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A COMPARISON OF RISK ASSESSMENT METHODOLOGIES

Bridges V.[1], Salman M.[2], Forsythe Jr K.[1]

Dans le climat actuel du commerce international, les pays s'éloignent de l'approche du risque zéro. Dans ce contexte, l'appréciation et l'analyse de risque sont utilisées comme des outils destinés à aider la gestion des risques et les décisions politiques d'import/export ayant un impact significatif sur les pays importateurs et exportateurs. Cependant, ceci a eu pour résultat une augmentation du nombre d'appréciation des risques due à une augmentation de situations commerciales. Un dilemme se pose actuellement sur la méthodologie à utiliser dans des situations particulières. Le résultat de l'augmentation de l'utilisation de l'appréciation du risque avec un défaut de spécificité de la part des organisations internationales est l'adaptation et le développement de méthodes différentes.

Afin de différencier entre les méthodologies, trois méthodes d'appréciation des risques sont discutées, en incluant leurs avantages et leurs inconvénients et la façon dont elles répondent aux diverses exigences spécifiées par l'OIE, GATT et NAFTA. La première méthode insiste sur l'analyse de la protection économique dans un plan coût-bénéfice afin de déterminer les niveaux de risque tolérables. La seconde méthode est représentée par le modèle d'APHRAN développé par Agriculture et Agri-Food Canada. La troisième méthode utilise des arbres de scénarios qui intègrent les fonctions de densité de probabilité.

Les deux premières méthodes sont les mieux alignées sur les exigences du GATT, NAFTA et OIE. La troisième répond à l'appréciation des risques biologiques mais n'inclut pas d'évaluation économique tel que c'est exigé par le GATT et NAFTA. Les deux premières méthodes fournissent des recommandations aux décideurs alors que la troisième coupe court à cela. La troisième méthode pourrait joindre à un plan plus global des méthodes telles que la 1ère ou la 2ème.

In today's climate of international trade, countries are moving away from zero risk approaches to trade. In light of this, risk assessments and analyses are being used as tools to help manage risk and to help make import/export policy decisions that have significant impact on both the importing and exporting country. For the facilitation of trade, international trade agreements such as the General Agreement on Tariffs and Trade (GATT) and the North American Free Trade Agreement (NAFTA) have requirements for risk assessments in their sanitary and phytosanitary (S&P) agreements.[3,5] These factors have resulted in increasing numbers of risk assessments being completed for increasing numbers of trade situations.

The dilemma that many face is deciding what risk assessment methodology to use for a particular situation. NAFTA and GATT both recommend using standards for risk assessments specified by appropriate international organizations, specifically the International Office of Epizootics (OIE) for animal health issues. However, while OIE does provide basic guidelines for risk assessment, they state that countries "should design their own methodology for carrying out the exercise."[6] The result of the increase in usage of risk assessment along with the lack of specific direction from international organizations is the adaptation and development of many different methods. To help differentiate between methodologies, three different risk assessment methods will be discussed, including their advantages and disadvantages and how they address the various requirements for risk assessment as specified by OIE, GATT, and NAFTA.

FIRST METHODOLOGY

The first methodology emphasizes economic welfare analysis in a benefit-cost framework as a method of determining tolerable risk levels. It also considers trade from the perspective of the exporting country as well as from that of the importing country.[2] The framework described includes three components: 1) the likelihood of entry, establishment or spread of a disease agent, 2) the post-entry biological and economic consequences of disease entry, establishment or spread, and 3) the benefits of trade to the importing country and the exporting country given the costs of pre-entry S&P border measures. These three components allow the evaluation of the question "Under what conditions should trade occur?" against three decision criteria. The decision criteria provide an economic cost-benefit framework for assessing and evaluating the risk involved in a particular trade situation, using the dollar as a common unit of measure.

Decision Criterion #1: If the benefit of the trade to the importing country is greater than the cost of the trade to the importing country, then allow the trade to take place. The cost of trade under decision criterion #1 is derived from the product of the likelihood of disease entry, establishment and spread and the economic consequences of such events.

