



Report 1

Overview of the Development and Applications of a Conceptual Framework for Analyzing Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans



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On-Farm Food Safety and Environmental Farm Plans:
Identifying and Classifying Benefits and Costs

Canada

*Overview of the
Development and Applications of a
Conceptual Framework for Analyzing Benefits and
Costs of On-Farm Food Safety and Environmental Farm Plans*

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Foreword

As consumers become more sophisticated and discerning in their food purchases, Canadian agriculture and agri-food production is changing to meet the challenge. Supply chains have been formed that specifically address food safety, food quality, and environmental concerns. Even at the farm gate, producers are reassessing the way they do business. Industry initiatives are looking at the feasibility, and in many instances are already in the process, of implementing on-farm food safety programs (OFFS) and environmental farm plans (EFP). The Agricultural Policy Framework (APF) recognizes the importance of food safety and environmental concerns for the future growth of the agriculture and agri-food sector. For this purpose, Agriculture and Agri-Food Canada (AAFC) has commissioned a series of six reports to develop a conceptual framework to strengthen our understanding of the benefit and cost implications OFFS and EFP will have across the agri-food chain¹. The conceptual framework provides a systematic approach for organizing and pulling together the on-going work of stakeholders and government in determining how best to implement on-farm food safety and environmental planning. The reports also provide preliminary qualitative applications of the conceptual framework to the Canadian pork, beef, grain and dairy sectors.

This first report in the series *“On-Farm Food Safety and Environmental Farm Plans: Identifying and Classifying Benefits and Costs”* summarizes the conceptual framework and the key conclusions from the four sector reports. Full details of the analyses are available in reports 2-5.

The full list of reports in the series *“On-Farm Food Safety and Environmental Farm Plans: Identifying and Classifying Benefits and Costs”* is as follows:

Report 1: *Overview of the Development and Applications of a Conceptual Framework for Analyzing Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans* by J.E. Hobbs, J-P. Gervais, R. Gray, W.A. Kerr, B. Larue and C. Wasyluniuk

Report 2: *On-Farm Food Safety and Environmental Farm Plans: A Conceptual Framework for Identifying and Classifying Benefits and Costs* by J.E. Hobbs, J-P. Gervais, R. Gray, W.A. Kerr and B. Larue

1. *The bulk of the analysis for this study was completed in March 2003, prior to the discovery of bovine spongiform encephalopathy (BSE) in a single beef cow in Alberta, and the subsequent closure of the U.S. and other countries' borders to all Canadian live ruminant and ruminant meat and meat product exports.*

- Report 3:** *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Pork Sector* by B. Larue, J-P. Gervais, J.E. Hobbs, W.A. Kerr, and R. Gray
- Report 4:** *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Beef Sector* by W.A. Kerr, C. Wasylyniuk, J.E. Hobbs, J-P. Gervais, R. Gray and B. Larue
- Report 5:** *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Grain Sector* by R. Gray, M. Ferguson, B. Martin, J.E. Hobbs, W.A. Kerr, B. Larue and J-P. Gervais
- Report 6:** *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Dairy Sector* by J-P. Gervais, B. Larue, J.E. Hobbs, W.A. Kerr and R. Gray



Executive summary

The APF stresses food safety and environmental stewardship as among the top priorities for Canadian agriculture. By March 2003, 19 Canadian commodity associations had launched or were developing national on-farm food safety (OFFS) systems and quality assurance programs. To date, environmental farm plans (EFP) have been developed at a provincial level. This report provides an overview of a series dealing with the assessment of potential benefits and costs associated with OFFS and EFP initiatives for Canadian agriculture.

The basis of the analysis for the series is a conceptual framework laying out a generic benefit-cost appraisal. The framework is used to identify private and public benefits and costs for OFFS and EFP. Demand-side and supply-side benefits and costs are considered. The impact of the benefits and costs at different levels of the supply chain, from input supplier to retailer and consumer, are identified. The conceptual framework indicates that benefits and costs are expected to differ across different institutional delivery mechanisms.

Sector analyses are summarized for the pork, beef, grain and dairy sectors. Quality assurance and food safety initiatives are quite advanced in the pork sector. An industry-led national environmental management system is under development. Provincial environmental protection initiatives have also been encouraged. Implementation of food safety and quality assurance initiatives in the beef sector are also in an advanced stage. The potential for additional record keeping costs due to OFFS and EFP are a concern among beef industry stakeholders. The Canada Grains Council is spearheading the national OFFS initiative for the grain sector. Canadian grain has an excellent safety record. Current institutional arrangements provide credible quality assurances to buyers. The Canadian Quality Milk Program has been developed by the dairy sector, however, enrollment remains low. Industry stakeholders raise concerns about potential for overlap between food safety and environmental initiatives.

