Allocating Vote: Biosecurity- Towards an 'Economics-Based' Approach for Setting Priorities for the Importation of Risk Goods

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Abstract

The New Zealand government (through its agency the Ministry of Agriculture and Forestry, MAF) seeks to mitigate the potential negative impacts of importation through requiring commodities that may pose a risk to New Zealand's primary production systems, human health, indigenous flora, fauna or biodiversity to have an import health standard. Given, potential import opportunities exist in a wide variety of commodities from many different countries, the demand for import health standards far outweighs MAF's available resources to develop them. Therefore MAF must have a framework that prioritises which import health standards will be developed. This paper briefly presents the framework MAF is currently using to undertake the prioritisation of import health standards and then discusses how the current framework could evolve to become more 'economics-based'.

Key words: Prioritisation, Biosecurity, multiple criteria decision making.

Introduction

The concept of 'gains from trade' has a long history in economics, indeed the profession's founding father, Adam Smith, propounded the notion in his seminal work, "An Inquiry into the Nature and Causes of the Wealth of Nations" in 1776.

> "Whether the advantages which one country has over another be natural or acquired is in this respect of no consequence. As long as the one country has those advantages, and the other wants them, it will always be more advantageous for the latter rather to buy of the former than to make".
>
> (The Wealth of Nations, Book IV, Chapter II).

> If a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy it of them with some part of the produce of our own industry employed in a way in which we have some advantage....It is certainly not employed to the greatest advantage when it is thus directed towards an object which it can buy cheaper than it can make.
>
> (The Wealth of Nations, Book IV, Chapter II).

[1] The views expressed are the authors and do not necessarily reflect the views of Biosecurity New Zealand or the Ministry of Agriculture and Forestry.

The growth in both the volume and participation in global trade over time indicates that countries too recognise these gains and are actively seeking to capture them. However, whilst trade can be immensely beneficial to countries who engage in it, the actual commodities traded can also have severe negative impacts on the societies that receive them, particularly if the importation of these commodities is allowed unchecked.

The New Zealand government seeks to mitigate the negative impacts of importation on New Zealand by requiring imported commodities to comply with the following Acts or conventions:

- Customs and Excise Act 1996;
- Hazardous Substances and New Organisms Act 1996;
- Convention on Trade in Endangered Species of wild fauna and flora; and
- Biosecurity Act 1993.

This paper focuses on the last of these Acts: the Biosecurity Act. Section 22 of the Biosecurity Act allows the Director-General of the Ministry of Agriculture and Forestry (MAF) to issue an import health standard specifying the requirements to be met for the effective management of risks associated with the importation of risk goods. In practice, biosecurity risk goods cannot be imported without an import health standard.[2] Risk goods, in the biosecurity sense, can be thought of as any commodity that may harbour organisms that are a risk to New Zealand's primary production systems, human health, indigenous flora, fauna or biodiversity. The rationale behind import health standards is that because the control or eradication of invasive species is often technically difficult and therefore costly, reducing the risk pre-border through the requirement of risk goods to have an import health standard is a cost effective biosecurity risk management strategy.

Given potential import opportunities exist in a wide variety of commodities from many different countries, the demand for import health standards far outweighs Biosecurity New Zealand's available resources to develop them. The absence of a price for import health standards means that the rationing problem must be solved in other ways.[3] Therefore Biosecurity New Zealand needs a framework that selects which import health standards will be developed. The large number of applications received (over 300 in the application round for the 2006/07) means the selection framework needs to be simple and quick to use (ruling out a detailed cost benefit analysis of each application), whilst

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[2] We cannot however refuse a request for import health standards only prioritise them lower.

[3] The traditional impediments to charging for import health standards are (from Sinner and Gibbs, 1998):
(a) the "free rider" problem (the first applicant pays for the import health standard to be developed, but all subsequent importers get the benefit of being able to import under it); and
(b) charging for "generic" import health standards that cover all country sources for a specific commodity or pathway (such as sea containers), rather than a specific country/commodity combination.
However, both MAF (2004b) and Denyer et al. (2003) feel there is a strong economic case for charging for import health standards. MAF is currently in the process of designing a system that will allow this to happen. There is currently an option for importers to voluntary self fund applications.

ensuring that that the applications selected to be progressed are the ones that have the largest net benefit to New Zealand.

This paper is set out as follows. Section 2 outlines the ideal framework at a conceptual level. Section 3, gives a brief overview of the past and present systems for prioritising import health standards. Section 4 outlines how we believe the framework for prioritising import health standards could evolve. Section 5 concludes.

The framework at a conceptual level

A simple characterisation of the government's objective functions when prioritising import health standards is given in equation (1):

$$\underset{\boldsymbol{x}}{Max}\ \mathrm{U}(\boldsymbol{x}) \qquad (1)$$

subject to $\boldsymbol{p}.\boldsymbol{x}=y$

Where $\boldsymbol{x}$ is the vector of import health standard applications chosen to be developed, $\boldsymbol{p}$ is the vector of cost to the government of developing the import health standards chosen and y is the portion of Vote: Biosecurity allocated toward developing import health standards.

We are seeking to extract a preference order on the set of import health standard applications such that $\boldsymbol{x}= \boldsymbol{x}^*$, where $\boldsymbol{x}^*$ is the set of import health standard applications that will maximize the government's objective function specified in (1).

In an ideal world we would be searching for a social welfare function or a social choice rule, which transforms the set of individual preferences from each member of the public into a single global societal preference order. Arrow's (1950) well known result (Arrow's impossibility theorem) shows that under a set of reasonable requirements and if there are more than two individuals and three options to decide between then it is impossible to design a social welfare function that satisfies these reasonable requirements.[4] We follow Brown and Jackson (1986) in regarding Arrow's result not as a stumbling block, but as benchmark against which social choice rules can be compared (in the same way perfectly competitive markets are used to make welfare judgements about alternative market structures). Brown and Jackson (1986) offer the solution that a social welfare function that is related to the intensity of individual preferences will allow a societal preference order to be reached.[5]

[4] These reasonable requirements are: unrestricted domain, the Pareto principle, the independence of irrelevant alternatives, and individual utilities that are ordinally measurable and interpersonally noncomparable.

[5] This type of system fails to conform to Arrow's requirements since preferences are regarded as being cardinal rather than ordinal.

