DRAFT
Version 1

Local Environmental Protection and Trade:

The Cases of Hog Production in Canada and Mexico

Prepared by

L. Martin Cloutier, Paul J. Thomassin,
Florence Dagicour, José-Carlos Rodríguez

for

The Second North American Symposium on Assessing the Environmental Effects of Trade

Commission for Environmental Cooperation

Mexico City, Mexico

25-26 March 2003

Executive Summary

Environmental concerns have been voiced with the expansion of trade under the NAFTA. A number of approaches have been suggested to ensure that the environment is protected under the agreement. These suggests, for the most part, fall into two broad categories: (1) command and control or (2) industry lead voluntary business initiatives. Each of these broad categories has its own set of advantages and disadvantages to provide the necessary incentives for producers to incorporate the environment into their production decisions.

Command and control policies follow the traditional regulatory approach that defines rules that are constraints on individual behavior. These constraints usually take the form of pollution standards or Pigovian taxes. However, standards and taxes are often difficult to enforce in the agricultural sector because of the non-point source nature of most agriculture pollution. As a result, many jurisdictions have chosen to define acceptable production practices that producers must adhere to.

Command and control policies have the advantage of being familiar to the agricultural sector. However, using this method to protect the environment will have some disadvantages. These advantages and disadvantages will be explored in the paper. They will include such things as: information costs in setting policy, enforcement costs, penalty setting requirements and incentives for producers to decrease their pollution further.

Industry lead voluntary business initiatives is a fairly new approach of environmental protection. With this approach industry initiates a program to protect the environment on a voluntary basis. The literature cites three broad reasons for industry to adopt this approach: (1) consumer demand for green products, (2) cost savings with changes in production effort, and (3) political motivation to avoid further increased regulation. Which of these reasons provides the incentive to adopt voluntary business initiatives depends on the location of the farm, the legal/political structure of the jurisdiction and the markets where the product is sold.

One of the main advantages for the voluntary business initiative is that it provides the producer with flexibility in dealing with environmental problems. Some of its disadvantages include: ensuring that claims of environmental protection are real, management ability of producers to implement such a program and monitoring costs. Finally, voluntary business initiatives can be structured in several ways. The choice of structure is important both in terms of determining the costs of the program for producers and providing a means for outside parties to verify the claims that are made.

Increased hog production between NAFTA countries has also resulted in growing local environmental concerns. These environmental concerns include water pollution (point and non-point), soil pollution, and air pollution that can result in health problems to the broader population. The goal of the research is to present a legal and economic treatment of the mechanisms available to provide incentives to ensure environmental protection in hog production. Potential measures of environmental protection include both voluntary business initiatives and mandatory regulations. The objective of the research is to determine which mechanisms best encourage less polluting methods of hog production in NAFTA countries while not creating trade barriers.

This research is interdisciplinary in nature (economics, management and law) and is being conducted using approaches specific to the objectives of the analysis. A case research study is undertaken to investigate two main hog production areas in Canada in Mexico. A review of the information available from government agencies and industry was conducted. The case research for the two regions is conducted. The case dwells on the pressures for environmental regulation (local v. international) and determines whether they are linked to trade imperatives. The cases report on production and exports trend data. In addition, data on regulatory environmental initiatives to manage manure and other environmental initiatives is analyzed.

An analysis of the legal tools available to provide incentives to encourage the application of environmental protection is presented. Mainly, the existing general and specific environmental regulation impacting on hog production was identified and analyzed. This involves an extraction of the different approaches, methods and principles used to ensure environmental protection regarding water, soil and air pollution. With this information in hand, we describe the objectives underlying those approaches. Also, the regulatory analysis described above is contrasted against an examination of general legal principles such as non-contractual obligations. This examination provides insight on how tort regimes deal with environmental harm. In others words, a case law analysis reveals whether and, if so, the extent to which, general law considers environmental pollution arising from hog production to be a harm leading to legal consequences.

The output from this research contribute to the growing debate on the role of voluntary business initiatives and mandatory regulations for the agriculture sector as a means of protecting the environment in the North American free trade context. It will identify the advantages and disadvantages of each approach, from both theoretical and practical perspectives, and illustrate how an integrated approach can be used to provide flexible mechanisms for producers that will fulfill environmental objectives, encourage trade and competitiveness in the agriculture sector in the long term.

Table of Contents

1.0 Introduction

The formation of large economic blocks of countries and increasing globalization attracts attention to the development of common institutions to make trade and economic agreements work. While global economic benefits and potentials often are publicized and emphasized in discussion, the management of the "details" on how to make these relationships between people and countries work is a tremendous challenge. Such details often are found in the local pressures and conditions to preserve various tangible and intangible aspects that may be seen as limiting the reach of global system-wide performance. A major source of protein for a large portion of the population on the world, pork meat production is an obvious case where the link between the environment and the use of the resource base is clearly established in many parts of the world. Certainly, the resource base and its management is an important factor in the future development of this sector on a world scale basis (Haley et al., 1998). Countries would like to strike a balance between protecting the environment locally while maintaining the competitiveness of the industry at the international level and enhance trade (Metcalfe, 2001).