OFFS can have an insurance role to play in reducing the risks of market loss due to a food safety problem. OFFS and EFP could potentially yield productivity gains from producer education and closer attention to management issues on the farm operation. Potential public benefits from EFP include reductions in ground water contamination and reduced odour, although producers who already have good environmental records are the most likely to adopt EFP. Public benefits from voluntary OFFS appear more nebulous. A preliminary qualitative assessment suggests that the beef and pork sectors may obtain more benefits from OFFS and EFP than the dairy or grain sectors, given differences in international markets and existing institutional arrangements. Costs are

expected to arise in all sectors implementing OFFS but may not be large for voluntary industry programs. EFP may lead to increased manure/land management costs for the livestock sectors. Future sector-specific quantitative assessments of benefits and costs could build on the conceptual framework and qualitative assessments presented in this series of reports.



Chapter 1

Introduction

Food safety, food quality and environmental concerns have become issues in domestic markets and in export markets for many Canadian agri-food products. A large number of industry-led and public sector initiatives are attempting to respond to these rising concerns. While these initiatives can be solely reactive, it is hoped that the changes being put in place can improve the competitive advantage of individual Canadian agri-food industries and the Canadian agri-food industry as a whole. Besides the positive effect on profitability, there may be other benefits that accrue to society from initiatives that enhance food safety and improve the environmental sustainability of agricultural production.

The APF, endorsed by the Government of Canada and all provincial and territorial governments, stress food safety and environmental stewardship as among the top priorities for guaranteeing a strong future for Canadian agriculture. The APF considers the implementation of Hazard Analysis Critical Control Point (HACCP)-like on-farm food safety systems (OFFS) and the implementation of environmental farm plan programs (EFP) as vital in ensuring Canada continues to be a world leader in the agri-food industry.

OFFS and EFP have been proposed as core components of a Canadian “brand” for agri-food products. Several Canadian industries have been pro-active in developing national on-farm food safety and quality assurance programs, for example, the Canadian Cattlemen’s Association’s Quality Starts Here ✓ Verified Beef Production program, the pork industry’s CQA™ Canadian Quality Assurance program, and the Canadian Quality Milk (CQM) program.

This is the first report in a series dealing with the assessment of potential benefits and costs associated with proposed OFFS and EFP initiatives for Canadian agriculture. The objective of this report is to provide an overview of the five main reports in the series.



Chapter 2

What are OFFS and EFP?

By March 2003, 19 Canadian commodity associations had launched or were developing national OFFS and quality assurance programs under the Canadian On-Farm Food Safety Program (COFFS). These programs are based on HACCP, which is an internationally recognized preventative system for food safety. It is a process standard, meaning that critical control points are established during production at points where control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels.

To date, EFP have been established on a provincial basis. EFP are documents voluntarily prepared by farm operators and are designed to raise their awareness about the environmental implications of their activities. Farm operators identify the environmental strengths and weaknesses of their operations and set realistic goals to enhance their local environment.



Chapter 3

Why are these issues important?

There is a need to be pro-active, rather than reactive, in responding to potential food safety and environmental problems that could weaken consumer confidence in the domestic food supply and close off access to export markets. Initiatives to maintain or enhance on-farm food safety and environmental standards are part of a risk-reduction strategy. In addition, some sectors are pursuing on food safety and environmental standards in the hope that these strategies can help differentiate Canadian agri-food products in export markets.



Chapter 4

The purpose of this study

A series of public consultations about the proposed APF generated many questions about the scope of OFFS and EFP, the cost of implementation, the effectiveness of these programs and scepticism over their potential benefits. This study is a first step in assessing the potential benefits and costs of OFFS and EFP. A series of six reports has been produced for this study. First, a conceptual framework for developing a qualitative analysis of the benefits and costs of these programs was developed (Report #2). This formed the basis for the four subsequent sector analyses: pork (Report #3), beef (Report #4), grain (Report #5) and dairy (Report #6). This report presents a summary of the main findings. For more details readers are directed to the individual reports as referenced in the Foreword to this report.



Chapter 5

The conceptual framework

The conceptual framework provides a generic benefit-cost appraisal and is used to identify benefits and costs for OFFS and EFP. A range of private and public benefits and costs are identified. While on one level it is easy to understand the need to consider both benefits and costs when contemplating substantial initiatives such as OFFS and EFP, there is an important reason for developing a conceptual framework with which to approach the evaluation of these initiatives – their sheer complexity. Food safety and the environment both have effects that extend beyond those benefits and costs that accrue to, or are financially incurred by, the enterprises that implement them. There are non-monetary benefits and costs that directly affect those implementing OFFS or EFP, network effects that involve the entire supply chain, as well as benefits and costs that affect society such as reduced pollution or reductions in food safety incidents. Laying out a framework for a benefit and cost analysis forces the complexity and the multifaceted, inter-related aspects of proposed programs to be dealt with. Even if some benefit or costs are difficult to measure, the formal structure prevents them from being ignored simply because their estimation is difficult.

