contributing to farm enterprise productivity, enhancing the attractiveness of the sector to new entrants and in developing and growing the sector. Given the contribution that farmer/ farm worker health is essential to the performance and competitiveness of the agri-food industry, this criterion has been allocated the third highest weighting.

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\(^{13}\) ‘Stress and Loss: a report on the impact of bovine TB on farming families’, The Farm Crisis Network (2009)
<table>
<thead>
<tr>
<th>Criteria and Description of issues being assessed</th>
<th>Weighting</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4 Reduction in negative long term impacts on farm businesses</strong></td>
<td>19%</td>
<td>A reduction in the negative business impacts of bTB on farm enterprises has the potential to contribute positively to the viability and sustainability of these businesses and in doing so, assist in the sustainable development of the wider agri-food industry. Consequently, this criteria has been allocated the 4th highest weighting.</td>
</tr>
<tr>
<td>Previous studies\textsuperscript{14} have highlighted numerous longer-term costs of bTB that impact upon farm businesses e.g. the devaluation of farm businesses, the need for extension of overdrafts/cash flow problems, the postponement of capital investment and the restructuring of farm enterprises. Options that have the potential to achieve a reduction in bTB incidence will contribute positively to increased farm productivity and will therefore score higher than those that have no/limited impact. The greater the potential reduction in bTB, the higher the score allocated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5 Enhance benefits associated with Governments partnership working with stakeholders</strong></td>
<td>6%</td>
<td>Whilst this potential area of benefit is important, it will have limited impact on the future growth and sustainability of the local agri-food industry. Consequently, it has received the lowest weighting.</td>
</tr>
<tr>
<td>TBSPG recommendations include provision for a new and radical form of bTB governance for NI, bringing together a range of diverse stakeholders including government officials, farmers, vets, environmentalists, scientist and industry bodies. It is anticipated that these new structures and the associated partnership working will enhance the effectiveness of the bTB programme and help deliver a lowering and ultimately, eradication of the disease. In addition to the benefits associated with bTB reduction/eradication, the new/ enhanced structures, relationships and communication channels developed by the TBSPG recommendations could, over time, be utilised to provide communication and obtain stakeholder feedback in relation to a range of non-animal health related issues (e.g. in relation to rural, farm development, countryside management, environmental management, funding opportunities etc), thereby enhancing governments relationship and partnership working with rural stakeholders.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{14} Bennett (2004) and University of Exeter (2010)
3.4.3 Risk Analysis

Evaluating the risks associated with each involved making assumptions about the behaviour of various elements of the project there is a degree of risk and uncertainty involved. The issue of project risk has been assessed by the identification of:

- Key areas of project risk specific to each option and their associated risk mitigation strategies;
- Other general areas of risk / uncertainty and associated risk mitigation strategies; and
- Option exposure to risk the profiling of these risks in terms of impact and probability.

Reflecting the risk assessment detailed in Table 6.1, Table 6.3 provides a summary of an assessment of risk by option. The risk assessment process involves estimating the Probability (P) and Impact (I) of each area of risk as it applies to each option and assigning values to these factors whereby:

- Low levels of P and I were assigned values of 1 – 2;
- Medium levels of P and I were assigned values of 3 – 4;
- High levels of P and I were assigned values of 5 – 6.

Table 3.5 details key areas of risk associated with the Status Quo option.

Table 3.6 identifies the risk score (P x I) for each area of risk for the Status Quo option and a total risk score. Risk areas receiving higher risk scores are denoted by darker shading.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Risk Assessment</th>
<th>Probability</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays in implementation of key programme elements</td>
<td>The Status Quo option is rated at low risk of a delay due to the programme’s established processes.</td>
<td>Delays in implementation will have a ‘high’ negative impact on the programmes ability to achieve the assumed levels of reduction in bTB and ultimately eradication.</td>
<td></td>
</tr>
<tr>
<td>Resource costs higher than budgeted</td>
<td>The Status Quo option is rated at low risk as the programme is established and costs can be projected based on previous years.</td>
<td>Higher costs will challenge the affordability and value for money of interventions and will have medium/high negative impact on programmes ability to achieve the assumed levels of reduction in bTB and ultimately eradication.</td>
<td></td>
</tr>
<tr>
<td>Uncertainty of disease outcomes/reduction</td>
<td>The ‘Status Quo’ option is rated at low-medium risk as although the future level of disease incidence is uncertain, the level of disease incidence is not projected to change significantly.</td>
<td>Failure to achieve the projected levels of disease reduction will have a ‘high’ negative impact on the programmes ability to achieve eradication, it will impact negatively on other key areas of expenditure and will challenge the overall effectiveness/ value for money of the programme. Consequently, the value assigned to the impact associated with this area of risk is this highest impact value allocated across all risk factors.</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Negative media coverage</strong></td>
<td>The ‘Status Quo’ option is rated at medium-high risk, as a perceived lack progress in relation to bTB, particularly following the TBSPG report and Brexit vote, is likely to attract significant negative media attention. Negative media attention in itself will have a ‘low’ negative impact on the programmes ability to achieve the assumed levels of reduction in bTB and ultimately eradication. However, the absence of stakeholder buy-in could delay delivery (see below).</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insufficient level of farmer/farm family buy-in</strong></td>
<td>The ‘Status Quo’ option is rated ‘low’ as it requires limited change/associated farmer buy-in to be taken forward. Failure to achieve farmer/farming group support will have a ‘high’ negative impact on the programmes ability to achieve levels of reduction and ultimately eradication of bTB.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insufficient level of buy-in from political representatives</strong></td>
<td>The ‘Status Quo’ option is rated at medium risk, as a perceived lack progress in relation to bTB, particularly following the TBSPG report and Brexit vote, is likely to attract negative attention/opposition from some political representatives. Failure to achieve political support will have a ‘high’ negative impact on the programmes ability to secure funding and achieve the assumed levels of reduction/eradication.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Opposition from environmental lobby groups</strong></td>
<td>The Status Quo option is rated ‘low’ as there is limited aspects of the current programme which result in opposition from environmental lobby groups. Failure to achieve support from environmentalists will have the potential to have a ‘medium - high’ negative impact on the programme as a result of a potential legal challenge for the element of the programme.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Affordability (ability to ensure required level of funding)</strong></td>
<td>Risks relating to funding/affordability increase as the costs of implementation increase. It is not expected that costs of the current programme will not increase significantly. Consequently, the Status Quo option is rated at low risk. Failure to secure an appropriate level of resource to implement the preferred option will have a ‘high’ negative impact on the programmes ability to achieve target levels of reduction/eradication.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3:6: Summary of Quantitative Risk Assessment - Status Quo Option