Economists, management and legal researchers are interested in understanding the connection between environmental regulation, production, and ultimately the impact on trade and industry success. Within the North American context, it is interesting to look at the cases of hog production and to compare the experience of Canada with the one of Mexico. Canada is a major hog producing and exporting country of this commodity. Mexico has had a recent history of production growth and industry rebuilt, since its massive collapse of the mid-1980s. Both countries have employed different means to address the local concerns with the use of economic instruments and institution in managing public pressures about resource use and the quality of life, more generally.

The objective of this paper is twofold. First, the paper presents an overview of the economic literature related to the use of economic mechanisms to protect the environment. Environmental concerns have been voiced with the expansion of trade under the NAFTA. A number of approaches have been suggested to ensure that the environment is protected under the agreement. These suggests, for the most part, fall into two broad categories: (1) command and control or (2) industry lead voluntary business initiatives. Each of these broad categories has its own set of advantages and disadvantages to provide the necessary incentives for producers to incorporate the environment into their production decisions. These measures are examined and discussed in the paper.

Second, the cases of Mexico and Canada, and in particular, Quebec, are presented. At the time the research was completed, limited information was available for specific states in Mexico to fully develop a compelling comparison with Quebec. However, discussions with international trade representatives, and secondary literature, have allowed us to provide an overview of the general situation in Mexico on the production and legal environmental protection front in hog production. In Quebec, we have had a direct access to information sources that are allowing us to draw some conclusion between environmental regulation and production issues.

An analysis of the legal tools available to provide incentives to encourage the application of environmental protection is presented. Mainly, the existing general and specific environmental regulation impacting on hog production was identified and analyzed. This involves an extraction

of the different approaches, methods and principles used to ensure environmental protection regarding water, soil and air pollution. With this information in hand, we describe the objectives underlying those approaches. Also, the regulatory analysis described above is contrasted against an examination of general legal principles such as non-contractual obligations. This examination provides insight on how tort regimes deal with environmental harm. In others words, a case law analysis reveals whether and, if so, the extent to which, general law considers environmental pollution arising from hog production to be a harm leading to legal consequences.

This research is interdisciplinary in nature (economics, management and law) and is being conducted using approaches specific to the objectives of the analysis. A review of the information available from government agencies and industry was conducted. The case research for the two regions is conducted. The case dwells on the pressures for environmental regulation (local v. international) and determines whether they are linked to trade imperatives. The cases report on production and exports trend data. In addition, data on regulatory environmental initiatives to manage manure and other environmental initiatives is analyzed. The current situation is such that environmental regulation has not yet been linked to trade within current institutional framework. Of course, environmental regulation can limit output in certain areas and circumstances, and this would translate into lower output and ultimately exports. In fact, sanitary issues, appears to be a more important impediment to production in the short term in Mexico, which has a very technologically diverse industry.

The paper is organized as follows. After this introduction, in Section 2 there is an overview section on agriculture, the environment and trade. Section 3 presents and provides the definitions for the various economic instruments that deal with environmental regulation in agricultural production. Sections 4 and 5 look at production and trade data for the cases of Canada and Mexico. A discussion and conclusion, in Section 6, links economic instruments of environmental regulation with specific illustration of applications and the situations found in Canada and Mexico to further illustrate how these have been applied in practice.

2.0 Agriculture, Environment and Trade

The interaction between agricultural production and the environment will be discussed in the next section. Pollution problems associated with agriculture production are often different than those in other industrial section. This next section provides a brief review of agricultural production and how it impacts the environment. This is followed by a discussion on trade and the environment. Increased trade amongst the three countries under NAFTA will impact on the production undertaken in each country and this has environmental implications.

2.1 Interaction between Agriculture and the Environment

A by-product of agricultural production is the residuals that are left in the environment (Weersink et al., 1998). These residuals can be found in soil, water or air and can move over time and space. The size, concentration and movement of these residuals depend on the physical characteristics of the farm, for example soil type and typography, management practices that are undertaken, such as tillage practices, manure handling and storage, and climate conditions, such as the amount and timing of rainfall. The impact of these residuals on-farm can be loss of

productivity that will increase the cost of production for the producer. Off-farm costs, such as soil erosion and decreased water quality, are usually much larger and these cost are borne by other individuals in society (Braden and Lovejoy, 1990).