Having a framework to consult is also important because the benefits and costs for any particular producer will vary with the mechanism chosen for delivery of the program, hence, it is helpful to be able to compare the net result for different delivery options. Further, the types of business to business relationships that exist along the supply chains for various Canadian agricultural commodities will differ considerably. The structure and operation of supply chains in the grain industry and the dairy industry, for example, are radically different. Supply chains for the same commodity may also be strikingly different in various parts of the country. The supply chain for grain in the Canadian Wheat Board area in western Canada is considerably different than supply chains for grain in the Fraser Valley of British Columbia or in Southern Ontario. The supply chain structure of the pork industry in Quebec is quite different to that in Manitoba. The benefits and costs of OFFS and EFP initiatives will also be distributed among the various actors along a supply chain depending upon their relative market power and their ability to reap gains from the programs. A conceptual framework must be sufficiently robust to consider all these complexities. A comprehensive framework may have elements that are not applicable to a particular sup-

ply chain and absent entries do not signal an incomplete assessment. Having the broad framework, however, provides a checklist so that even those aspects that can be safely ignored are given due consideration.

In general, benefits and costs can be divided into demand side effects and supply side effects. It is particularly important to consider demand side effects because there is a tendency to focus solely on supply side effects of programs because they usually affect costs directly, either positively or negatively. This does not mean that all demand side effects are benefits; far from it. Firms in value chains need to be as much aware of negative demand side effects as they are of increases in costs. Of course, not all supply side effects are cost increasing. There may be considerable cost savings from operational efficiencies – sometimes even when no demand side benefits are manifest.

As suggested above, not all of the benefits or costs are received or borne by the implementing firms or even by other members of their supply chain. These public benefits and costs are as important to a comprehensive evaluation as the private costs, both to indicate where a public role may be discerned and where markets are not working as well as they might.

- An example of a private cost is additional record keeping costs incurred by the agricultural producer in order to adhere to an OFFS or EFP.
- An example of a private benefit for the agricultural producer could be receiving a price premium due to the accountability ensured by the OFFS or EFP. This is classified as a demand-side benefit.
- Another example of a private benefit could be productivity improvements from enhanced management practices as a result of the OFFS or EFP. This is classified as a supply-side benefit.

- An example of a public cost is undesirable odours from an intensive livestock operation that drift onto a neighbour's property. An example of a public benefit is improved water quality in a river due to the implementation of an EFP by an upstream livestock producer.

The conceptual framework also addresses the potential lack of product information received by consumers. This is known as information asymmetry and it may have detrimental effects to both the buyer and the seller of an agricultural good.

- Information asymmetry occurs when one of the transacting parties is better informed than the other. This can cause problems in a market if consumers cannot detect product attributes that they wish to avoid (harmful) or that they wish to consume (beneficial). If markets fail to adequately signal the presence of these attributes, product prices may not be an accurate reflection of consumers' willingness to pay.

It is also important to include the benefits and costs of independent monitoring of OFFS and EFP. Independent monitoring is important to eliminate free riders.

- Suppose two private agricultural supply chains labelled their products as “environmentally friendly” but only one supply chain has actually implemented an EFP. Independent monitoring is needed to eliminate the free rider problem by firms in the supply chain that have NOT implemented an EFP.

The theoretical basis for the comprehensive framework is fully developed in Report #2 of this series. For OFFS it is summarized in Table 1², which identifies potential private market (demand-side and supply-side) benefits and costs. The table indicates their potential impact at different points along the supply chain.

There are a wide range of benefits affecting consumers, intermediaries in supply chains and farm level producers. Benefits include cost reductions, as well as benefits from improving international marketing networks, and improving consumer confidence, and thus loyalty. The public benefits include reductions in food borne illnesses and the correction of market failures relating to consumers not knowing what standards apply to the food they are eating (information asymmetry).

The costs associated with OFFS cover both ongoing operating costs and the investments that must be made to put OFFS in place. They also include the costs of monitoring the system that is put in place.

The vertical columns set out the different supply chain interfaces where benefits or costs are expected to arise. As suggested above, for any given product or supply chain, not all of the boxes may be relevant for each delivery mechanism. Some examples for individual commodity sectors are provided in section 6 of this document.

Table 2³ provides a similar summary of benefits and costs for EFP.