We assume that the intensity of preferences is a positive linear function of the positive attributes of the commodity's importation and a negative linear function its negative attributes (however these are measured). That is:

$$\mathrm{U}(\boldsymbol{x}) = \sum_{i=1}^{n} v_i\left(x_i\right) \tag{2a}$$

$$\textit{subject to} \sum_{i=1}^{n} p_i x_i = y \tag{2b}$$

$$\text{Where } v_i\left(x_i\right) = \sum_{a \in A} w_{ai} b_{ai}\left(l(a)\right) - \sum_{z \in Z} y_{zi} c\left(m(z)\right) \tag{3}$$

Where $v_i(x_i)$ is the value of import i to New Zealand. Equation (3) states the value of import i to New Zealand is a positive function of the value placed on each of the positive attributes of an import, where a is an attribute from the full set of attributes A desirable in any import and $l(a)$ is the value placed on attribute a. $v_i(x_i)$ is also a positive function of the relative importance of the attribute a for commodity i, w_i, where $\sum_{a \in A} w_{ai} = 1$.

Equation (3) also states the value of an import to New Zealand is negative function of the disutility associated with the negative attributes of an import, where z is an attribute from the full set of attributes Z undesirable in any import, $v_i(x_i)$ is also a negative function of the relative significance of that attribute for commodity i, y_i, where $\sum_{z \in Z} y_{ai} = 1$.

As stated above we are seeking to find the subset of applications $\{1 \ldots n\}$, from the full set of applications $\{1 \ldots m\}$ that maximizes (2a) subject to our budget constraint as stated in equation (2b); p_i represents the cost of doing application i and y again is the portion of Vote: Biosecurity allocated toward developing import health standards.

In order for the set of applications that maximises (2a) to be selected ('prioritised') we need a transparent scoring system which allows a structured approach for the positive and negative attributes to be assessed. Dooley et al. (2006) note that the features of multiple criteria decision making include:

- making the decision transparent;
- providing a means of problem structure; and
- providing a quantitative means to assist with decision making when there are multiple and conflicting goals measured in different units (the most obvious example in this context is an import that is economically beneficial but harmful to the environment).

Multiple criteria analysis therefore appears to be the most logical framework under which to conduct import health standard prioritisation. There have been various attempts to develop a multiple criteria import health standard prioritisation system; in the next section we outline these attempts.

Past and present systems

Prior to 2005 (when an informal version of the current system was used) each of the sector groups (plant, forestry and animal) ran a separate system to prioritise import health standards. The three systems are outlined below.

Denyer et al. (2003) state there was some broad criteria and guidelines for how import health standards in the animal sector should be prioritised. First priority was "current biosecurity concerns" (for example, disease outbreaks in other countries, changes in current knowledge, and changes in exporting country disease status). Second priority was work already under way. Other areas listed in the import health standard procedures to consider when determining priorities include:

- response to trade issues;
- environmental impact;
- economic impact; volume of trade;
- likelihood of illegal importation; and
- the number of people requesting a particular risk analysis or import health standard.

Otherwise, the order of priority is "first in, first served". Denyer et al. (2003) note this process appears to lead to two possible outcomes:
(a) the request be given high priority ranking, in which case it is entered into the work programme; or
(b) the request is not considered a high priority, in which case it remains on the "waiting list".

The plant sector (excluding forestry) prioritised applications based on: [6]

- Overseas exporter priority for the application (for example, it is a specifically requested import health standard from an overseas government);
- value of the crop if grown in New Zealand and consequences if a pest incursion;
- ability to treat potential high impact pests off-shore;
- New Zealand importer interest and potential market;
- technical (i.e. how hard will it be to get the required information); and
- political requirements.

Dooley et al. (2003) report the system for prioritising import health standards in the forestry sector involved assessing application against the following criteria:

- potential economic risk;
- potential environmental risk;
- potential societal risk (human health);
- potential economic benefit;
- potential societal benefit; and

[6] Veronica Herrera, *per. com.*

- level of trade collaboration (this category had double the weighting of any other).

For the sake of brevity we refrain from providing detailed comment of these past systems. However we offer that the forestry system seems most aligned to a system that focused on the positive and negative attributes of importing the commodity, with the plant system also appearing to be reasonably consistent with this paradigm (although it is also based on importer and exporter interest); however the positive and negative attributes of the commodities importation appear to be secondary consideration in the animal system.

It was recognised that an allocation system where prioritisation occurred separately in individual sector groups failed to make best use of limited resources to maximise the (net) benefits of trade. The original argument for treating the prioritisation processes as separate was that the resource required to develop import health standards is specialized to the sector group and therefore cannot be substituted into the other process (you can not change plant scientists into animal scientists over night). While this is true, the funding used to pay that resource is directly substitutable (i.e. there is an opportunity cost in funding an import health standard in one sector group as it could be used to fund an import health standard in sector group). By indicating the sector group(s) in which the more (net) beneficial import health standards could be developed, prioritising all applications in a single process will give direction to how the resource should be split between each sector group. If the current resource split differs from the optimal resource split, resource reallocation should occur. There will be a degree of inertia in this resource reallocation due to the costs associated with hiring and firing workers (and therefore even if animal applications are ranked consistently above plant applications, some plant applications may still be developed in the short run because the resource is available and leaving it idle would be even more inefficient). However, in the long run the resource mix should change to ensure an optimal split.

The above thinking was the basis for formally prioritising all applications together using a process based on the biosecurity Integrated Risk Management Framework (hereafter the IRMF) in 2006.[7] The IRMF is Biosecurity New Zealand's current prioritisation framework (although it is currently under review) which aims to guide the allocation of resources for the management of risks across the biosecurity system.

The IRMF identifies five criteria on which grounds to prioritise the use of biosecurity resources to manage risk; these are technical feasibility, practical feasibility, benefit-cost, strategic considerations, and acceptability. Options for risk management are scored against the criteria outlined above.

Given the criteria in the IRMF are meant to apply to across the biosecurity system they are necessarily general in nature. Below, we describe how the general criteria from the IRMF were applied in the specific context of the prioritisation of import health standard applications.

[7] MAF (2004a).

The first criterion relates to the technical feasibility of the application; that is, the complexity of the task. When assessing an application against this criterion, the assessors were asked to consider:

- What information is needed to develop the import health standard?
- What technical information is currently available? (For example, published risk assessments, international codes or standard, peer refereed articles, or findings of research projects).
- How easily will it be to generate the information that is not currently available?

An application scored lowly on the technical criterion if information was not easily available or easily sourced, the import health standard would be complex to carry out and/or there is a high risk that the import health standard development would be held up due to non co-operation from the exporting country.