The impact of agricultural production on the environment is different from other industrial sectors for the following reasons: (1) the uncertainty in cause and effect relationships, (2) the large number of heterogeneous farms, and (3) the amount of non-point source pollution (Weersink et al., 1998). A large amount of the environmental impact from agriculture comes from residuals traveling through soil and concentrating or entering water systems. The movement of residuals through soil is poorly understood and thus it becomes difficult to identify from which field or farm the residuals originated from. This uncertainty in the relationship between farming practice, residual movement and environmental impact makes it difficult to identify an individual decision-maker with the environmental impact. In addition, the environmental impact from agricultural production will depend on the physical characteristics of the farm. As a result, the approach taken for environmental protection will have to take into account the heterogeneous mix of farms. Thus, an approach taken in one region may not be applicable in other regions with different physical characteristics. Finally, a large amount of agricultural pollution is characterized as being a non-point source of pollution. In these cases, the source of pollution cannot be identified back to a particular location. This makes policy design for environment protection more difficult because one does not have the exact location of the cause of the environmental effect.

Policy for environmental protection in most industries address the problem of point sources of pollution, with homogeneous production process and a well known cause and effect relationship between the pollutant and the environment. In the agricultural sector this is not the case. As a result, the approaches used in most other industries do not have the same effect on the agriculture sector.

2.2 Trade and the Environment

Multilateral trade agreements between countries provide the opportunity, for one or all countries party to the agreement, to increase output to satisfy the industrial and consumer demands in the other countries. This increase in economic growth, in terms of output, can have an impact on the environment when there exists a relationship between industrial output and pollution. Various authors have looked at the impact of trade on the environment in terms of changes in industrial inputs and outputs (Runge, 1995; Ulph, 1997), and transboundary pollution (Ulph, 1997), while other authors have analyzed the impact of trade on the environment in terms of incentives for firm behavior; in terms of plant location decisions and innovation (Tietenberg, 2000; Porter, 1991).

The theory of free trade is based on countries specializing their production in products that they have a comparative advantage in, as oppose to producing all goods themselves. Countries will have a comparative advantage in producing a good if it is relatively more efficient in producing that good than another. With this specialization, countries will use their relatively abundant resources and conserve their scarce resources. As a result, trade promotes allocative efficiency relative to a self-sufficiency situation. However, this changes the input and output mix of an

economy relative to the no-trade situation. These changes will have a scale effect on production in terms of both inputs and outputs. On the input side, this may result in increase use of particular inputs, for example land, water and air, which result in increased levels of pollution relative to the no-trade situation. Similarly, it would change the output mix of the economy, both in terms of relative and absolute outputs. It is usually thought that allocative efficiency impacts will have a positive effect on the environment, scale effects will be negative and output mix effects will be positive (Runge, 1995; Perman et al., 1999).

Transboundary pollution problems occur because of the spatial dimension of production and consumption. In this case, production or consumption in one country can effect the environmental quality in another country. Examples of these sorts of problems include air quality between Mexico and the United States and acid rain problems between the United States and Canada. Transboundary pollution problems can become more intense with the increased output that may result in one country's comparative advantage in production. Thus, a large number of plants could locate close to the border and increase the pollution problem. In these situations, trade policy could be used to reduce the importation of those goods that are associated with transboundary pollution (Ulph, 1997).

Some authors (Tietenberg, 2000) have looked at the impact of freer trade on firms' decision making with respect to plant location and the adoption of technology. For example, if one country has stricter environmental regulations than another country, then firms may relocate to those jurisdictions that have lower environmental requirements because of the corresponding lower cost of production. This would result in "pollution havens" where firms would migrate (Tietenberg, 2000). Individuals who live in countries or regions that have these lower standards may feel pressured to accept this decrease in environmental quality in order to keep employment opportunities.

M. Porter (1991) has argued that firms that reside in areas with higher environmental standards have a competitive advantage and not a disadvantage. This is because firms in this environment must be innovative and they will use this innovation to their competitive advantage. For example, firms in this situation would evaluate their whole production process to find areas where they could decrease costs, improve efficiency, and decrease pollution.

The literature is inconclusive on the impact of freer trade on the environment. The environmental impact of expanded trade will depend on a number of variables including: competitive advantage of the various parties, spatial location and the difference in the current environmental regulation. Institutional development in terms of policy development, implementation, and enforcement will determine the ultimate impact on the environment.

3.0 Mandatory versus Non-Mandatory Approaches to Environmental Protection

Environmental concerns have been voiced with the expansion of agricultural trade with NAFTA. The policy options available to decision makers to address these concerns fall into two broad categories (1) mandatory and (2) non-mandatory approaches to environmental protection. The mandatory approach to environmental protection has been used in the past to regulate industrial pollution. This approach includes command and control regulations such as emission or effluent

standards.

The non-mandatory approach uses economic incentives to influence the production and management decisions of the firm. These non-mandatory approaches can be broken down into two groups (1) taxes, subsidies and tradable permits and (2) voluntary programs. These voluntary programs are often referred to as business-led initiatives and rely on individual firm initiative to take proactive steps in environmental management.

The next section will discuss the interaction between agricultural production and the environment. This interaction has an impact on the approach chosen for environmental protection. This is followed by a brief description of the mandatory approach to environmental protection with its advantages and disadvantages. The non-mandatory approach is described next. The next section discusses the incentives to participate in non-mandatory approaches and compares the efficiency of mandatory and non-mandatory approaches. This is followed by a summary of the two approaches.