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability</th>
<th>Impact</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays in implementation of key programme elements</td>
<td>1.0</td>
<td>5.0</td>
<td>5</td>
</tr>
<tr>
<td>Resource costs higher than budgeted</td>
<td>1.0</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Uncertainty of disease outcomes/reduction</td>
<td>2.5</td>
<td>6.0</td>
<td>15</td>
</tr>
<tr>
<td>Negative media coverage</td>
<td>4.5</td>
<td>2.0</td>
<td>9</td>
</tr>
<tr>
<td>Insufficient level of farmer/ farm family buy-in</td>
<td>1.0</td>
<td>5.0</td>
<td>5</td>
</tr>
<tr>
<td>Insufficient level of buy-in from political representatives</td>
<td>3.0</td>
<td>5.0</td>
<td>15</td>
</tr>
<tr>
<td>Opposition from environmental lobby groups</td>
<td>1.0</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Affordability (ability to ensure required level of funding)</td>
<td>1.0</td>
<td>5.0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>63</strong></td>
</tr>
</tbody>
</table>

The Economic Analysis outlined that failure to achieve the projected levels of disease reduction will have a high negative impact on key areas of expenditure and will challenge the overall effectiveness / value for money of the programme. However, it was identified that rigorous and regular monitoring / review of disease incidence and development of research projects and scientifically robust monitoring / evaluation processes to assist in the assessment of impact of specific bTB interventions could help to mitigate against this impact.

In order to ensure buy-in from the various stakeholder groups, a robust communications strategy and stakeholder management plan should be developed to assist in the delivery of clear messages to all relevant stakeholder groups. As identified in the Behavioural Appraisal, a communications strategy should include public engagement that is simple to understand and motivates stakeholders to face challenges to deliver a better legacy in relation to bTB.

In order to maintain focus on bTB eradication in the event of an outbreak of another infectious disease, the development of bTB contingency plan should be prioritised. Regular liaison with DAERA officials on the status of other diseases and on the emergence of any risk factors indicating increased exposure to other diseases will ensure that the impact of other infectious diseases is mitigated.

In order to mitigate against the potential trade impacts of Brexit, ongoing liaison with political leaders will be required. A review of implications of any future trade negotiations on bTB status should be undertaken and a formal review of the eradication plan may be needed to reflect any significant change in the political and market context.
3.5 Summary of Findings

Through each of the reports, it was acknowledged that the current programme has been successful in keeping herd incidence below 10% and allowing consumer confidence in national and international markets for NI bovine products. Furthermore, the current programme is viewed as robust, has been accepted by the European Commission and there is a familiarity with the programme as the roles and responsibilities of each of the stakeholders are well-defined.

However, the main argument against maintaining the status quo is that there is little evidence emanating from the Scientific Review that proceeding with the current policies will achieve the objective of eradication of the infection from cattle and wildlife hosts. The Behavioural Appraisal identified that key stakeholders have become disenfranchised from the current programme due to limited progress towards eradication and that there is widespread pessimism that bTB will ever be eradicated from NI.

Furthermore, the Status Quo option was found to be the more expensive option in the Economic Analysis and it was found to produce a low level of non-monetary benefit, contributing to just one of the criterion identified in Table 3.3. The current programme is also subject to significant risks, the most likely of which will impact the current programme are:

- Uncertainty of disease outcomes / reduction;
- Negative media coverage; and
- Insufficient level of buy-in from political representatives.

A review into the control of bTB by NIAO in 2009\textsuperscript{15} found that bTB has been a long-standing major problem in Northern Ireland and, at that time, the Department’s progress in tackling the disease had been slow.

The NIAO 2009 report stated that stakeholder consultations indicated that the bTB eradication programme has been unsuccessful and that factors specific to Northern Ireland had contributed to this failure. Stakeholders had highlighted that other countries have found greater success and suggested the need to look at the differences in approach which have influenced this outcome.

In 2015, the Food and Veterinary Office conducted an audit of the current bTB eradication programme\textsuperscript{16}. This audit concluded that the eradication programme was being applied largely in accordance with EU Regulation but that the herd incidence rate was stagnating at levels above 6%, which is not what would be expected with an effective eradication programme in place.

The main factors identified in the audit as holding back eradication progress were:

- There is ineffective implementation of some measures to stop disease transmission between cattle and also between cattle and badgers (i.e. biosecurity measures);
- There is a need to further improve the sensitivity of testing for bTB to accelerate detection of persistent infection;
- The policies for clearing-up chronic herds and to understand and contain levels of infection in the badger population, contribute towards residual infection and result in its unsuccessful elimination from both the cattle and badger populations;
- The effectiveness of the measures contained in the eradication programme is not regularly evaluated to define and adapt disease control strategies to the epidemiological situation of bTB; and

\textsuperscript{15} “The Control of Bovine Tuberculosis in Northern Ireland” Comptroller and Auditor General for NI, March 2009

\textsuperscript{16} “Final Report Of An Audit Carried Out In The United Kingdom From 01 June 2015 To 05 June 2015 In Order To Evaluate The Effectiveness Of And Progress Made By The Programmes Co-Financed By The European Union To Eradicate Bovine Tuberculosis In Northern Ireland” European Commission, 2015
• The engagement and commitment of key stakeholders to the eradication programme are still insufficient to ensure its future success.

Each of the three independent reports rejected the Status Quo in that recommendations were made for its improvement. When the three independent reports are combined with the conclusions of the NIAO 2009 review and FVO 2015 audit, this provides a compelling case for the development of a revised approach to bTB eradication.
4 ANALYSIS OF THE PROPOSED PROGRAMME

4.1 Option Description

This option proposes the implementation of all TBSPG recommendations whilst continuing implementation of the baseline bTB programme activities.

This option includes provision for additional Veterinary, Epidemiology and Policy staff, to ensure effective implementation of TBSPG recommendations. Additional provision for Policy staff has been profiled for Years 1 and 2 only due to the potential for new legislation linked to the TBSPG recommendations. Additional Veterinary and Epidemiology staff are profiled for each year of the appraisal period, however they are reduced during the appraisal period as disease levels decline.