The second criterion relates to the net benefit (benefit minus cost) to New Zealand of carrying out the import health standard. Assessment of benefits and costs was carried out against the following values:

- Economic;
- Health;
- Environment; and
- Social

In order to define the scope of benefits and costs considered we needed to define a baseline scenario relative to which to assess them against. In the case of an import health standard application for a commodity that is not currently traded or if the commodity is being sourced from a new country, we consider no trade (with that country) as the baseline. The reason this is selected as the baseline is simply a reflection of the current practice that trade cannot commence for a commodity considered to be a biosecurity risk until an import health standard for its importation has been approved. Table 1 reports some of the specific guidance given assessors on what to consider when doing this assessment.

By contrast, when scoring the benefit-cost criterion for the review of an existing import health standard, the baseline scenario is trade. If the commodity's biosecurity risk status has increased since its import health standard was last reviewed, the benefits of the review is the lower biosecurity risk which will result if more stringent risk management procedures are placed on its importation. If the commodity's biosecurity risk status has decreased since its import health standard was last reviewed, the benefits of the review are lower compliance costs and the (probable) increase in the volume trade that will probably result from less stringent risk management procedures being put in place. Additionally there maybe benefits if undertaking the import health standard will result in more efficient import health standard conformance. Efficiency could result from updating risk mitigation measures meaning compliance with the import health standard is cheaper for the importer or decreasing inspection time resulting in lower MAF Quarantine Service costs.

Table 1: Benefits and costs associated with the importation of a previously untraded product (as considered under the current prioritisation system).

Benefits include…

Economic

- Consumers get access to cheaper product and/or more variety
- Potential economic benefits to other industries. For example, import is used as an input in another production process, meaning that industry now has access to cheaper or better inputs.

Environmental

- Possible environmental benefits may relate to anything that assists with species survive or the enhancement of natural features.

Cultural/Spiritual

- Special significance the imported commodity may have certain cultures or religions.

Health

- Possible benefits include nutritional value, reduced mortality, improvement of general health or use for medical purposes.

Costs include …

Economic

- Cost of MAF of doing the IHS.
- Costs to the importer of complying with requirements of the IHS. The costs of compliance with the import health standard which are borne by MAF, the importer and the general public are unlikely to be known for a specific commodity until the import health standard is completed, however an assessment can be made based on previous experience with similar commodities. The argument for including the costs of compliance is as follows:
  - even though the importer usually bears most of the cost of complying with the import health standard, it is still a cost to them and therefore needs to be considered if we are considering the costs and benefits from a national point of view of undertaking this import health standard (although in national terms the cost is unlikely to be significant).
  - the use of MAF or public resources to enforce the risk management procedures outlined in an import health standard has an opportunity cost associated with it. The use of resource to provide quarantine facilities, for example has an opportunity cost has those resources could be used else in the system to manage biosecurity risk.

- Any potential costs associated with increased biosecurity risk due to the importation of the commodity is not considered; as the risk management measures outlined in the import health standard are assumed to decrease this risk to a negligible level. If this were not the case, then any additional biosecurity risk would need to be considered under this criterion.

- The IRMF states "excluded from consideration as relevant economic factors [in cost-benefit analysis] are any benefits in protecting domestic producers from competition from imported risk goods, and, it is argued costs to consumers who benefit from the importation of risk goods," (p. 17). The reason for this is that denying market access on grounds other than those identified in the Agreement on the Application of Sanitary and Photosanitary Measures could expose New Zealand to international legal challenge or afford other countries the opportunity to restrict the importation of our exports on non-technical considerations.

Environmental

- Costs include damage the product could do to the environment or if carries diseases that could harm the environment.

Cultural/Spiritual

- Will its importation offend certain cultures or religions?

Health

- Will this have a negative New Zealander's nutrition, mortality or general health?

The resource used to fund new import health standards or reviews of existing import health standards is the same and therefore despite the distinctions made above with regard to the baseline scenario, applications for new applications and reviews are assessed on the same scale.

The strategic criterion relates to how the importation of the commodity would contribute or align with the goals and key priorities of Biosecurity New Zealand and the New Zealand government. When assessing an application against this criterion, the panel members considered if is was a priority for:

- the Minister of Biosecurity?
- in terms of wider government policy?
- in terms of MAF's statement of intent?
- in terms of the Biosecurity framework? or
- as part of the regulatory process?

Assessment guidelines state applications will score highly on this criterion if it is a very high priority for MAF or the government (to the extend it is almost mandatory). For example if the guarantee of a certain import health standard was a requirement for securing a Free Trade Agreement, or part of a government to government request.

The final criterion, practicality, relates to the MAF's ability to undertake the import health standard.[8] If used as a prioritisation criterion, an application would score highly on this criterion if MAF can easily undertake the import health standard with the resources available to it. These resources may be either 'in house' or easily contractible. However given the way we have defined the practicality criterion as relating to MAF's ability to undertake the import health standard. We felt it was more appropriate for an application to be checked against the 'practicality' criterion after the application had been against prioritised against the other criteria. That is, the 'practicality' criterion does not contribute to determining priority rather it is a check against whether the application should proceed or not. The reason we are advocating this approach is that the goal of this prioritising system is to ensure that resources are allocated in such a way that is best for New Zealand, not what is best for MAF. Prioritising something higher because MAF can do it is contrary to this goal. Indeed the long term goal of this system is to ensure MAF's resource mix changes so we can do the import health standards that are best for New Zealand. However, as discussed above, there will be a degree of inertia in changing this resource mix in the short run therefore the practicality criterion was used as a check to ensure we presently have the resources to do it. It is important if a priority application cannot be done due to lack of specialised resource to record this and feed it back into business planning to ensure the adjustment of resource mix occurs to allow optimal resource allocation in the long run.

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[8] In the IRMF there is also a fifth criterion, 'acceptability'. We did not score applications against this criterion because it was feared having a criterion that reflected public support for an application may mean domestic producers (i.e. potential competitors with the import) may have an incentive to undertake behaviours that will see an application score low on the acceptability criterion just so they avoid the threat of competition.

Applications were scored against the strategic, technical and net benefit criteria on a 0-6 scale to generate an initial ranking;[9] panel members were then asked if they agreed with the ranking. The reason we asked panel members to check if they agreed with the ranking is because under the scoring system a score of '2' is superior to '4' for a category, however it is not necessarily twice as superior than '4' and therefore straight aggregation of the scores is not appropriate. For straight aggregation to be appropriate going from 1 to 2 needs to have the same impact on utility as going from 4 to 5; that is the utility associated with an application and the criterion score must be a linear function of each other.[10] For utility to be a linear function of a criterion's score some form of calibrating (through a revealed preference survey, for example) would need to happen to ensure each incremental increase in score leads to the same incremental increase in utility.