3.1 Mandatory Approach

Mandatory policies are those that require a quantitative or qualitative control on production. These controls can be in terms of output produced (either pollution output or final output), inputs used, technology required or the timing and location of polluting activities (Perman et al., 1999). These types of regulations are often referred to as command and control regulations and the most common of these are emission standards and effluent standards. The timing of hog manure spreading in Quebec over certain months of the year is an example of a mandatory policy.

This approach requires the state to identify an environmental objective and to quantify an environmental target. Once this is done, a standard can be developed that will fulfill the environmental target taking into account the number of firms in the region. In addition, the state must identify a penalty for those who violate the standard. This penalty must be set high enough to be a deterrent for breaking the standard (Perman et al., 1999; Randall, 1987). The advantage of a mandatory policy is that if a clear environmental target can be identified then it can be obtained with these controls as long as transaction costs are not too high.

The disadvantage of a mandatory approach is the potential size of the transaction costs. These costs will include information costs of determining the environmental target and setting the appropriate standard. Monitoring costs are another cost to the mandatory approach. In this case, individual firms need to be monitored to ensure that they are meeting the standards. Finally, there are enforcement costs for those firms who violate the standard. Violators will have to be penalized with fines or other actions and these must be collected upon (Randall, 1987).

In addition to these transactions costs that would occur in a static timeframe, there are also the dynamic transaction costs. Over time the number of firms or the output from the sector or the number of individuals in a region may change. Any changes in these variables require the standard be adjusted. As a result, the standard will have to adjust to this dynamic change in the region (Perman et al., 1999).

Finally, the development of emission or effluent standard usually requires a capital

investment by the firm. In these situations, it becomes difficult for regulators to change the standard once the firm has made a financial obligation in good faith to fulfill the standard. This results in grand parenting firms with previous standards that make it difficult for the approach to satisfy its environmental target over time.

3.2 Non-Mandatory Approach

The non-mandatory approach provides the firm or decision-making unit with the flexibility to adjust to the financial incentives or market demands. The first group of policies provides incentives for firms or decision-making units to adjust their behavior in response to such things as Pigovian taxes or subsidies or tradable pollution permits. The second group of policies is voluntary for the decision-making unit. These can be broken down further into three groups: (1) public voluntary programs, (2) bilateral initiatives, and (3) unilateral initiatives (Alberini and Sergerson, 2002; Khanna, 2001).

3.2.1 Pigovian Tax or Subsidy

The Pigovian tax was designed to bring social costs and private costs together in order to obtain efficient decision-making (Randall, 1987). It was recognized that private costs often did not take into account the social costs of the production process and thus resulted in a market failure. In particular, often the environment is used for waste disposal and the firm does not have to pay for this input. Putting a price on this input, that is a tax, provides an incentive for the decision-maker to take the environment into consideration when production decisions are made. Decisions then reflect all relevant cost, not just private costs, and will result in a socially efficient solution (Perman et al,. 1999; Randall 1987).

The advantage of a Pigovian tax is that it provides for a socially efficient solution if the tax is set at the appropriate level. Second, with a tax the firm will choose that technology or approach that is most cost effective for its operation in terms of providing abatement. Third, the tax also provides an incentive for firms to invest in research and development to decrease its environmental impact. Any decrease in environmental impact will decrease the tax that would have to be paid to the state.

A disadvantage of the tax is the information required to set the tax at the appropriate level. The tax should be set at the value of the marginal damage at the efficient level of pollution (Perman et al., 1999). This tax rate can only be determined once the marginal damage and marginal benefit curves have been estimated for the pollution, a difficult objective to meet in practice. Another disadvantage of the tax is that firms have to be monitored to determine the level of pollution generated. This information will be used with the tax rate to determine the total cost to the firm. In addition, the implementation of a Pigovian tax often comes under-attack by industry who argue that it makes the sector less competitive. Finally, the tax rate would have to change as the marginal damage and marginal benefit curves change over time (Perman et al., 1999).

Though the Pigovian tax and subsidy provide the same level of abatement at the firm level, the choice of instrument will have an impact on the long run solution. A subsidy program attracts activity into the sector and thus increases the number of firms. This results in distributional

impacts on the solution.

Pigovian taxes are used in the agriculture sector. In Mexico, a tax is paid for the right to discharge wastewater into the national water system.

3.2.2 Tradable Permits

A tradable permit system creates a property right to pollute for the firm. For this system to work, the following must be undertaken: (1) an authority must determine the target level of pollution and then generate the number of permits that is equal to that amount, (2) all firms must have permits for the pollution that they generate, (3) the mechanism for initial allocation of permits must be determined, and (4) emissions permits can be traded amongst firms (Perman et al., 1999). Firms with higher costs of abatement will be willing to purchase permits from firms that have lower costs of abatement. The market price for permits is determined by the supply and demand for permits. Allowing for transferable permits ensures the target is met at least costs.