In addition, expenditure associated with a number of the TBSPG recommendations is anticipated to vary with disease incidence. Those that are expected to vary the most are:

- Expanded use of severe interpretation during breakdown to include compulsory removal of all animals that are inconclusive on standard interpretation;
- IFNG testing is expanded to remove as many infected animals as soon as possible;
- DNA tags applied to any animal detected with reactor readings at the level of interpretation specified for the test;
- VNTR typing;
- 2NVL becomes OTW; and
- Additional DAERA staff costs.

4.2 Scientific Review

As previously outlined, the Scientific Review did not consider all of the recommendations proposed in the bTB Eradication Strategy, it considered the recommendations associated with the “Existing Tools and Processes”, “Herd Health Management” and “Wildlife” themes.

4.2.1 Tools and Processes

The proposed ‘Tools and Processes’ measures can be grouped within the following key strategies relevant to bTB eradication:

- Improved surveillance;
- Improvement management of known infected herds;
- Additional control strategies, programme integrity; and
- Additional information to support decision-making and scientific knowledge.

The Scientific Review highlights that these measures are each important components of an integrated approach to national bTB eradication. Nonetheless, some of the measures are likely to be more effective than others in reducing the infection risk to other herds. The effectiveness of these measures should be evaluated through ongoing review and relevant supporting scientific research.

4.2.2 Wildlife and Vaccination

The Scientific Review highlighted that badgers are an important maintenance host for M. bovis, acting as a reservoir of infection with spillover of infection to cattle, on the island of Ireland. The presence of an infected wildlife reservoir is a key constraint to bTB control or eradication. As highlighted previously, bTB eradication will only be achieved by simultaneously addressing all factors that meaningfully contribute to the persistence
and spread of M. bovis in all infected animal populations. Therefore, intervention to limit badger-to-cattle transmission is necessary, as part of an integrated national approach to eradication.

The Scientific Review highlighted that options to limit transmission from badgers to cattle are limited, either to reducing the adequacy of contact (through badger culling or improved biosecurity) or reducing the proportion of the population susceptible (through badger or cattle vaccination). Based on current scientific knowledge, badger culling and badger vaccination each have the potential to contribute to national bTB eradication. Based on available knowledge, the Scientific Review highlighted that it is reasonable to expect badger vaccination to reduce M. bovis prevalence in badgers, and in cattle in high bTB prevalence areas, over time. However, no data is currently publicly available to assess the magnitude and timing of these effects.

The Scientific Review highlighted that NI's badger road traffic accident (RTA) survey will provide valuable insights into the impact on badger populations of the national bTB eradication programme. It is critical that the survey is designed and conducted so as to maximise both the validity and precision of the study.

In areas of increased bTB risk, TBSPG recommends that badger removal precede vaccination. In these areas, a badger intervention programme is proposed, including a ‘ring vaccination’ area surrounding a control (removal) area. The Scientific Review highlighted that, consistent with current knowledge, culling will be required in areas of high bTB risk prior to mass vaccination, specifically to reduce the prevalence of M. bovis infection in the re-emergent badger population.

In summary, the Scientific Review highlighted that the proposed badger intervention programme is seeking to balance two competing objectives, namely the requirement for a low prevalence population in which to introduce a badger vaccination programme, and concerns that a perturbation effect may occur following badger removal. On balance, the approach proposed by TBSPG seems both reasonable and prudent. Research should be conducted in NI, as part of the badger intervention programme, to clarify whether the perturbation effect occurs following badger removal.

### 4.2.3 Farm Practice and Biosecurity

The Scientific Review highlighted that biosecurity is a critical aspect of good farming practice, protecting a herd (or industry) from the spread of a broad range of infectious diseases. Furthermore, the review found that there are numerous reports, from a range of countries, of problems with the widespread adoption of effective biosecurity on farms.

The Review highlights several strategies to increase awareness of biosecurity on farms in Northern Ireland, including the development of a checklist to guide biosecurity assessment and the provision of farm-specific biosecurity advice. At this stage, farmer effort should primarily focus on cattle-related biosecurity risks. Improvement notices may be helpful, but there is a need to first review progress and available evidence concerning the impact of improved farm-level biosecurity on future bTB risk in Northern Ireland.

With bTB, there are two key biosecurity-related risks: contact with infected cattle and contact with infected wildlife. Risk mitigation measures to limit cattle-related biosecurity risks are robust and generally well understood. With respect to wildlife-associated biosecurity risks, there are important gaps in knowledge. Further, there is as yet no empirical evidence linking improved biosecurity with reduced wildlife-related bTB risks.

TBSPG recommends the introduction of informed purchasing to allow farmers to make purchasing decisions informed by knowledge of past testing history, of the animal and herd. The Scientific Review highlighted that the underpinning principle is sound, however, limited progress has been made towards the development of predictive tools, to allow accurate prediction of future bTB risk. The Scientific Review stated that there is a need for ongoing research to critically evaluate the value of informed purchasing with respect to infection control benefit to the national bTB eradication programme.
The Scientific Review highlighted that there is currently little understanding of the risks posed by farm fragmentation to national bTB control and eradication. The proposed strategy, including research to quantify the impact of farm fragmentation on future infection risk, is welcome.

4.2.4 Summary

In summary, the Scientific Review found that efforts to eradicate bTB from Northern Ireland will likely only be achieved through an integrated programme that addresses all factors that contribute to the persistence and spread of M. bovis in all infected animal populations. The Review found that the recommendations presented by TBSPG would address all factors, therefore, the proposed programme is the only viable option for eradicating bTB in Northern Ireland.