2. *Table 1 from Report #2 in this series.*

3. *Table 4 from Report #2 in this series.*

Table 1: Impact-based classification system of potential private benefits and costs of on-farm food safety programs according to their distributional implications in the supply chain

Private benefits and costs	Input supplier-to-producer	Producer-to-producer	Producer-to-processor	Processor-to-retailer	Retailer-to-consumer
Demand-side effects					
Reduce transaction costs for consumers		Reduce substitution effects between farm products			Reduce product avoidance, brand switching, mitigation and averting actions
Build consumer confidence			Domestic marketing mechanisms can allow premiums to be distributed to producers	Domestic marketing mechanisms can allow premiums to be distributed to processors	Extract premiums from consumers for foods with safety assurances
Convey additional information (when used with identity preservation systems)		Reduces the incentive to free-ride	Protect the integrity of the product	Protect the integrity of the product	Protect the certification mechanism for consumers
Provide differentiation on the international market	Domestic marketing mechanisms can allow premiums to be distributed to suppliers		Domestic marketing mechanisms can allow premiums to be distributed to producers	Domestic marketing mechanisms can allow premiums to be distributed to processors	Collect premiums for quality and product characteristics
Facilitate trade by reducing non-tariff barriers				Potentially increase market penetration in foreign markets	
Reinforce and develop trade networks	Reduce marketing costs in communicating nature of quality management systems and after-sale service		Reduce marketing costs in communicating nature of quality management systems and after-sale service	Reduce marketing costs in communicating nature of quality management systems and after-sale service	
Supply-side effects					
Benefits:					
Improve productivity of inputs	Increase demand for farm inputs				
Improve efficiency in production	Inputs used more efficiently reduces costs of production				
Reduce logistics costs	Reduce in-bound and out-bound logistic costs		Reduce in-bound and out-bound logistic costs	Reduce in-bound and out-bound logistic costs	Reduce cost of goods for the retailer
			Reduce producers' average cost which leads to lower prices for farm products.		
			Reduce cost of raw inputs		

Table 1: Impact-based classification system of potential private benefits and costs of on-farm food safety programs according to their distributional implications in the supply chain (Continued)

Private benefits and costs	Input supplier-to-producer	Producer-to-producer	Producer-to-processor	Processor-to-retailer	Retailer-to-consumer
Reduce measurement costs: performance versus process standards			Improve quality control mechanisms; reduce resources devoted to quality monitoring		
Reduce monitoring and enforcement costs	Applies to business relationships between producers and input suppliers		Applies to business relationships between producers and processors	Applies to business relationships between processors and retailers	
Reduce product liability costs	Potentially higher costs for those at fault. Lower for others	Potentially higher costs for those at fault. Lower for others	Reduce expected losses in the event of a serious incident	Reduce expected losses	Fewer consumers affected in the event of a serious incident
Reduce ex-post cost following detection of contaminant in food	Potentially higher costs for those at fault. Lower for others	Potentially higher costs for those at fault. Lower for others	Stabilize supply for processors	Stabilize supply for retailers	Reduces the potential for or degree of market disruption
Reduce free-rider impacts		Reduce vulnerability to food contamination in non-adopter sector	Reduce processor information costs		Consumer information costs reduced
<u>Costs:</u>					
Management and compliance costs		National programs spread some costs over all adopting producers.	Small farms may be disadvantaged if OFFS implementation costs vary little with output. Marketing mechanisms and market structure at the processing level will determine the extent of damages		
Sunk investments		National programs reduce risk. Buyer-specific programs increase risk.	Suppliers vulnerable to opportunistic behaviour by processors if buyer-specific OFFS sunk investments made	Processors vulnerable to opportunistic behaviour by retailers if buyer-specific OFFS sunk investments made	

Table 2: Impact-based classification system of potential private benefits and costs of Environmental Farm Plans according to their distributional implications in the farm output supply chain

Private benefits and costs	Input supplier-to-producer	Producer-to-producer	Producer-to-processor	Processor-to-retailer	Retailer-to-consumer
Demand-side effects					
Reduce transaction costs for consumers.		Reduce substitution effects between farm products			Reduce product avoidance, brand switching, mitigation and averting actions
Build consumer confidence	Domestic marketing mechanisms can allow premiums to be distributed to suppliers of environmentally friendly inputs		Domestic marketing mechanisms can allow premiums to be distributed to producers	Domestic marketing mechanisms can allow premiums to be distributed to processors	Extract premiums from consumers for environmentally friendly foods
Convey additional information (when used with identity preservation systems)		Reduce the incentive to free-ride	Protect the integrity of the product	Protect the integrity of the product	Protect the certification mechanism for consumers
Provide differentiation on the international market	Domestic marketing mechanisms can allow premiums to be distributed to suppliers of environmentally friendly inputs		Domestic marketing mechanisms can allow premiums to be distributed to producers	Domestic marketing mechanisms can allow premiums to be distributed to processors	Premiums collected for environmentally friendly production methods
Facilitate trade by reducing non-tariff barriers				Potentially increases market penetration (or maintains market share) in foreign markets	
Reinforce and develop trade networks			Reduce marketing costs in communicating nature of environmental management systems	Reduce marketing costs in communicating nature of environmental management systems	
Supply-side effects					
Private benefits and costs	Input supplier-to-producer	Producer-to-producer	Producer-to-processor	Processor-to-retailer	Retailer-to-consumer
Supply-side effects					
Benefits:					
Reduce monitoring and enforcement costs	Applies to business relationships between producers and input suppliers		Applies to business relationships between producers and processors	Applies to business relationships between processors and retailers	
Reduce free-rider impacts		Reduce vulnerability to environmental disaster in non-adopter sector	Reduce processor information costs		Reduce consumer information costs