The evolution of the system

Criticisms of the present process

At the conclusion of the prioritisation process, panel members were asked to express their feelings on the prioritisation process. One point raised was: "[t]o improve the defendability of the process, MAF should continue to clarify the criteria descriptors. The clearer the descriptors are, the more accurate the result is likely to be". (Import health standard prioritisation panel meeting minutes, 22 March 2006).

We feel the lack of clarity actually stems from the fact that the criteria are overlapping.[11] The strategic criterion is really a subset of the benefit criteria, whilst the technical criterion is an indication of how difficult the import health standard will be to undertake and therefore an indicator of cost.

Our proposed system

The system we are proposing is based on the concept that importation of the commodity will both positively and negatively impact on New Zealander's economic, natural environment, human health and social/ cultural well-beings ('the four outcomes') plus government.[12] We believe this is a superior to the current approach as it does not matter where the source of the benefit or cost comes from, their influence will be captured by

[9] For brevity we have omitted the descriptors for each score for each category.
[10] Additionally for aggregation to be possible, an increase of 1 point in *each* category would have to result in the same increase in utility no matter what category the increase occurred in.
[11] For the sake of clarity 'we' from now on *especially* refers to the author's views and not the views of MAF or Biosecurity New Zealand.
[12] There will therefore ten criteria consisting of the positive and negative impacts of each of the four outcomes plus government.

how they impact on the outcomes.[13] Figure 1 shows the source of the benefit could be strategic (as defined under the current system) or a benefit of the commodity itself. Similarly the negative impacts on our outcomes could result from such sources as:

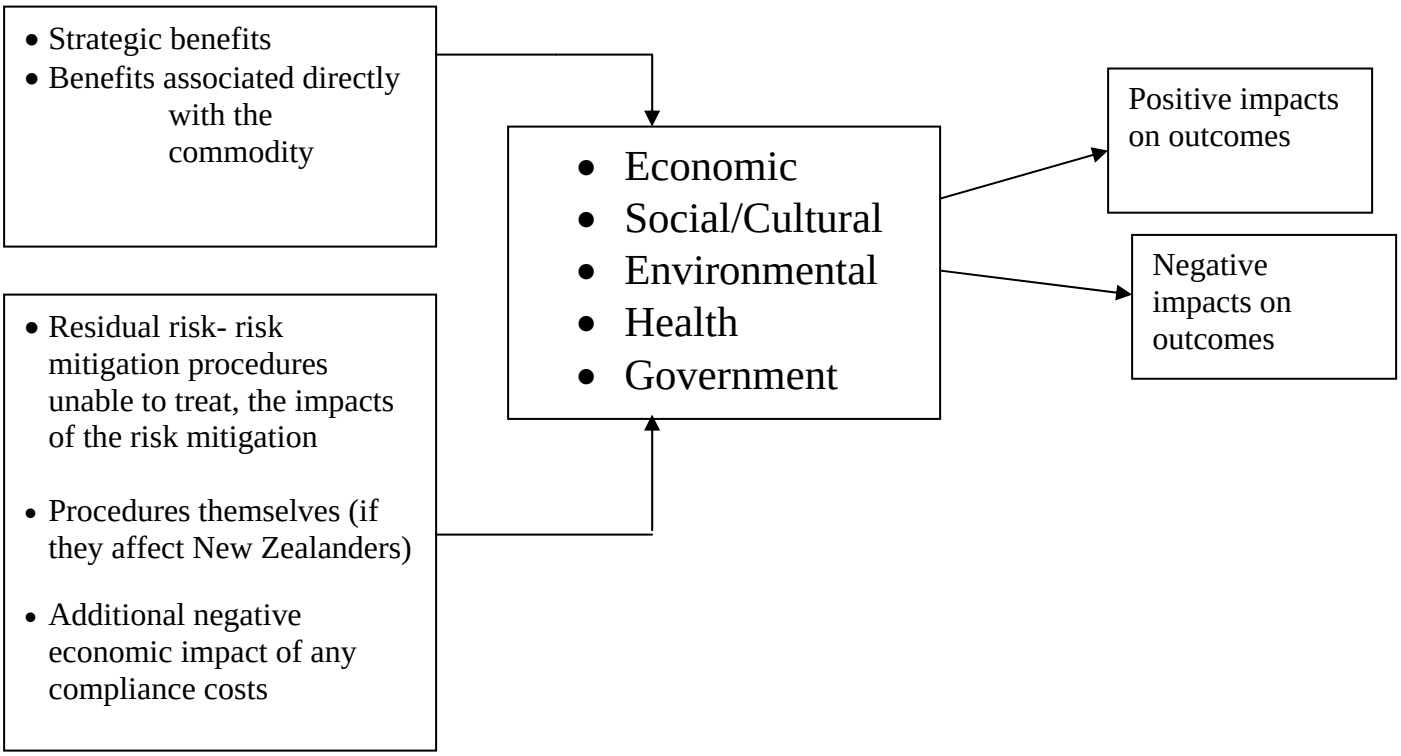
- residual risk that treatment measures in the risk mitigation procedures (in the import health standard) are unable to treat;
- the impacts of the risk mitigation procedures themselves (if they affect New Zealanders; for example, the impacts on the environment of any fumigation carried out in New Zealand); and
- compliance costs incurred by New Zealand importers and the Ministry of Agriculture and Forestry staff (either head office or Quarantine service) in ensuring compliance with the import health standard.[14]

The net impacts of doing a review are essentially the same as discussed in the section on the IRMF and therefore for brevity are not repeated here.

[13] It also links with the shifting paradigm in the public service of managing for outcomes.

[14] In line with the SPS agreement (WTO, 1994) we do not include the impacts on domestic producer as a cost.

Figure 1: Sources of impact on our outcomes



When trying to estimate the positive and negative impacts of a new import or a review on our outcomes there will be considerable uncertainty. Uncertainty will arise for a number of reasons:

- uncertainty inherent in what the positive and negative impacts of the import will be;
- uncertainty as to the accuracy and actual availability of knowledge; and
- uncertainty from assessors themselves concerning their own knowledge.

One way to manage this uncertainty is through belief nets (also known as Bayesian Networks, probability nets, causal nets). Belief nets manage uncertainty by explicitly representing the dependencies between the different components of the impact. This provides an intuitive graphical visualization of the impact including the interactions among the various sources of the impact.