4.3 Behavioural Appraisal

The Behavioural Appraisal states that:

“TBSPG’s main objective is to recommend a comprehensive package of measures which will create and enable the conditions which will lead to the eradication of bTB in NI in the future. Acknowledging the multifactorial nature of the disease, the recommendations, if accepted in their entirety, and implemented together, should make a major impact on the bTB programme and reduce the incidence of TB in both cattle and badgers.” (Page 58)

The report highlights that recommendations must be implemented as soon as possible to effect change on the ground, building trust and obtaining ‘buy-in’ from all stakeholder groups. The report also highlights that:

- The proposed governance arrangements will bring together different stakeholder groups - importantly, this invites farmers and vets to work in partnership with government officials, scientists, environmentalists and processors to influence and make decisions together. Stakeholders in bTB eradication who may have previously felt disengaged with bTB eradication now have opportunity for meaningful engagement.
- Biosecurity is an important factor in reducing the risk of bTB incursion into farms, and better understanding and adoption of biosecurity by farmers will have beneficial impacts on the incidence of bTB. There are significant challenges in persuading farmers that biosecurity is practical and has benefits in terms of lowering the risk of infection.
- The extension and strengthening of existing tools is a logical step which means that the current programme is fine-tuned to provide maximum impact. Badger welfare groups have repeatedly called for increased focus on cattle factors influencing disease spread, and the extension of skin and IFNG testing measures will be particularly welcomed by this stakeholder sector.
- Finance, particularly compensation payments for bTB reactor animals, has been a thorny issue for some time. There has been a belief in government that the 100% compensation rate for reactors has dis-incentivised farmers from taking responsibility to minimise the chances of bTB incursion into their herds. Farming groups have withheld their potential support for a reduction in compensation rates until action has been taken by the government to cull badgers. The recommendation to cull and vaccinate badgers should therefore remove this economic barrier.
- The proposal to cull badgers in heavily infected areas, with vaccination in surrounding buffer zones, is likely to be the most controversial aspect of the overall package of recommended measures, and is likely to be strongly opposed by badger welfare groups. Persuading all stakeholders to agree to this measure will be the most difficult challenge the TBSPG will face in launching this proposal.
The benefits of implementing the proposed programme were outlined as:

- The combination of measures proposed addresses all of the major hurdles to further progress towards the eradication of bTB and promotes confidence that definitive action is being taken;
- Implementing all recommendations in full signals complete commitment to moving bTB eradication forward as speedily as possible;
- Implementing all measures avoids a selective and piecemeal approach where which measures are more important or acceptable becomes debatable; and
- Farmers and environmentalists (in particular) are given decision-making powers to affect change where previously they have been excluded by government holding a monopoly on power.

The disbenefits were found to be:

- The implementation of all measures together produces a considerable increase in workload for DAERA staff which may be resisted or deemed unmanageable without additional staff recruitment in the short-to-medium term;
- Environmentalists may strongly oppose the culling of badgers across wide areas of land on ethical grounds and take legal action to prevent such action; and
- Even though planning may begin concurrently, it may take longer to plan and implement badger culling than to reduce compensation payments and other measures which primarily affect farmers. Farmers may therefore oppose the early reduction in compensation payments for reactor cattle without badger culling having been instituted.

The Behavioural Appraisal concluded that, the recommendations should make a major impact on the bTB programme and reduce the incidence of TB in both the cattle and badger populations of NI. However, the Behavioural Appraisal noted that this impact would only be achieved if the recommendations were accepted in their entirety and implemented together.

4.4 Economic Analysis

4.4.1 Quantitative Analysis

Implementation of the full package of TBSPG recommendations (whilst retaining the appropriate level of underlying baseline activities) is anticipated to achieve a herd incidence rate of <0.1% by Year 37 (2053) and that it will remain at this rate thereafter. Once incidence falls below 0.1%, it is recorded as being maintained at <0.1% with NI obtaining official tuberculosis free (OTF) status from the EU after six consecutive years at this level.

Funding the implementation of the TBSPG recommendations would involve a significant investment, with the independent cost: benefit analysis placing this in the range of an additional £244m (2016 prices) across a 40 year period. This is expenditure above that required to fund the existing control and eradication programme. However, this cost excludes compensation paid to farmers for animals removed for slaughter under control arrangements.

The ongoing delivery of baseline programme activity and the full implementation of the TBSPG recommendations would cost an estimated £850m (based on 2016 prices).

In comparison to the cost of continuing the do-minimum (current status quo) programme across 40 years (£1,055m at 2016 prices), full implementation would lead to a saving to government of approximately £205m (based on 2016 prices) over 40 years. This saving is achieved through reduced disease incidence and associated compensation costs, and reduced testing activity in later years.

Despite the additional investment required, eradication of the disease would lead to a substantial long term reduction in costs for government and farm businesses as a result of reduced programme costs and fewer
bTB breakdowns. Cost profiling suggests that, after 10 years of intervention, programme costs would fall back to the baseline level i.e. in c2028, the total cost to government of implementing TBSPG recommendations, including compensation payments, would fall below the total cost of maintaining the status quo. Thereafter, costs would fall below baseline and continue to fall over the remaining 30 year planning horizon until bTB is eradicated and official bTB free status is achieved.

Beyond eradication, it is estimated that implementing a scaled down monitoring and control programme would cost c£8.5m per year, compared to maintaining the current annual estimated costs of c£24m-£28m (ad infinitum, based on 2016 prices). Figure 4.1 highlights that the full implementation of the TBSPG recommendations gradually decreases in total annual economic cost, with a high of £45.1m in Year 2 to a low of £2.3m in Year 40. The average annual cost over the 40 year period being £16m. Whilst the application of a 3.5% discount rate is a factor in the observed reduction in annual NPC, the sharper decline in annual NPC is a direct result of a lower projected disease level.

Throughout the appraisal period, a significant proportion of baseline bTB programme costs will decrease as disease levels decline and the number of breakdowns are reduced. The programme costs will decrease due to decreased testing, decreased staff costs and decreased compensation, with further savings due to the proposed cap in compensation. Annual expenditure will decline further after Year 40 if the herd incidence level remains at 0.1%, as current EU Directives allow for the testing regime to move to triennial and ultimately, four yearly testing, at these levels.
Figure 4.1: Proposed Programme Forecast Herd incidence (%) and Economic Cost Levels

Forecast Herd Incidence (%), Secondary Axis) and Cumulative Expenditure (£, Primary Axis) reflecting full implementation of TBSPG Recommendations, 2017 - 2056. Discount rate of 3.5% applied to expenditure figures.
4.4.2 Qualitative Analysis

Table 4.1 details the scores allocated to the proposed programme for each weighted criterion – refer to Table 3.4 for detail on weightings. Table 4.2 details the rationale for the allocated scores.