The advantage of the permit trading system is that once the target is set, firms can choose that combination of abatement and permits that best suits their situation. It supplies a given level of pollution abatement at least costs and firms with lower cost of abatement supplying more abatement and higher cost abatement firms supplying less. It provides an incentive for firms to invest in research and development in pollution abatement because they are able to sell any excess permits in the market (Randall, 1987).

The disadvantage of a permit trading systems is the cost associated with establishing an authority to oversee the development of permits and the initial allocation amongst firms. As with the other approaches, a pollution target must be established. Second, the initial allocation of permits can often be contentious. Third, polluting firms must be monitored to ensure that each firm has the required number of permits for the pollution that is generated. Finally, an enforcement system with penalties must be developed for firms that violate their permitted pollution level (Perman et al., 1999).

3.2.3 Public Voluntary Programs

These types of programs are based on a public agency determining the eligibility criteria for participating in the program and defining the rewards and obligations of the firms (Alberini and Segerson, 2002; Khanna, 2001). Individual firms are free to join the program, if they fulfill the eligibility criteria, and are willing to fulfill the obligations of the agency. Examples of public voluntary programs in agriculture include the Conservation Reserve Program and the Environmental Quality Incentives Program in the United States. These programs use a cost sharing arrangement where producers withdraw from production highly erodible lands and manage their nutrient applications in order to decrease non-point source pollution (Ribaudo and Caswell, 1999). In Quebec, a voluntary program has been developed to improve manure handling, storage and treatment. With this program producers receive a subsidy for the construction of manure handling systems if they meet government approval (MAPAQ, 2002).

The advantage of these types of programs is the flexibility for decision-makers to access the program. The firm level decision-maker can decide whether or not the rewards associated with the program are greater than the obligations. It should provide a cost effective means of obtaining a pollution target. The disadvantages of the program are that an agency has to determine the rewards, obligations and eligibility criteria, which is a cost to the agency. The agency will also have to monitor and enforce these agreements.

3.2.4 Bilateral Initiatives

An individual firm and a public agency enter into this program. In this case, the rewards and obligations are negotiated between the firm and the agency (Alberini and Everson, 2002; Khanna 2001). Specific abatement targets are identified and binding contracts with the firm are signed. The major advantage of this program is the flexibility it provides for firms to develop pollution abatement strategies for their specific site. This can increase efficiency and innovation. However, it also increases information, monitoring and enforcement costs for the agency.

3.2.5 Unilateral Initiatives

These initiatives come from the firm and do not need approval from an environmental agency. The types of initiatives that fall into this group include: (1) individuals who develop their own environmental plan, (2) individuals who follow the guidelines of an association, and (3) individuals who follow the standards of a registered certified body (Khanna, 2001). Two examples of the last type of program in agriculture are farms that become certified organic and ISO 14000. Organic producers must follow certain production practices to qualify for organic certification. In January 2003, Du Breton Farms in Quebec completed the certification process for organic pork. This required them to document that all feed was certified organic and that the animals were provided safe and spacious housing (Macleod, 2003).

ISO 14000 is an international certification process that incorporates an environmental management system (EMS) into the operation of an individual firm. ISO 14000 is not a quantitative standard but a management process. Certification for ISO 14000 requires a third party audit of the organization (Kuhre, 1995). The five major steps to ISO 14000 are: (1) writing an environmental policy for the firm, (2) planning the firm's EMS, (3) implementing the EMS, (4) checking the EMS and taking corrective actions where necessary and (5) management review of the EMS (CSA 2002; Khanna 2001; Kuhre, 1995; Lussier et al., 1997; Wall et al., 2001).

Both organic production and ISO 14000 allow for the development of eco-labels that provide signals to consumers about the characteristic of the product (Khanna, 2001; Karl and Orwat, 1999). Educating consumers about the characteristics of a product can change their purchasing behavior. This can result in an increase in market share (Teisl et al., 2002) and/or a price premium being received for the product (Moon et al., 2002).

3.3 Incentives to Participate in Voluntary Initiatives

Traditionally, the profit-maximizing motivation of the firm was seen as a hindrance to voluntary initiatives because firms were assumed to be price takers who respond to exogenously determined environmental regulations (Cropper and Oats, 1992). This view has been revised by taking into account that voluntary initiatives may be in the firm's economic interest. The supporting arguments include: environmental stewardship incentives, market incentives, government incentives, regulatory avoidance and industry incentive (Alberini and Segerson, 2002; Khanna, 2001; Videras and Alberini, 2000).

Alberini and Segerson (2002) identify environmental stewardship as an incentive for adopting voluntary initiatives. Environmental stewardship is motivated by personal satisfaction or the utility generated from following particular production practices that are beneficial to the environment. This can also be motivated by a bequest value that would occur with the inter-generational transfer of the farm.