Table 2: Impact-based classification system of potential private benefits and costs of Environmental Farm Plans according to their distributional implications in the farm output supply chain (Continued)

Private benefits and costs	Input supplier-to-producer	Producer-to-producer	Producer-to-processor	Processor-to-retailer	Retailer-to-consumer
Costs:					
Planning costs		Standard industry format for preparing farm plans may reduce planning costs for individuals			
Management and compliance costs			Small farms may be disadvantaged if environmental mitigation costs vary little with output. Marketing mechanisms and market structure at the processing level will determine the extent of damages		
Sunk investments			Producers vulnerable to opportunistic behaviour by processors if buyer-specific EFP require sunk investments. National programs reduce this risk.		

Tables 3 and 4⁴ provide a summary of the benefits and costs under different delivery mechanisms. Not all of the boxes are applicable to each delivery mechanism. Using this approach, different delivery mechanisms can be qualitatively compared. If the information is available, values for alternative delivery mechanisms could also be calculated and then compared using this framework.

Table 3: The benefits and costs of OFFS

	Voluntary industry- wide OFFS	Enforced industry- wide OFFS	Buyer specific OFFS	Regulatory standards
Private benefits				
Reduce transaction costs for consumers				
Build consumer confidence				
Convey additional information				
Provide differentiation on international markets				
Facilitate trade by reducing NTBs				
Reinforce and develop trade networks				
Improve productivity of inputs				
Improve efficiency in production				
Reduce logistic costs				
Reduce measurement costs: performance versus process standards				
Reduce monitoring and enforcement costs				
Reduce product liability costs				
Reduce ex-post cost following contamination				
Reduce free-rider impacts				
Public benefits				
Reduce incidence of foodborne illness				
Reduce information asymmetry				
Total benefits				
Costs				
Management costs				
fixed – establishing the HACCP plan				
variable – revising plan to reflect external changes				
Compliance costs				
fixed – capital costs				
variable				
Sunk investments				
risk of hold-up				
Segregation costs				
fixed				
variable				
Monitoring and enforcement costs				
fixed				
variable				
Total costs				
TOTAL NET BENEFITS				

4. Tables 7 and 8 from Report #2 in this series

Table 4: The benefits and costs of EFP

	Voluntary EFP	New building EFP	Annual EFP	Annual enforced EFP	Emission standards	Land use regulations
Private benefits						
Reduce transaction costs for consumers						
Build consumer confidence						
Convey additional information						
Provide differentiation on international markets						
Facilitate trade by reducing NTBs						
Reinforce and develop trade networks						
Reduce monitoring and enforcement costs						
Reduce free-rider impacts						
<u>Non-pecuniary benefit to farmers</u> (feel-good factor)						
Public benefits						
<u>Direct effects on human quality of life</u>						
Reduce negative human health externalities (disease, toxic substances, etc.)						
Negative impact on value of assets (air quality, etc.)						
Nuisance (odours, etc.)						
<u>Ecosystem effects</u> (upland habitat, riparian/wetland habitat, water quality, greenhouse gases, soil resource quality, etc.)						
Total benefits						
Costs						
Planning costs						
fixed – establishing the framework						
variable – revising policy to reflect external changes						
Monitoring and enforcement costs						
fixed						
variable						
Compliance costs						
fixed – capital costs						
variable						
Segregation costs						
fixed						
variable						
Total costs						
TOTAL NET BENEFITS						



Chapter 6

Sector analyses and results

This section summarizes key points from the sector-specific reports (Reports #3 to #6). Program details for each of the four sectors are highlighted below. These highlights are followed by Tables 5 and 6 which provide a summary and cross comparison of the key benefits and costs identified for each sector.

Pork sector

- The *Fédération des Producteurs de Porc du Québec* (FPPQ), Ontario Pork and Alberta Pork fully endorse the voluntary Canadian Quality Assurance™ (CQA) program. The CQA program details HACCP-based, national OFFS initiatives for the hog sector. The program is independently audited by licensed veterinarians and gained federal recognition in July 2004.
- Processors such as Maple Leaf Burlington now require CQA enrolment. In Quebec, a premium is available to CQA producers from the provincial revenue pooling program. However, this premium will vanish when CQA enrolment is completed. In 2004, 80 percent of market hogs were enrolled in the program.
- OFFS are likely to stabilize and enhance the global market share of Canadian pork. It is possible that most of the program benefits will be due to increasing market share as opposed to minimizing contamination costs.
- The Canadian Pork Council initiated the voluntary, national Environmental Management System (EMS) in July 2000; pilot projects started in late 2004 to test the implementation tools and audit abilities. The program complements existing environmental regulations. It is a performance-based standard, and it will be independently audited.
- Provincial environmental protection initiatives have been encouraged. The FPPQ in Quebec launched its environmental initiative in 2004. This is being developed in an effort to lift the moratorium on production expansion in Quebec.