Table 4:1: Summary of Qualitative Scoring – Proposed Programme

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weighting</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to improved perception of product quality, enhanced industry reputation and international trade</td>
<td>28</td>
<td>7 (196)</td>
</tr>
<tr>
<td>Improvement in animal health</td>
<td>25</td>
<td>7 (175)</td>
</tr>
<tr>
<td>Improvement in the health and welfare of farm workers and farm families</td>
<td>22</td>
<td>7 (154)</td>
</tr>
<tr>
<td>Reduction in negative long term impacts on farm businesses</td>
<td>19</td>
<td>7 (133)</td>
</tr>
<tr>
<td>Enhanced benefits associated with government partnership working with stakeholders</td>
<td>6</td>
<td>5 (30)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>33 (688)</strong></td>
</tr>
</tbody>
</table>

Table 4:2: Qualitative Scoring Rationale - Proposed Programme

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Basis of Allocating Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to perceived product quality, reputation of industry and international trade</td>
<td>The proposed programme has been allocated a score of 7, as reduction and eventual eradication of bTB would make a positive contribution to the perception of NI food and in meeting consumer preferences for higher standards of livestock husbandry and food production. Reduction in bTB incidence may also be looked upon favourably by EU countries that GB / NI trades with post Brexit.</td>
</tr>
<tr>
<td>Improvement in animal health</td>
<td>The proposed programme includes a wide range of measures that aim to change attitudes, behaviours and practice that aim to improve herd health. If successful, this would mean that risks to animal health from other infectious diseases (as well as bTB) will be reduced. Consequently, this option has been allocated a score of 7.</td>
</tr>
<tr>
<td>Improvement in the health and welfare of farm workers and farm families</td>
<td>The proposed programme has been allocated a score of 7 as it is anticipated that it will deliver a reduction and an eventual eradication of the disease, which will lessen farm family/farmer worker exposure to the stress and anxiety associated with bTB outbreaks.</td>
</tr>
<tr>
<td>Reduction in negative long term impacts on farm businesses</td>
<td>The programme has been allocated a score of 7 as it is anticipated that it will deliver a reduction and an eventual eradication of the disease, which will reduce the negative long-term impacts stemming from bTB outbreaks.</td>
</tr>
<tr>
<td>Enhance benefits associated with government partnership working with stakeholders</td>
<td>The proposed programme involves the development of a new and radical form of bTB governance arrangements that aim to enhance partnership working. It is anticipated that these new arrangements will be established in 2017. This option was allocated a score of 5.</td>
</tr>
</tbody>
</table>
Full implementation of the TBSPG recommendations was assessed as providing the potential to contribute to all of the identified areas of non-monetary impact, scoring significantly higher than the Status Quo option (33 compared to 5). It scored higher than the Status Quo option on an improved perception of product quality, enhanced industry reputation and international trade.

4.4.3 Risk Analysis

Using the same approach applied to the Status Quo option, the issue of project risk has been assessed by the identification of:

- Key areas of project risk that vary by shortlisted option and their associated risk mitigation strategies;
- Other general areas of risk/uncertainty and associated risk mitigation strategies; and
- Option exposure to risk the profiling of these risks in terms of impact and probability.

Table 4.3 highlights areas of risk and the potential impact these risks would have:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Description</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient level of buy-in from DAERA staff</td>
<td>Many of the TBSPG recommendations involve a change in current DAERA staff practice, not least the proposed multi-tiered and collaborative governance model, which will involving a sharing of power/responsibility and the development of new relationships. Organisational change of this nature inevitably meets some resistance and new structures/approaches take time to become established. However, it is anticipated that DAERA staff will share a common vision to work towards eradication of bTB irrespective of the option being pursued.</td>
<td>Insufficient buy-in from DAERA staff has the potential to have a medium-high level of impact on effective implementation of the preferred option.</td>
</tr>
<tr>
<td>Insufficient level of buy-in from other sector stakeholders (e.g. private sector vets, auctioneers, hauliers)</td>
<td>Many of the TBSPG herd health management and governance recommendations involve a change in current practice by other stakeholders. Change of this nature may meet some resistance, requiring effective change management and communication from DAERA officials to secure buy-in from other stakeholder groups.</td>
<td>Insufficient buy-in from DAERA staff has the potential to have a “medium-high” level of impact on effective implementation of the preferred option.</td>
</tr>
<tr>
<td>Impact of breakout of other disease (e.g. FMD)</td>
<td>There is potential (albeit limited) for the outbreak of another infectious disease to dominate DAERA and industry time and resource. If this situation should occur, the focus on bTB would be diverted. That said, given existing biosecurity and control mechanisms in place, this area of risk is considered to be low and therefore all options have been rated as having a ‘low’ level of risk probability.</td>
<td>Diversion of focus and resource away from bTB would have a “high” impact on the effective implementation of the preferred option.</td>
</tr>
<tr>
<td>Risk</td>
<td>Description</td>
<td>Impact</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Impact of Brexit (i.e. changes animal health requirements for international trade)</td>
<td>The impact of Brexit on trade and future funding of bTB control is not clear and will not be determined until after trade negotiations have taken place. There is the potential that NI’s trade status with other EU countries will be affected, which could impact on the viability and sustainability of the sector and individual farm enterprises. There is also a possibility that the disease status of the local sector is identified as a key issue in any future trade negotiations. Furthermore, DAERA’s bTB programmes have been part funded in the past by the EC – for example, in 2013 the EC provided £4.46m in co-funding, representing approximately 20% of total programme costs. EU funding arrangements for bTB post Brexit are uncertain.</td>
<td>Although, future trade decisions may affect the economics of the local agri-food sector and/or the future focus of trade policy makers on the prevalence of bTB within NI, it is unlikely to impact negatively on the delivery of the bTB eradication programme and therefore it has been allocated a “low” level of impact.</td>
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4.4.4 Sensitivity Analysis

Projections of future bTB levels are fraught with uncertainty because of the complex and multifactorial nature of the disease. In addition, disease projections for the proposed option have to take into account significant programme changes, which introduce a further degree of uncertainty, especially when projections are being made decades into the future.

In recognition of the high degree of uncertainty associated with the bTB projections, the Economic Analysis profiled the impact of the following scenarios:

- Scenario 1 – a 25% increase in the rate of bTB incidence decline was applied to the full implementation scenario;
- Scenario 2 – a 25% decrease in the rate of bTB incidence decline was applied to the full implementation scenario;
- Scenario 3 – a 50% increase in the rate of bTB incidence decline was applied to the full implementation scenario; and
- Scenario 4 – a 50% decrease in the rate of bTB incidence decline was applied to the full implementation scenario.