[1] United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Centers for Epidemiology and Animal Health, 555 S. Howes, Ft Collins, CO 80521, USA

[2] Colorado State University CVMBS, Ft Collins, CO 80523, USA

Decision Criterion #2: If the benefit of the trade to both the importing and exporting country is less than the cost of the trade to the importing country, then do not allow the trade to take place. If this criterion is met, the benefits of trade are so low that it is not possible for there to be a net gain from trade for the importing country.
Decision Criterion #3: If (1) the benefit of the trade to the importing country is less than the cost to the importing country, and (2) the benefit to both the importing and exporting country is greater than the cost to the importing country, then allow the trade to take place if sufficient benefit can be transferred from the exporting to the importing country. In this situation, if only the importing country were looked at, the trade would not occur because the costs outweigh the benefits. However, by looking at the entire situation, including both the importing and exporting countries, a net gain in economic welfare is still possible from allowing the trade. The problem is in the distribution of that gain. This distribution problem could be handled via some form of compensation from the exporting to the importing country, resulting in neither country having a net loss of welfare and at least one country having a net gain in welfare. Whether such compensation takes place, and in what form, would be a political decision determined by the importing country.

SECOND METHODOLOGY

The second methodology analyzed is the Animal and Plant Health Risk Assessment Network (APHRAN) model developed by Agriculture & Agri-Food Canada.[1] The risk assessment process is begun with the Process Initiation, which is the request for the risk assessment to be done. In Hazard Identification, a list is developed of potential hazards or concerns (typically disease agents) associated with the commodity. This identification process also includes a preliminary assessment of the importance of each hazard or concern.
Risk Characterization and Estimation includes assessments of probability, impact, and uncertainty. The assessment of probability describes and models the likelihood of entry, exposure and transmission to the domestic population, and spread of the hazard. This may be done quantitatively, if reliable data is available, or qualitatively. Two estimates of probability are done. One is based on the status quo conditions of risk management actions. The second takes into account additional risk management actions which might be applied, such as increased testing or quarantines.
The impact component of risk characterization and estimation addresses the consequences and magnitude of what could go wrong. The biological impact addresses the range of potential hosts and the impact of the agent on their health. The emphasis of the impact analysis focuses on biology, but also includes the economic implications as well. An environmental impact is included which addresses the direct and indirect impacts of the hazard as well as impacts of any risk mitigation options, such as increased usage of pesticide. The probability and impact assessments are then used to determination an overall risk rating. Acknowledging the fact that quantitative data are usually not available, a qualitative rating system of high, medium, low, or negligible is usually used.
Also included in risk characterization and estimation is documentation of the uncertainty of the data used in the probability and impact assessments and the magnitude of the uncertainties, including documenting any assumptions used. Any conflicting evidence regarding the risk of the issue is included in this section, as well as a summarization of any sensitivity analyses that are done.
Biological Recommendations, the fourth section, provides testing and control options, eradication feasibility, and biological recommendations made by the risk assessor for the consideration of the risk managers. Assessment of various risk management scenarios may be included along with the recommendations. Documentation via Disease Agent Facts Sheets and a List of Hazards are the final portions of the risk assessment process.

THIRD METHODOLOGY

The third method to be discussed utilizes scenario trees that incorporate probability density functions.[4] This method quantitatively evaluates the likelihood of importing an exotic animal disease agent as well as the uncertainty associated with the calculated likelihood value. It consists of nine components.

1. State the question to be addressed.
2. Identify the hazard of interest.
3. Develop a scenario tree which outlines the pathway of events that are expected to occur during importation and the failures which can possibly occur along this path. At each failure point, a deviation in the pathway can end in the occurrence of the hazard of interest, the same outcome as the planned events pathway, or some other outcome. Important aspects of the scenario tree are that all possible outcomes are included and all are mutually exclusive.
4. Label and assign units to the pathway and all deviations.
5. Gather and document evidence.
6. Assign values to the branches of the scenario tree. This is also the step where probability distribution curves are used to determine uncertainty values, which are assigned to the values of each branch.
7. Perform calculations to summarize the likelihood of the hazard occurring.
8. Consider risk management options that could be implemented at the various branching points of the tree.
9. Prepare a written report.

This methodology also calls for an evaluation of the impact should the disease at issue be introduced into the importing country. This is accomplished in a qualitative manner based on the classification of the disease by the OIE as a List A or List B disease.

COMPARISON OF METHODS INCLUDING ADVANTAGES AND DISADVANTAGES

The first and second methods are very similar in their approach towards risk assessment. The third method is a more narrowly focused approach, yet shares many of the same features as the first two. All three methods

include uncertainty analysis and analysis of risk mitigation options. All three methods include an evaluation of the impact, however the third method's approach of qualitatively basing this assessment on whether the disease is OIE List A or B does not adequately address the issue. The first two methods include an environmental impact component that is not included in the third method.