Beef sector

- The Canadian Cattlemen's Association's Quality Starts Here ✓ program has developed HACCP-based, national on-farm food safety initiatives for the cow-calf and feedlot sectors. The first of three strategies, a technical review, was completed in November 2004. Stage two, implementation and a third party audit, is in its initial phase.
- The potential for additional record keeping costs due to OFFS and EFP to exceed any production efficiencies realized is causing significant debate. It is unclear if these programs will increase or decrease operational efficiency.
- It is likely that a high degree of computerization will be necessary to implement OFFS due to record keeping requirements. This includes the potential use of radio frequency identification tags, which can automatically transmit data to computer software. This software can transfer data up and down the beef supply chain.
- Public and private benefits of improving the ability to trace problems back to their source and in being able to more quickly deal with food safety breakdowns are anticipated. In this sense, the costs of implementing OFFS could be viewed as insurance against a catastrophe.
- There is a blend of provincial environmental regulations and voluntary, provincial environmental farm plans in Alberta and Ontario. EFPs are not as well developed as the OFFS initiatives.
- OFFS could stabilize and enhance Canadian beef's global market share. EFP will likely provide benefits to the local environment.
- Few synergies are expected between OFFS and EPF initiatives. The one exception is the potential for sharing of audits and auditing costs.

Grain sector

- The Canada Grains Council is currently developing HACCP-based, national OFFS. There will likely be on-farm, independent audits. The proposed OFFS being developed by the Canada Grains Council has most of the components of an EFP.
- The Canadian Grain Commission is an export-oriented agency responsible for grades, consistency and safety of Canadian grain shipments. The commission monitors for unacceptable levels of toxic substances, pesticide residues, insects, faeces, and other foreign materials. When the OFFS is implemented, the Canadian Grain Commission's roles in grain quality assurance could increase.
- The Canadian organic grains industry already has various process-based programs in place to verify the authenticity of its products to consumers. It is unclear how an OFFS for the conventional grains industry would affect the organic grain industry.
- A voluntary OFFS will create a need to develop an Identity Preserved Product Management (IPPM) system to segregate OFFS grain from non-OFFS grain. This will greatly increase logistical costs.

- The majority of producers who adopt a voluntary OFFS or EFP probably already produce grain safely. These producers are likely to adopt the program because their costs are similar to program costs. Based on experiences in other countries, market premiums for OFFS grain are not expected. A voluntary program is not likely to be adopted by farm operators who currently have poor on-farm food safety and environmental practices.
- The current Canadian grain quality system uses performance-based standards. In the grain handling system, a product is pooled and samples are tested. The nature of the grain handling system allows the performance-based system to be relatively inexpensive for quality assurance. This is in direct contrast to a HACCP based system which is process-based.
- Canadian grain is already world renowned for its safety. It is unlikely that OFFS implementation will result in an increase in Canada's global grain market share.

Dairy sector

- The Dairy Farmers of Canada (DFC) and the CFIA developed the voluntary Canadian Quality Milk (CQM) program in late 2001. The CQM program details HACCP-based, national OFFS initiatives for the dairy sector. Stage one, the first of three stages, was completed in November 2003. Stage two, implementation and third party audit is underway.
- The CQM program has not yet gained wide acceptance among dairy producers. Enrolment is less than 3% of all Canadian dairy producers. Some dairy producers are concerned about the level of record keeping required.
- OFFS (CQM) programs will not affect market share due to supply management. The performance-based standards, which already exist in the dairy sector, have successfully prevented Canadian milk contamination. It is essential that the CQM program addresses domestic milk safety concerns because of the lack of exports.
- OFFS initiatives provide two types of benefits to dairy producers: 1) they provide insurance against food safety scares and 2) they can increase profits when OFFS trigger positive changes in consumers' preferences and/or cost efficiencies that are accompanied by proportional movements in prices and quantities.
- The CQM program contains some provisions for local environmental stewardship. There are no specific EFP initiatives for the dairy sector. However the Dairy Farmers of Ontario encourage the implementation of the Ontario EFP.
- The potential for an overlap between food safety and environmental initiatives in the dairy sector needs to be accounted for in the documentation and implementation of these initiatives to minimize complaints from time stressed farmers.