Market incentives for adopting voluntary initiatives are important if they can impact either the cost of production or the value of the output. Certification programs such as ISO 14000 are promoted as providing a management tool that can potentially decrease costs through better management of resources (Bansal and Bogner, 2002; Kuhre 1995; Wall et al, 2001). In addition, other input costs may decrease with a recognized initiative through decrease loan costs as a result of lower risk associated with the operation. Whether or not input costs increase or decrease depends on a number of factors that are particular to the firm, institutional arrangements and region (Bansal and Bogner, 2002).

Voluntary initiatives can increase the revenue of the firm by increasing market share or providing a price premium for the output produced with product differentiation using eco-labels (Moon et al. 2002; Teisl et al., 2002). Voluntary initiatives can also play a role in providing access to foreign markets with a recognized eco-label. The size of the market premium for differentiated products will depend on the long run supply and demand for the product.

Government can create the incentive to participate in voluntary initiatives by subsidizing the participation of the firm (Alberini and Segerson, 2002; Khanna 2001). The agency can support some or all of the financial obligations of the participant. This limits or protects the firm from the costs associated with the voluntary program. This type of assistance can include technical assistance and information. This approach was used in establishing the Ontario Environmental Farm Plan initiative. In this situation producers were given technical assistance and a $1,500 financial incentive to complete the Environmental Farm Plan (Weersink et al., 1998).

Firms can also be motivated to enter into voluntary initiatives as a means to avoid regulation (Alberini and Segerson, 2002; Khanna, 2001). Government can threaten to use mandatory regulation to motivate firms to participate in voluntary initiatives. A voluntary initiative program can have lower costs and greater flexibility for the firm than a mandatory

regulation and thus would be a preferred option. The usefulness of this motivation will depend on the credibility of the threat by the government agency (Alberini and Segerson, 2002; Khanna, 2001).

Finally, governments may try to negotiate with industry associations for the establishment of voluntary initiatives (Alberini and Segerson, 2002). In this case, there is a potential for a free rider effect for individual firms who may not want to join the initiative if other firms will satisfy the government requirement. However, there is an additional incentive for firms that do join the initiative to provide additional abatement equal to the higher cost associated with mandatory regulations. Even though a sub-optimal number of firms participate, each individual firm that does may provide additional abatement to avoid the higher cost of mandatory regulation.

3.4 Efficiency of Mandatory and Non-Mandatory Approaches

The efficiency of mandatory and non-mandatory approaches to environmental protection will depend upon a large number of factors. It is usually assumed that approaches with the greatest degree of flexibility satisfy environmental goals at lower costs (Alberini and Segerson, 2002; Khanna, 2001). This is because firms are able to choose the most appropriate means to provide abatement at the least costs. Once flexibility is restricted, with such things as mandatory technology, individual abatement costs tend to increase. When comparing the two extremes, mandatory regulations with an identified technology versus a unilateral initiative, one would expect the abatement costs for the unilateral initiative would be lower (Segerson and Dawson, 2001). However, when the alternative approach provides flexibility, such as a permit trading system, then the cost differential between the permit trading system and a unilateral initiative would decrease.

An efficient allocation of abatement would occur when the marginal cost of abatement for each firm is equal (Field and Olewiler, 2002). It has been demonstrated that a Pigovian tax can provide such a solution if the tax is set at the appropriate level (Randall, 1987). Whether or not a voluntary approach provides an efficient allocation depends on a number of factors. If the voluntary initiative is going to be negotiated between the regulator and the firm, then an efficient outcome is more likely if: (1) the regulator has a creditable mandatory threat, (2) the social cost of subsidies are low and (3) the regulator has bargaining power with the firm (Segerson and Miceli, 1998).

Wu and Babcock (1999) compared the relative efficiency of voluntary and mandatory environmental regulations for the agriculture sector. They concluded that the efficiency of the voluntary approach relative to the mandatory approach depends on the deadweight loss associated with government expenditures for the voluntary approach and the private and public costs of the mandatory approach. If the deadweight loss of the voluntary approach is less than the difference between the private and public costs plus the implementation costs then the voluntary approach is more efficient (Wu and Babcock, 1999). When reviewing the Environmental Quality Incentive Program and the Oregon Salmon Habitat Recovery Program, these programs had the characteristics that favored the voluntary approach (Wu and Babcock, 1999).

3.5 Summary

The early work on the development of voluntary initiatives identified four required areas for policy development. These were: (1) that environmental objectives would have to be clearly defined and that producers should be given the flexibility to meet these objectives, (2) the management skills of agricultural producers would have to be increased, (3) that transaction costs would have to decrease for the new production and marketing systems, and (4) new research and technical development on public goods (Batie and Erwin, 1997). They recognized that greater flexibility was needed to address problems of non-point source pollution than the mandatory approach that had been applied in the past. However, they also indicated that there must be a relationship between the environmental regulation and the market mechanism. If this relationship did not exist, then the threat of mandatory regulation would have to be used to provide the incentive for producers to supply voluntary initiatives (Batie and Ervin, 1997).