In our application, the nets represent, and give structure to, a 'top down' thought process where we progress down the diagram to the point where we know enough about the subcomponent to 'score it' accurately. We then use this information to help us assign a score to the broad outcomes (economic, social, health, environment and government) by combining the impacts on each subcomponent to formulate an overall score for the outcome. A subcomponent is any of the boxes in the nets that is not the broad outcome;

for example in figure A1 (in Appendix 1), health is the broad outcome and mental health and anxiety are examples of subcomponents.

Figures A1-A5 (in Appendix 1) outline our initial thinking on what the nets could look like for each of the four outcomes plus government. These nets can then be used to assess both the positive and negative impacts of the import health standard on these outcomes.[15]

To clarify consider the following example. Say we are seeking to score the positive impacts of the importation of Mangos on the health outcome. The information we have about Mangos is that it reduces the risk of colon cancer, is a rich source of beta carotene (which the body converts to Vitamin A) and is also a source of fibre and Vitamin C.[16] If we are unsure how to 'score' these positive health benefits we could use figure A1 as outlined in table 2.

Table 2: Mango Importation Example

Level one questions	Level two questions
How will the outcome 'physical health' be affected? Can not say with certainty- so go to the next level	**How will the outcome 'energy and nutrition' be affected?** Given there is currently little or no domestic supply and importation is limited, this importation will increase the supply of nutritional benefits associated with Mangoes but there is little marginal benefit as Vitamins A, C and fibre are available cheaply from other sources.
	How will 'degree of mobility' be affected? Say with sufficient certainty that its unlikely to be affected materially
	How will 'ability to undertake self care' be affected? Say with sufficient certainty that its unlikely to be affected materially
	How will 'degree of pain or discomfort' be affected? The consumption of mango is unlikely to reduce your degree of pain or discomfort.
	How will the outcome 'mortality' be affected? Moderately if reduces the risk of colon cancer.
How will 'mental health be affected? Say with sufficient certainty that its unlikely to be affected materially- therefore do not need to go to level 2 questions.	

The first step is to see if we can answer the 'Level 1' questions with certainty: Does the consumption of mangoes affect mental health? We can say with acceptable certainty that

[15] For brevity we have not given an explanation of each of these diagrams and the interconnections. It is probable this will form the basis for a separate paper once these nets for each of the outcomes have been finalised. We stress these nets are very much in draft form, we present them to illustrate the concept rather than the detail that goes into each net.

[16] Source of this information and information in table 2 is www.health24.com and www.freshmangoes.com.

it does not and therefore we do not have drop down to the next level. Does consumption of mangoes affect physical health? We are unsure the extent to the importation of Mangoes will have positive impacts of physical health (we know it will have some as it a source of vitamin A, C and fibre). So therefore we drop down to level 2 to help us reduce the uncertainty around this answer. We do know that it will increase the supply of vitamins A,C and fibre so therefore the 'energy and nutrition' outcome will be improved; although the marginal increase is unlikely to be that large as there are other cheap, readily available sources of vitamins A and C and fibre. It is clear that through reducing the risk of colon cancer, the importation of Mangoes will impact positively on the mortality subcomponent. While we can confidently say the consumption of Mangoes is unlikely to materially affect positively the 'degree of mobility', 'ability to under take self care' and 'degree of pain or discomfort' outcomes. There maybe secondary impacts from reducing the risk of colon cancer but we feel to make the assessment tool more manageable, it is better to focus on primary effects and therefore the reduction in the risk of colon cancer is picked up through the mortality. We then use the information we have from level 2 to make an assessment about the positive impact of the importation of the physical health outcome (how we could do this will be discussed below).

The 'nets' could either be semi-qualitative or quantitative tool to help assess the impacts of an import health standard. If this tool was used as a semi-qualitative tool, figures A1-A5 could be used to provide structure on what is considered under each of our five outcomes; for example, if deciding what the positive impacts of Mango importation will be on the health outcome, panelists know that they must consider the impact on physical and mental health (and the outcomes under these headings) in the structured way outlined above. Panelists could then come up with a qualitative description for that impact on this outcome based on the information. However, given the large number of application there need to be a numerical value placed on both the positive and negative impacts for each of the outcomes to allow applications to be ranked. If, for example, a panelist feels there are 'significant' positive impacts on the health outcomes from the importation of Mangos after working through figure A1 then on that basis they may chose to assign a score of '8' for the 'positive impacts on the health outcome' criterion.

The use of this tool as a quantitative assessment tool would require the scoring of each of the subcomponents (at the level where you have sufficient certainty) with these subcomponents having a relationship/weight to the subcomponent above (with weights needing to be agreed upon). Using the same example of the positive impact on the health outcome of Mango importation, say panelists agree of scoring and weightings as outlined below in table 3.

Table 3: Example of a Quantitative Use of the Proposed New System

Outcome	'Level 1' Input	'Level 2' Input	Score	Weight
Health (positive impacts)			**1.05**	1
	Mental health		0	0.5
	Physical health		**2.1**	0.5
		Mobility	0	0.15
		Discomfort	0	0.15
		Self care	0	0.15
		Mortality	4	0.4
		Energy and nutrition	3	0.15

note: The bold scores in this table have been calculated using scores from level below .For example, the score for mental health is calculated by multiplying the scores for by their weights.

The score for the positive impacts on the health outcome criterion would therefore be 1.05. This is the sum of the weighted average for the score for physical and mental health; with the score for physical health being a weighted average of the scores assigned to its subcomponents (mobility etc)

On balance, we believe the qualitative use of this tool is the more appropriate in this context. We base this conclusion on two factors, firstly the quantitative process described above is very time consuming, which is concerning given the large numbers of applications received. Secondly while the quantitative approach does give explicit values to w_i, we believe being too prescriptive about the weights and scores gives the process a spurious accuracy. Because our net approach is not, and does not pretend to be, a comprehensive list of what could be impacted we believe it is dangerous to lose the ability to exercise judgement by imposing such a rigorous framework. It needs to be noted that with this scoring system (whether qualitative or quantitative) allowing aggregation of the categories without panel moderation is still not possible because we have yet to address the problem of ensuring a one point increase in each category is an equivalent to an equal increase (decrease) in utility for positive (negative) impacts (similarly increasing the score by 1 within a category should result in an identical change in utility not matter what initial score you start from).

Conclusions

We do not pretend that any of the frameworks discussed above are anything but crude measures of the net welfare an import will bring to New Zealand. However by adopting the structured approach of multi criteria analysis the choices between applications for import health standard development are made explicit and transparent. As Dooley et al. (2005) note this allows people to identify the key drivers of decisions as well as providing a structured process to help people think through and understand the decision. After all no framework can make decisions for you rather it can only be used as a guide for decision making- the decision making is up to panelists.