The third method clearly stops at the point of assessing the risk while the first two methods go further. The first method does so by not only addressing the question of "Should trade take place?" but also addressing the question "If so, under what conditions?" The second method's Biological Recommendations includes testing and control options, eradication feasibility, and biological recommendations made by the risk assessor as well as assessing various risk management scenarios. The first method is similar in its evaluation of alternative mitigation options.

The first method takes a global view of trade by looking at the benefits to both the importing and exporting countries. In the second method, completing two estimates of probability gives formalization to the need to assess risk under current risk management control measures as well as the need to assess risk under alternative control measures. The third method should primarily be used when quantitative data is available. While qualitative data could be used in this methodology, the forcing of qualitative data into quantitative form puts false credibility on such an assessment. This method has no alternative in its methodology for the utilization of qualitative data.

GATT, NAFTA, AND OIE REQUIREMENTS

As defined by the GATT, a risk assessment should take into account relevant economic factors in addition to the relevant biological factors. Specifically, these economic factors are: 1) the potential damage in terms of loss of production or sales in the event of the entry, establishment or spread of a disease, 2) the costs of control or eradication in the territory of the importing Member, and 3) the relative cost effectiveness of alternative approaches to limiting risks.[3] The NAFTA defines risk assessment as "an evaluation of the potential for the introduction, establishment or spread of a pest or disease and associated biological and economic consequences".[5]

A component the first two methods share that is not included in the third methodology is an economic impact analysis of benefits and costs incorporated in with the biological portion of the assessment. These two methods take into account indirect economic impacts (e.g. impact on trade) as well as direct economic impacts (e.g. impact on production, quality, marketability, price, cost of treatment, and clean-up). What the first methodology brings out in more detail is the importance of the welfare economics of the issue at hand, as addressed by the three decision criteria. The view is a global one, assessing economic welfare at a national level. It incorporates the aspects of benefits to the importing country via consumer access to foreign goods and benefits to the exporting country via producer access to foreign markets. By satisfying the three decision criteria, any trade which occurs results in no country being worse off and at least one country being better off. If only one country is better off, it could be the importing country or the exporting country.

The first methodology also takes into account the negative trade effects of S&P restrictions and provides methods for measuring these negative effects such that they could be countered via compensation should the situation warrant it. This is consistent with the GATT and NAFTA, which give a country that is ruled to be in violation of the agreement the option of keeping the non-compliant requirement and compensating the trading partner for the value of the impaired trade.

All three methods meet the guidelines as set by OIE, which does not specify an economic component.

CONCLUSION

The first and second methodologies discussed are well aligned and definitely meet the requirements of GATT, NAFTA, and OIE. Method three meets the biological assessment requirements but does not adequately include an economic assessment as required by GATT and NAFTA. To provide a complete assessment for the risk manager using the third method, a separate economic assessment would have to be done. While this is possible, it is preferable that the risk manager be provided with an assessment where the biological and economic aspects have been done in conjunction with each other, as in methods one and two. So doing results in assessments which are integrated and complementary in nature. If the two pieces are done totally separately, they are likely to be disjointed, resulting in missing pieces of the complete picture. The first two methods provide for the making of recommendations to the decision maker while the third method stops short of doing so. The third method would very nicely combine with a more encompassing framework such as methods one or two.

BIBLIOGRAPHY

1 Animal and Plant Health Risk Assessment Network. Agriculture & Agri-Food Canada, 1994. A General Model for Animal Health Risk Assessment.

2 Forsythe Jr K., 1997. Baseline Analysis System Technical Documentation (unpublished manuscript - draft).

3 GATT Secretariat, 1994. Agreement on the Application of Sanitary and Phytosanitary Measures. MTN/FA II-AIA-4.

4 Miller L., McElvaine R., McDowell R., Ahl A., 1993. Developing a quantitative risk assessment process. Review Scientifique et Technique Office International des Epizooties 12(4), 1153-1164.

5 North American Free Trade Agreement, 1993. Sanitary and Phytosanitary Measures. Chapter 7, Section B.

6 Office International des Epizooties, 1994. International Animal Health Code: mammals, birds and bees.