Table 5: Potential private benefits and costs of on-farm food safety systems

Demand-side benefits				
	Pork	Beef	Grains	Dairy
Domestic market				
Reduction of transaction costs for consumers	Yes – if safety image of pork enhanced	No – beef considered safe	No – existing safety record excellent	No – existing post farm treatment sufficient
Building consumer confidence	No – possible short-run premiums disappearing in long run	Yes – market share due to HACCP	No – areas of consumer concern not addressed	Yes – increased consumer loyalty
International Markets				
Differentiation on the international market	Yes – increased market share	Yes – market share due to HACCP	No – existing high reputation	Yes – lower trade barriers for some specialty products
Reinforce and develop trade networks	Yes – if Canadian product is differentiated on safety	No – other food safety initiatives dominate	No – existing high reputation	No – safety not really an issue
Facilitate trade by reducing non-tariff Barriers	Yes – full supply chain covered	Yes – full supply chain covered	No – current absence of safety related barriers	Yes – lower trade barriers for some specialty products
Supply-side benefits				
	Pork	Beef	Grains	Dairy
Efficiency gains at the farm level				
Improve the productivity of inputs	Yes – existing programs suggest increased efficiency	No – does not impact technical efficiency	Yes – improved awareness and management	Yes – improved awareness and management
Efficiency gains in the rest of the supply chain				
Lowers logistical costs	Yes – fewer product recalls	Yes – fewer product recalls	No – current bulk handling is low cost	No – no effect due to current cold chain system
Ex-post cost reduction following food contamination	Yes – fewer and less severe incidents	Yes – fewer and less severe incidents	No – existing high quality reputation	Yes – fewer and less severe incidents
Reduce measurement costs	No – existing programs maintained	No – existing programs maintained	No – OFFS unlikely to be less costly than current	No – existing post farm treatment sufficient
Reduce monitoring costs	No – existing programs maintained	No – existing programs maintained	No – OFFS unlikely to be less costly than current	No – existing post farm treatment sufficient
Reduce product liability costs	Yes – fewer and less costly court cases	Yes – fewer and less costly court cases	No – no new hazards addressed	No – existing post farm treatment sufficient

Table 5: Potential private benefits and costs of on-farm food safety systems (Continued)

Supply-side costs				
	Pork	Beef	Grains	Dairy
Management costs				
Fixed – establishing the HACCP plan	Yes – to establish plan but are very small	Yes – to establish plan but are very small	Yes – to establish plan but are very small	Yes – to establish plan but are very small
Compliance costs				
Fixed – capital costs	Yes – modifications of facilities	Yes – modifications of facilities	Yes – some upgrading of on farm facilities	Yes – modifications of facilities
Variable – self monitoring	Yes – record keeping	Yes – record keeping	Yes – record keeping	Yes – record keeping
Third party monitoring	Yes – when combined with quality audits	Yes – when combined with quality audits	Yes – move from point of delivery to on farm	No – existing system adequate

The results in Table 5 are of a preliminary and illustrative nature and are presented to illustrate the use of the framework⁵. Table 5 shows that the benefits and costs of OFFS are likely to vary considerably among sectors. The beef and pork sectors can be expected to garner more benefits than the dairy and grain sector. In part this arises because of differences in international markets. The grain sector is a relatively low risk sector for food safety, and the current grain handling institutions have already helped establish Canadian grains as a differentiated high value product in international markets. In the dairy industry, exports are constrained by existing trade barriers, after farm processing (pasteurization) provides high safety standards and there appear to be few possibilities for increasing markets with international product differentiation based on OFFS. In beef and pork, on the other hand, international markets are dynamic, relatively unconstrained by other forms of trade barriers and prospects for product differentiation on a positive food safety image are possible.

In all of the sectors the supply-side benefits from OFFS do not appear strong. In the beef and pork sectors there may be some supply side benefits from lower incidents of food safety breakdowns and the associated reduction in liability costs.

Costs are expected to rise in all sectors but for the most part are not expected to be large for voluntary industry programs. For some farms, modifications or upgrading of facilities may be required on a one-time basis. Ongoing record-keeping costs are likely.

5. *It should also be noted that the entries in table 5 are not definitive as there is considerable debate among those consulted in industry and government regarding both the benefits and costs. The intricacies of these positions are presented in full in the individual sector reports in this series.*

Table 6: Potential private benefits and costs of Environmental Farm Plans

Demand-side benefits				
	Pork	Beef	Grains	Dairy
Domestic market				
Building consumer confidence	Yes – in higher proximity areas	Yes – for niche market of eco-consumers	Yes – in areas where groundwater quality is an issue	Yes – for niche market of eco-consumers
Convey additional information	Yes – if can reduce negative publicity	Yes – if consumers care	No – organic alternatives exist	No – dairy has positive environmental image
International markets				
Differentiation on the international market	Yes – if niche markets exist	No – not on the basis of environmental stewardship alone	No – organic alternatives exist	No – will not offset other trade constraints
Reinforce and develop trade networks	No – benefits too small	No – benefits too small	No – organic alternatives exist	No – benefits too small
Facilitate trade by reducing non-tariff barriers	Yes – but only if barriers based on agricultural practices are allowed to arise	Yes – but only if barriers based on agricultural practices are allowed to arise	No – trade barriers not allowed based on production methods	No – environmental trade barriers non-existent
Supply-side benefits				
	Pork	Beef	Grains	Dairy
Efficiency gains at the farm level				
Improves efficiency in production	Yes – better awareness for some producers	No – no positive effect on efficiency	Yes – better awareness for some producers	No – dairy efficiency already high
Efficiency gains in the rest of the supply chain				
Reduces monitoring and enforcement costs	Yes – better legal defence	Yes – better legal defence	Yes – due to fewer incidents	Yes – better legal defence
Supply-side costs				
	Pork	Beef	Grains	Dairy
Management costs				
Fixed – establishing the EFP	Yes – management costs in plan design	Yes – management costs in plan design	Yes – management costs in plan design	Yes – management costs in plan design
Mitigation costs				
Fixed – capital costs	Yes – facilities modification particularly for manure disposal	No – facilities modification already done due to other programs	Yes – facilities upgrades on some farms	No – existing requirements lead to modern facilities in most cases
Variable	Yes – land management for manure disposal	Yes – land management for manure disposal	No – unless plan turns up a major problem	Yes – land management for manure disposal