We believe the proposed evolution of the prioritisation system from what were initially three separate processes with different criteria to an integrated system assessing priority based on impacts on outcomes (rather than the source of the impact as is currently the case) will result in the selection of applications that will go some way to maximizing the social welfare function stated in (1).

However in saying this, the new system proposed by the author still needs some work. Specifically key priorities include developing a scoring system that reflects both the significance of the group/ sector being impacted on as well as the marginal impact on our outcomes of the commodity's importation (i.e. how much is the import adding to the outcome compared to the status quo).

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Appendix 1: Well being nets

Figure A1: Bayesian Impact Net for the Health Outcome

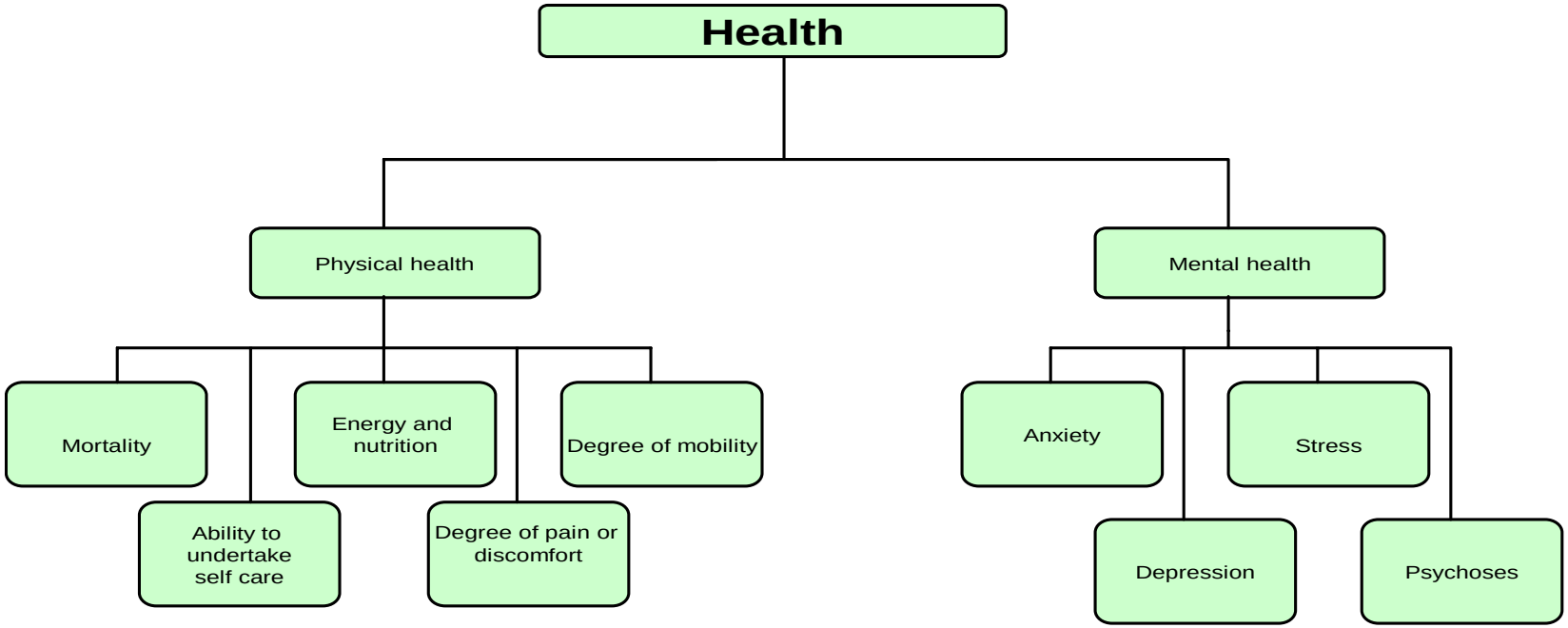

Figure A2a: Partial Bayesian Impact Net for the Economic Outcome (Industry Outcome)