The impact of each scenario on the achievement of eradication is profiled in Figure 4.2, which demonstrates:

- Eradication within 21 years with a 50% faster decline;
- Eradication within 27 years with a 25% faster decline; and
- A failure to achieve eradication within 50 years with a 25% and 50% slower decline.
The number of cattle and average size of herds, coupled with the disease incidence rate will influence the costs and benefits associated with bTB. Consequently, calculations in the Economic Analysis are presented using three different herd number / size scenarios. The scenarios profiled are as follows:

- **Scenario 1** – reflecting no change in animal numbers, herd numbers and average herd size over the forecast period. The 2015 baseline represents a scenario where there were 1,652,601 animals, 23,980 herds tested and the average herd test size was 68.9 animals;
- **Scenario 2** – using DAERA data, application of trends observed over the period 2005 – 2015 and application of these trends to 2016 – 2025. Given the difficulties in risk associated with forecasting trends beyond this timeframe, the animal and herd size numbers are then held constant from 2025 to 2046; and
- **Scenario 3** – using DAERA data, application of trends observed over the period 2005 – 2015 and application of these trends to the entire forecast period (2016 – 2046).

**Variations in Farmer and Government costs associated with bTB breakdowns**

The scenarios associated with the cost incurred as a result of breakdowns are as follows:

- Farmer cost of breakdowns increased by 10%;
- Farmer cost of breakdowns decreased by 10%;
- Government cost of breakdowns increased by 10%; and
- Government cost of breakdowns decreased by 10%.
Variations in Cost of Implementing TBSPG recommendations

The scenarios associated with the cost of implementing TBSPG recommendations are:

- Implementation costs increased by 5%;
- Implementation costs increased by 10%;
- Implementation costs decreased by 5%; and
- Implementation costs decreased by 10%.

Results of Sensitivity Analysis

The cost-based sensitivity analysis found that, irrespective of the scenario profiled, the option with the lowest NPC does not change i.e. ‘implementation of the TBSPG recommendations’ continues to exhibit the lowest NPC when a 3.5% discount rate is applied and the Status Quo continues to exhibit the lowest NPC when an 8% discount rate is applied.

Further analysis assessed the impact that different rates of reductions in disease would have on the NPC of each option and highlights that:

- A faster decline in disease incidence would result in the proposed programme (implementation of the TBSPG recommendations) exhibiting the lowest NPC across both discount rates;
- A 25% slower decline in disease incidence does not impact on the ranking of options, i.e. the proposed programme continues to produce the lowest NPC (using both discount rates); whereas,
- A 50% slower decline in disease does impact on the ranking of options i.e. the Status Quo emerges with the lowest NPC (using both discount rates).

The analysis also highlights that the achievement of disease reduction targets, in line with the disease projections and budgets profiled within this report, will be central to achieving value for money.

4.5 Summary of Findings

All three independent reports concluded that the proposed programme (i.e. implementation of TBSPG recommendations) was the preferred option.

The Scientific Appraisal found that international experience shows that the eradication of bovine tuberculosis (bTB) will only be achieved by simultaneously addressing all factors that meaningfully contribute to the persistence and spread of the disease in all infected animal populations. Eradication success in Northern Ireland will only be possible with an integrated approach to M. bovis eradication. The proposed programme was found to address all factors and was the only viable option presented to eradicate bTB in NI.

The Behavioural Appraisal suggests that there needs to be a radical overhaul of the programme to push incidence towards eradication and promote stakeholder confidence that barriers to eradication are being removed. The proposed programme was found to be the preferred option as the TBSPG recommendations address all of the major hurdles limiting progress towards eradication under the current programme. Further to this, the TBSPG recommendations promote confidence that definitive action is being taken and actively seek to engage all stakeholders in the process. However, it was also identified in the Behavioural Appraisal whilst farmers will be more willing to accept a reduction in the compensation rate given that wildlife interventions have been included in the proposed programme, there will be tension from badger preservation groups which will need to be addressed through effective communication.

The economic analysis utilises disease incidence projections that suggest that full implementation of the TBSPG recommendations will achieve a herd incidence rate of <0.1% by Year 37 (2053) and that it will
remain at this rate thereafter. Once incidence falls below 0.1%, it is recorded as being maintained at <0.1% with NI obtaining official tuberculosis free (OTF) status from the EU after six consecutive years at this level. This is the only option which results in the eradication of bTB in NI.

Assuming the projected levels of disease reduction are achieved, the total cost of implementing the TBSPG recommendations over 40 years is estimated at £850 million, of which £206 million relates to compensation costs. This reflects a revised compensation process in which a cap in compensation levels would be introduced with a maximum of £1,500 for non-pedigree bovine animals and a 20% premium for pedigree bovine animals (to a maximum of £1,800).

In Year 40, compensation costs will be £177,000 per annum at 2016 prices, compared to £13.5 million in 2015, reflecting a total saving in compensation costs across the 40-year period of £260 million.

Annual programme costs will decrease as disease incidence decreases, due to a lower number of breakdowns, resulting in lower compensation payments and a reduced requirement for testing. Annual expenditure will decline further after Year 40 if the herd incidence level remains at 0.1%, as current EU Directives allow for the testing regime to move to triennial and ultimately, four yearly testing, at these levels.

The proposed programme would also result in further economic benefits to the sector, including:

- Contribution to perceived product quality, reputation of industry and international trade;
- Improvement in animal health;
- Improvement in the health and welfare of farm workers and farm families;
- Reduction in negative long term impacts on farm businesses; and
- Enhance benefits associated with government partnership working with stakeholders.
5 CONCLUSIONS ARISING FROM INDEPENDENT ANALYSIS

5.1 Preferred Option

The findings of all three independent reports highlight that full implementation of the TBSPG recommendations is the preferred option and that it offers the greatest potential to eradicate bTB.

The combination of measures proposed by the TBSPG recommendations was found to address all of the major hurdles to achieving eradication of bTB and provided greater value for money compared to the other two options.