Table 6: Potential private benefits and costs of Environmental Farm Plans (Continued)

Monitoring costs				
Fixed	Yes – cost of initial audit	Yes – cost of initial audit	No – no new equipment	Yes – cost of initial audit
Variable	Yes – compliance with land use regulations	Yes – compliance with land use regulations	No – little monitoring required	Yes – compliance with land use regulations

The results in Table 6 are of a preliminary and illustrative nature and are presented to illustrate the use of the framework⁶. Table 6 indicates considerable variation in the expected benefits and costs of EFP across the four sectors examined in these studies. Benefits were expected to be small in the grains sector because an environmentally friendly alternative already exists with organic production. Consumers who are concerned with the environment already have a means to express their preferences. In dairy, due to other constraints in the international market place and a positive domestic image, only limited benefits from EFP can be expected. In the pork and, to a lesser extent the beef industry, EFPs may provide considerable benefits if the environmental image of intensive livestock production can be improved. In the case of supply side benefits, there may be some lowering of legal costs in the case of an environmental accident.

Costs were expected to increase in all sectors. In the case of the beef, dairy and pork sectors, some farms will face increased manure/land management costs.

6. *It should also be noted that the entries in Table 6 are not definitive as there is considerable debate among those consulted in industry and government regarding both the benefits and costs. The intricacies of these positions are presented in full in the individual sector reports in this series.*



Chapter 7

Conclusion

The conceptual framework developed to assess OFFS and EFP aims to be as comprehensive as possible. All of the categories of benefits and costs will not be applicable to all sectors. One of the reasons for having a comprehensive framework is to encourage care in the analysis and to force those conducting the analysis to justify why a particular benefit or cost should not be included.

The conceptual framework formed the basis of the analysis in the pork, beef, grain and dairy sectors. The test cases indicate that the conceptual framework is robust across widely varying types of farm operations, supply chains and international markets. The results for the individual sectors are preliminary and qualitative, serving to illustrate the usefulness of the benefit-cost framework. Further work is required if quantitative estimates are to be obtained and full assessments made.

Each of the four sectors has implemented, or is in the process of implementing, a voluntary national HACCP-based OFFS. Only the hog sector has developed its own voluntary, national EFP. Currently, there are EFPs in Ontario and Alberta that are recognized by their respective provincial governments. These plans are not sector specific and are not continuously audited, with the exception of an initial examination.

Traditionally, the grain and dairy sectors have successfully relied on performance-based standards to ensure food safety and quality. A move to a HACCP, process-based OFFS could prove to be very expensive for the grain sector while yielding no measurable increase in food safety. The dairy sector may confront the same dilemma, although a HACCP based, OFFS may yield some additional food safety benefits. The dairy sector has a problem in that it cannot market its increased food safety and environmental sustainability internationally due to institutional rigidities.

The structure of the beef and pork sectors allows for relatively low cost product identity preservation when compared to the grain and dairy sectors. The beef and pork sectors have the potential to market OFFS and EFP internationally. OFFS may have an insurance role to play in reducing the risks of market loss due to a food safety problem. It is quite possible that packers will eventually require producers to be members of an OFFS to reduce their risks. However, pre-

miums are unlikely to be available in the long run. OFFS, and to some extent EFP, may yield productivity gains from producer education and closer attention to management issues on the farm operation.

Potential public benefits from EFP include reductions in ground water contamination, reduced odour, etc. However, producers with good environmental practices are those most likely to adopt EFP as their costs of doing so will be lower. Positive incentives or regulatory inducements may be necessary to facilitate widespread adoption of EFP in the absence of clear market benefits. Public benefits from voluntary OFFS appear more nebulous and will depend on the extent to which the programs lead to a measurable increase in food safety versus merely acting to reassure markets.

A comparison of these four sectors suggests that beef and pork sectors are likely to have the most to gain from HACCP-based OFFS and EPF initiatives. Again, it should be pointed out that these are preliminary qualitative assessments and that more work is required if quantitative estimates of the benefits and costs are of interest to decision-makers.