Other authors concluded that greater efficiency and effectiveness can be obtained with environmental regulations that are based on voluntary initiatives because they can have lower transaction costs and introduce greater flexibility than mandatory programs (Alberini and Segerson, 2002; Khanna, 2001). However, they also recognized that it was important that the regulatory agency have a strong and credible threat of mandatory regulation. The threat of mandatory regulation is needed to increase the incentive for producers to participate, to increase the bargaining power of the regulatory agency and to decrease the need for financial incentives to be supplied by the regulatory agency (Alberini and Segerson, 2002).

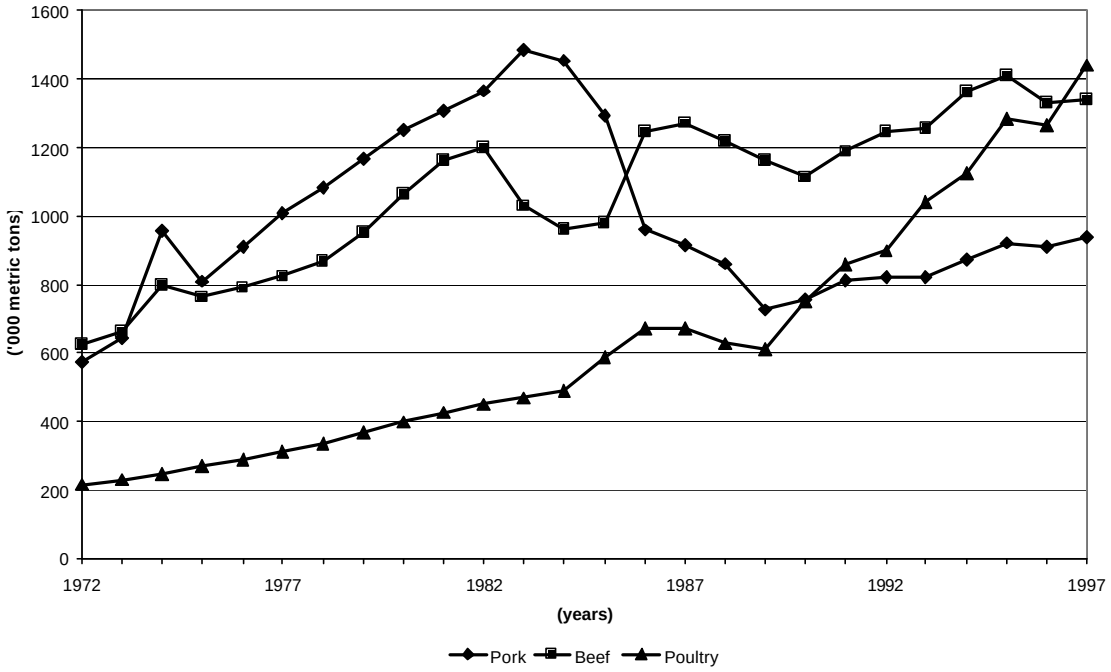
Voluntary initiatives are considered more effective when there are a few, homogenous producers willing to cooperate (Khanna, 2001). A reliable monitoring system also provides support for the development of voluntary initiatives (Alberini and Segerson, 2002). Finally, government could promote the creation of product labels to generate market incentives for product differentiation and provide additional incentives for producers to participate in voluntary initiatives (Khanna, 2001).

The choice of mandatory or non-mandatory approach to environmental protection depends on a number of factors such as the type of pollution, its spatial dimension and industry structure. There is no blanket approach that suits all situations (Alberini and Segerson, 2002; Khanna, 2001). In many instances, a mix of approaches may be appropriate in order that the proper incentives are given to firms (Weersink et al., 1998).