Furthermore, a risk assessment was conducted and a thorough risk mitigation strategy will ensure that risks associated with the preferred option will be managed effectively. The full implementation of the TBSPG recommendations is exposed to a significant number of risks that must be successfully mitigated in order for it to deliver in an effective manner. These areas of risk include, but are not limited to: affordability; delays in programme implementation; resource costs higher than budgeted, uncertainty in disease outcomes; negative media coverage; and opposition from environmental lobby groups.

5.2 Scientific Reasoning

The Scientific Review considered each of the recommendations individually to assess the viability of successfully implementing the recommendation and their proposed impacts and found that the scientific evidence, where available, was in support of the recommendations. Where scientific evidence was not available, it was recognised that further research and monitoring of outputs would be required to ensure that the measures are generating value for money.

The proposed programme is the only feasible option, hence, the TBSPG recommendations should be implemented as described. A number of factors are critical to the success of the recommended approach, as outlined below.

In Australia, effective control was primarily achieved through cattle controls, using a range of strategies to limit the potential for damage from undetected, residually infected animals. Feral animal reservoir hosts (water buffalo and feral pigs) were also removed during the eradication programme.

In New Zealand, control efforts have greatly reduced the bTB burden in cattle, from 11% of mature cattle in 1905 to <0.003% in 2012/13. Until 1995, control was based on established cattle-based methods of test and slaughter, and movement controls. Wildlife involvement was suspected following unexplained regional control failures and serious disease outbreaks, with the Australian brushtail possum subsequently identified as a true maintenance host of M. bovis infection. In recent years, New Zealand has implemented a multifaceted approach to bTB eradication, including test and slaughter programmes and risk-based movement controls (in both cattle and farmed deer) as well as extensive possum control and wildlife surveillance.

Efforts to eradicate bTB from Northern Ireland will likely also only be achieved through an integrated programme that addresses all factors that contribute to the persistence and spread of M. bovis in all infected animal populations.
5.3 Evidence Base

The Behavioural Appraisal concluded that the benefits of implementing the TBSPG recommendations outweigh the disbenefits and is the preferred option for bTB eradication. It identified that there needs to be a radical overhaul of the programme to push incidence towards eradication and promote stakeholder confidence that barriers to eradication are being removed.

Implementing the full TBSPG recommendations would promote confidence amongst all stakeholder groups that definitive action is being taken in the ambition to eradicate bTB. Implementing all recommendations in full signals complete commitment to moving bTB eradication forward as speedily as possible. The Behavioural Appraisal found that implementing all measure would avoid a selective and piecemeal approach where which measures are more important or acceptable can be debatable and would continue the atmosphere of competing stakeholder interests.

Whilst the proposed programme could still result in tension between stakeholder groups, particularly between farmers and environmentalists in relation to wildlife measures, the Behavioural Appraisal found that it is likely that stakeholder buy-in will be higher than under the current programme (status quo). Farmers and environmentalists are given decision-making powers to affect change where previously they have been excluded by government holding a monopoly on power.

The Economic Analysis concluded that, when quantitative economic costs and benefits are considered over a 40 year period, the full implementation of TBSPG recommendations is (c10%) less expensive than the Status Quo option. In addition to the quantitative benefits, the full implementation of the TBSPG recommendations could result in further benefits, such as:

- Contribution to perceived product quality, reputation of industry and international trade;
- Improvement in animal health;
- Improvement in the health and welfare of farm workers and farm families;
- Reduction in negative long term impacts on farm businesses; and
- Enhance benefits associated with government partnership working with stakeholders.

Considering the above, on balance, the proposed programme emerges as the preferred option, as it offers the potential to achieve the TBSPG’s stated objective of bTB eradication, whilst providing greatest value for money.

That said, the proposed programme is exposed to significant number of risks that must be successfully mitigated in order for it to deliver in an effective manner. These areas of risk include, but are not limited to:

- Affordability;
- Delays in programme implementation;
- Resource costs higher than budgeted;
- Uncertainty in disease outcomes;
- Negative media coverage; and
- Opposition from environmental lobby groups.

Economic analysis of the proposed programme found that, where the status quo would not achieve eradication, implementing the TBSPG recommendations in full would achieve a herd incidence rate of <0.1% by Year 37 (2053) and that it will remain at this rate thereafter. Once incidence falls below 0.1%, it is recorded as being maintained at <0.1% with NI obtaining official tuberculosis free (OTF) status from the EU after six consecutive years at this level.

The proposed programme was found to represent better value for money than the “do nothing” and “status quo” options. Despite requiring an investment of £244 million to implement that the recommendations in
full, the economic analysis demonstrates that the total cost of the proposed programme is less than maintaining the status quo.

Figure 5.1 overleaf illustrates that the annual NPC of the proposed programme over the 40 year appraisal period compared to that for the “status quo” option. This highlights that in 2027 (Year 10), the total annual NPC of the proposed programme falls below that of the status quo, using a 3.5% discount rate, and that after Year 10, these values continue to diverge, with the proposed programme exhibiting the lower cost, as the level of disease continues to decline.

5.4 Independent Report Recommendations and Associated Inter-Relationships

All of the independent reports provide recommendations on how the programme should be implemented and the steps that need to be taken to ensure the programme is effective. These recommendations are discussed below.

The Behaviour Appraisal stated that:

“There are costs for all stakeholders in the new arrangements, and there needs to be a spirit of compromise, co-operation and partnership working to make it a success. Stakeholder expectations will have to be managed to explain what is happening and when as plans are rolled out, and the communications strategy is a vital part of this process. The key factor is to deliver what has been promised in the new programme launch.” (Page 65)

The experiences from Australia and New Zealand highlighted within the Scientific Review and the Behavioural Appraisal provide encouragement that a partnership approach between farmers, vets, scientists and government progress towards the eradication of bTB. Divergent opinions must be brought together through trust-building and consensus, with decisions made which are guided by science and also take into account wider socio-economic perspectives.

All stakeholders must take their governance responsibilities seriously and work to produce gains and progress, not inertia or regression, especially when difficult decisions have to be made. Farmers will have to accept greater responsibility for herd biosecurity; accept the loss of a proportion of the financial compensation previously paid; and cope with stricter rules on how bTB is managed. Environmentalists will have to accept that badgers are part of the epidemiology of the disease in N. Ireland, and culling a certain proportion of the infected badger population will become part of the advancement towards eradication.