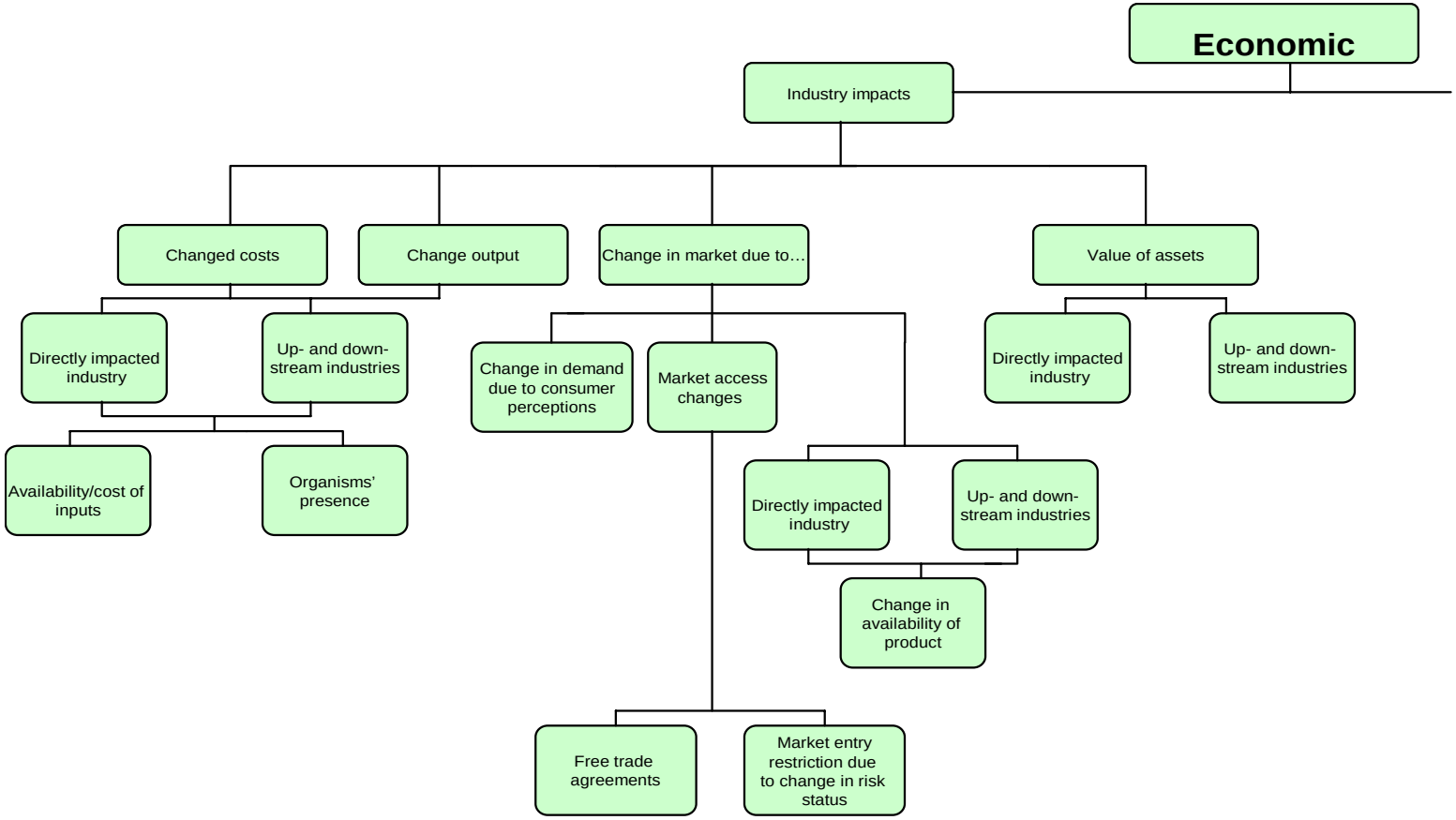

Figure A2b: Partial Bayesian Impact Net for the Economic Outcome (Consumer Outcome)