All three independent reports noted that DAERA needs to consider resources for managing the bTB eradication programme. The Department will need to ensure that adequate resources are in place to cope with the increased activity and the additional administrative and technical burdens placed upon it.

The TBSPG recommended the development of a communications strategy and stakeholder management plan, to assist in the delivery of clear messages to all relevant stakeholder groups. As identified in the Behavioural Appraisal, this strategy should include public engagement that is simple to understand and motivates stakeholders to face challenges to deliver a better legacy in relation to bTB. The Economic Analysis further expanded upon this and recommended that a review and update of communications strategy / stakeholder management plan should take place post launch, to support regular communication during programme implementation.
Figure 5:1: Total Annual NPC of the Status Quo compared to the Proposed Programme (Discount Rate = 3.5%), 2017 - 2056
The Economic Analysis and the Scientific Review detailed recommendations relating to ongoing programme monitoring and evaluation. They highlighted the need for:

- Ongoing monitoring of expenditure and implementation of cost control measures by theme and recommendation.
- Rigorous and regular monitoring / review of disease incidence using objective, science-based information which needs to be independent to ensure public-confidence in the data.
- Development of research projects and scientifically robust monitoring / evaluation processes to assist in the assessment of impact of specific bTB interventions. These processes should be benchmarked against international evidence from countries which have underwent similar programmes (e.g. New Zealand, Australia, US).

The Economic Analysis and Behavioural Appraisal both alluded to the need for ongoing liaison with political leaders as the proposed programme develops and the impacts of Brexit become clearer. A review of the implications of any future trade negotiations (during the Brexit process) on bTB status will be required and a formal review of the bTB eradication plan may be required to reflect any significant change in the political and market context.

A key message from the three independent reports was that all of the proposed recommendations should be implemented so that the potential for achieving eradication is maximised.

5.5 Funding Requirements

The extent to which any eradication programme is both successful and affordable depends to a significant degree on the appropriate sharing of costs between the public sector and industry. The Economic Analysis examined cost sharing experiences of other jurisdictions so that the eradication programme in NI can benefit from both good practice resulting from successful interventions, and key lessons from interventions that have not led to successful programmes. The other jurisdictions examined are listed below:

- ROI (2000 onwards);
- Australia (1970–1997); and
- New Zealand (1987 onwards).

Table 5.1 offers a summary of the main factors that enabled bTB eradication programmes to have successful outcomes in other jurisdictions, with an assessment of their applicability to the context of NI. In essence, both industry co-funding and joint governance are the main enabling factors that could be applied to NI. These policies would give strong ownership of the bTB eradication programme to stakeholders which the Behavioural Appraisal identified as being a key requirement for the programme’s success.

Public sector underinvestment (due to restricted public sector finances) is a significant risk factor given the scale and long term nature of the investment required to implement the TBSPG recommendations, i.e. £850 million (an average of £21 million) over 40 years at 2016 prices. Under the Status Quo option, the total cost of the programme over 40 years is significantly higher at £1,055 million, an average annual cost of £26 million. It should be noted that in Year 40, the total cost of the eradication at 2016 prices will have fallen to £8.5 million per annum, which is significantly lower than the estimated annual cost of the status quo option in Year 40, estimated to be £28 million per annum.

The establishment of a co-funding model is consistent with the new governance arrangements proposed by the TBSPG, which aim to create a shared ownership of the bTB Programme among stakeholders. It would also help reinforce positive behaviours and farm management practices that support efforts to control and eventually eradicate the disease.
<table>
<thead>
<tr>
<th>Enabling factors</th>
<th>Case study detail and comparison to NI</th>
<th>Applicability</th>
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<tr>
<td><strong>Political support for eradication scheme (from the public and policymakers)</strong></td>
<td>New Zealand and Australia had strong political support for eradication programmes due to the main vectors being possums, whereas the ROI and NI have political issues surrounding the eradication of bTB from badgers (the main vector). The ROI’s case study shows that progress in badger vaccination and in the reduction of TB within the badger population, may help to reduce the political issues of TB eradication in badgers. There is also recognition of the need for the ROI and NI to co-operate on animal health policy, with the island of Ireland seen as the most appropriate epidemiological unit for policymaking. Since 2010 there has been an All-Island Animal Health &amp; Welfare Strategy but there has been no formal co-ordination on bovine TB eradication beyond a Working Group format.</td>
<td>Medium</td>
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<td><strong>Industry is favourable to a co-funding model</strong></td>
<td>New Zealand and Australia required an industry co-funding model, through the ‘beneficiary pays’ principle, to propel progress in the eradication programmes. The industry contributions were over 50%. The new funding model in New Zealand prompted industry to increase its funding exponentially, which the government then felt the need to match. There is appetite from industry in NI for the eradication programme, as it is a beneficiary. Lessons from the case studies point to the need for government and industry to reach a governance structure that gives industry a degree of ownership, through committees and strategy formulation. New Zealand’s government-led model in the late 1970s saw a huge fall in funding for eradication and the consequences were an increase in bTB incidence, so the current executive-led model in NI and the ROI has funding risks in the future.</td>
<td>Medium/high</td>
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<td><strong>Farmer-led body independent of government / joint governance structure</strong></td>
<td>New Zealand and Australia programme models had a farmer-led body responsible for the programme. In the case of New Zealand it is an NGO independent of government. This setup was seen as critical to the ability for there to be a long-term strategy (e.g. clear targets specified at the outset of a multi-year strategy). In NI the current eradication programmes are part of the remit of government and there is not currently a political agenda to create a separate, independent agency. A truly independent setup would also need high levels of industry co-funding as a prerequisite in order to have policy formulation more independent of government restructuring. There also needs to be a co-ordination of activity with the ROI government for eradication to be achieved. In January 2010 the UK government presented the Draft Animal</td>
<td>High – for initial groundwork to create a joint governance structure (Low for a setup that mirrors the NGO format</td>
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<th>Case study detail and comparison to NI</th>
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<td>Health Bill, which proposed the creation of an industry-led non-governmental body (the Animal Health Organisation) that would take over animal health policy powers from Defra. The bill was criticised for not having clear provisions on how devolved agriculture policies would be affected and it did not address cost-sharing issues. Cost-sharing was described by critics as crucial to develop “a coherent animal health management environment”[^18].</td>
<td></td>
<td>in NZ)</td>
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