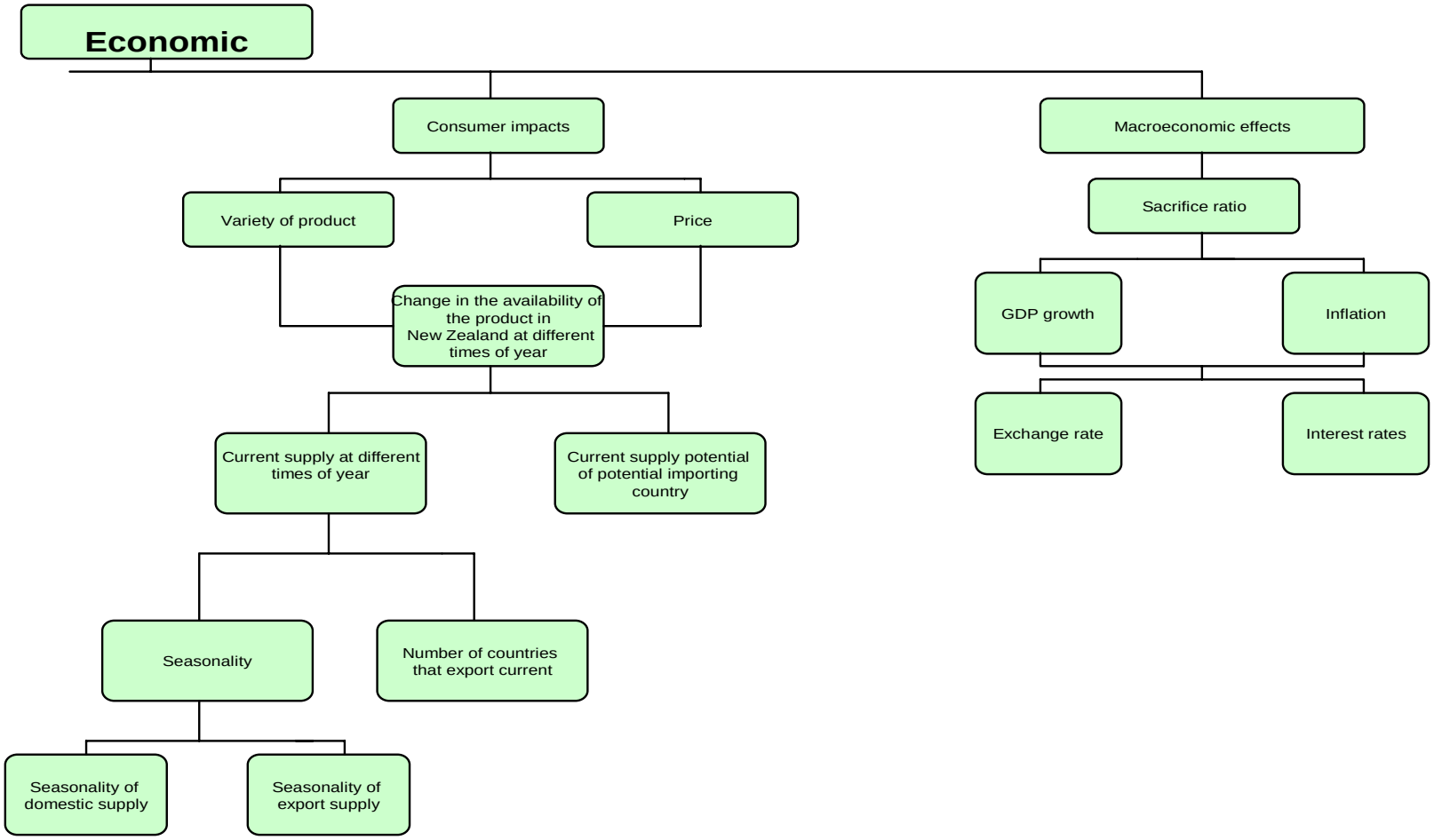

Figure A3: Bayesian Impact Net for the Environment Outcome

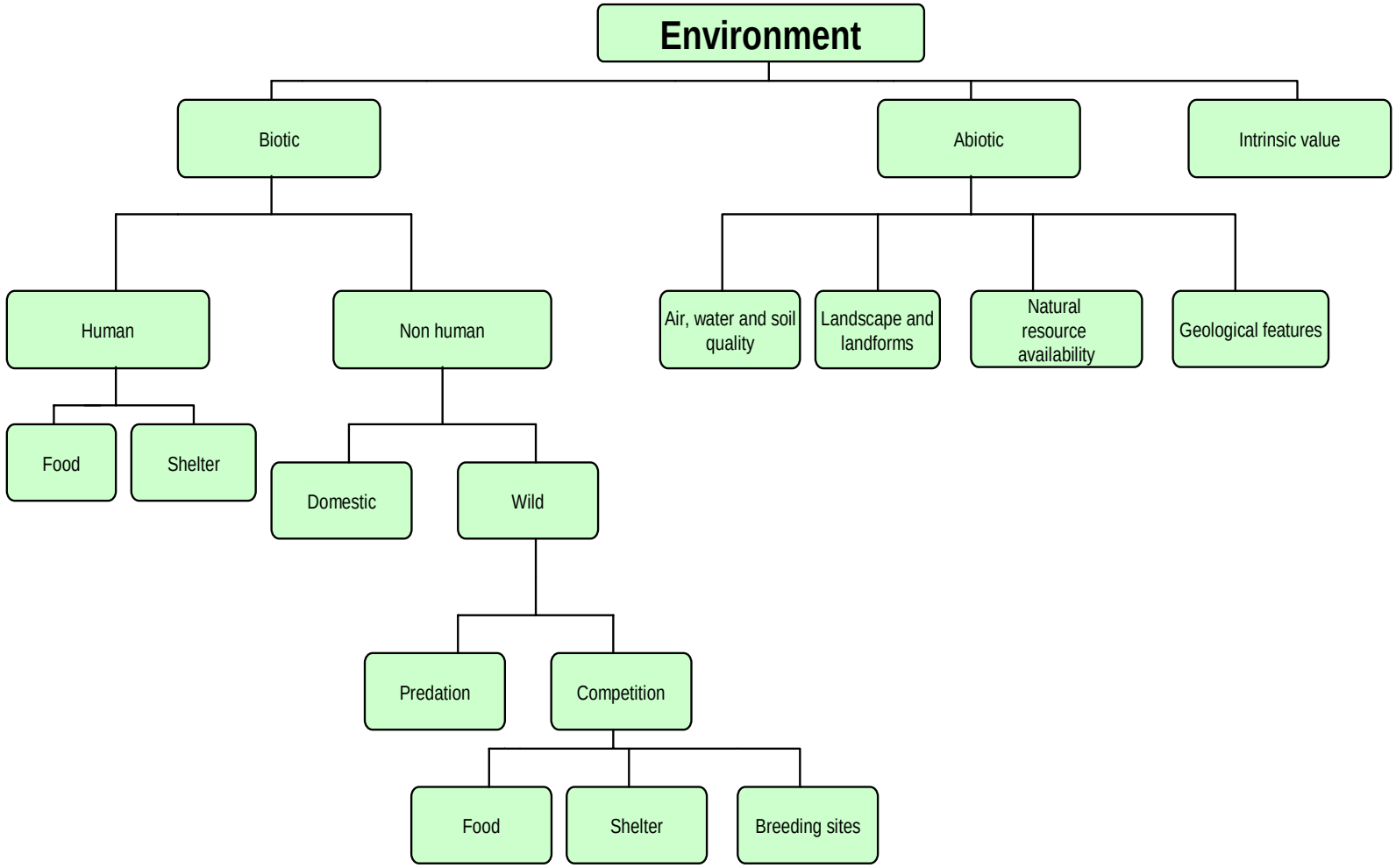

Figure A4: Bayesian Impact Net for the Health Outcome

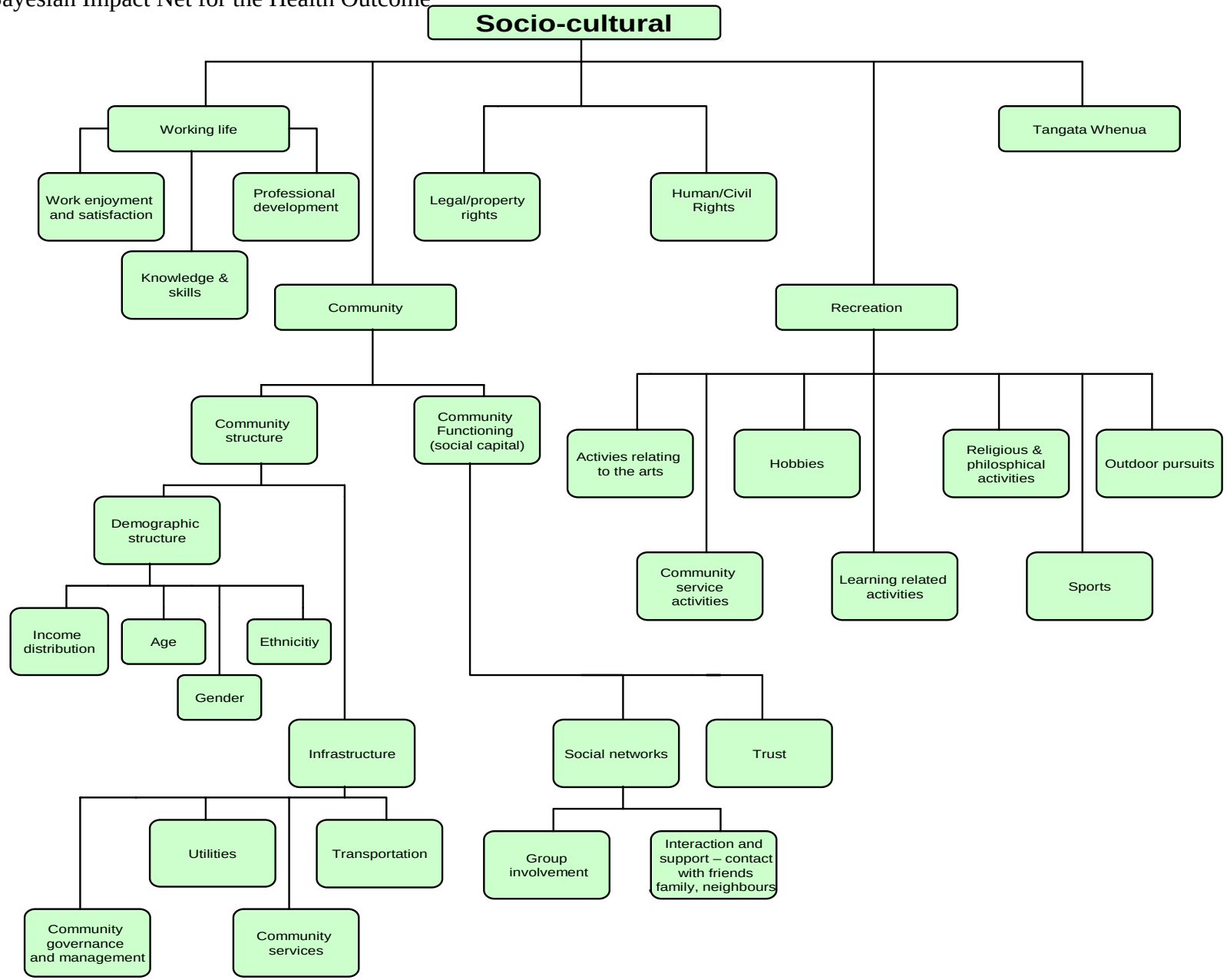

Figure A5: Bayesian Impact Net for the Government Outcome