4.0 Hog Production in Mexico

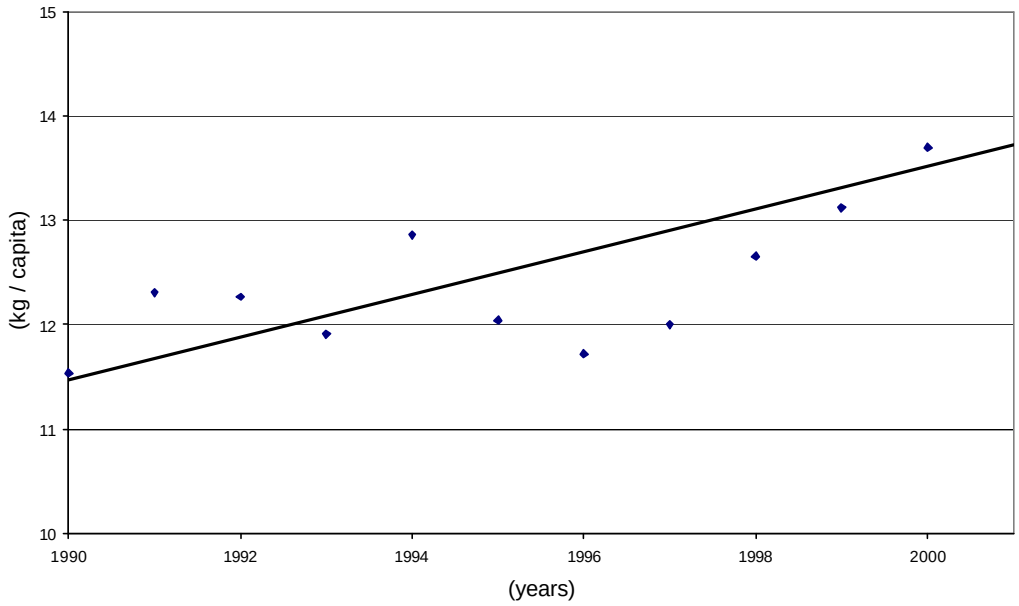
The pattern of emergence of the hog industry in Mexico since the early 1970s had been one of steep growth up until its massive collapse of 1984, and of re-growth since then. Prior to 1984, the industry had assimilated production technology allowing it to grow. As seen on figure 1, the hog production sector supplied nearly 50 percent of meat output at that time. In the early 1980s, the government had heavily subsidized animal feeds (sorghum). Following the withdrawal of that program in 1984 input costs rose only to cause production to shrink until 1989 to nearly 1972 levels. Since then, the industry has rebuilt almost to pre-1984 levels. As seen in figure 1, the industry has taken over 20 years to reach pre-1984 production levels. However, today's hog production is lower than both poultry and beef in terms of output measured in tons.

Figure 1. Pork, Beef, and Poultry Production in Mexico 1972 - 1997



But, hog production now trails beef and poultry consumption in the country. Consumers in Mexico have become more health conscious and prefer poultry meat because of the lower fat content of that protein source (Cite here). Nonetheless, the per capita consumption of pork meat seen in figure 2 displays an upward growth trend of 30 percent between 1990 and 2001 (SAGAR, 1998).

Figure 2. Pork meat consumption trend in Mexico
1990 - 2001



Recent production trends on production for the most important producing states provide a more detailed picture of the local industry situation. As seen on figure 3, a map of Mexico highlights that production is concentrated in six states. In decreasing order of importance for 2001, these are: Jalisco (25 percent), Sonora (16 percent), Guanajuato (9 percent), Yucatán (8 percent), Puebla (8 percent), and Michoacán (5 percent). These six states represented 70 percent of pork production in the country in 2001, up from 68% in 1994, when the NAFTA was introduced, a nearly flat trend.

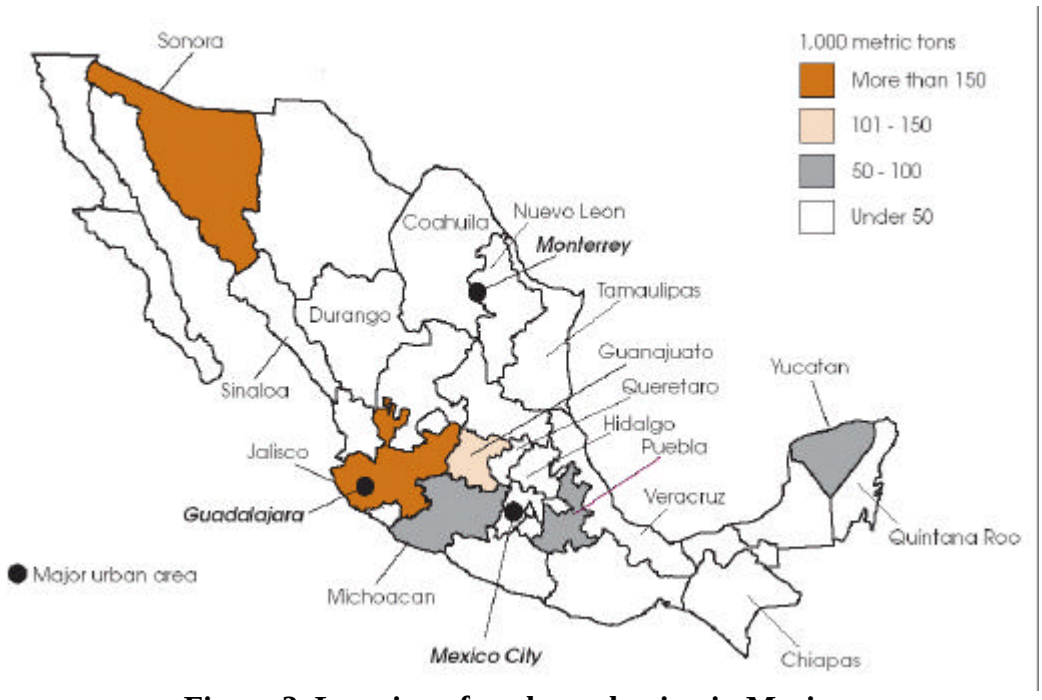


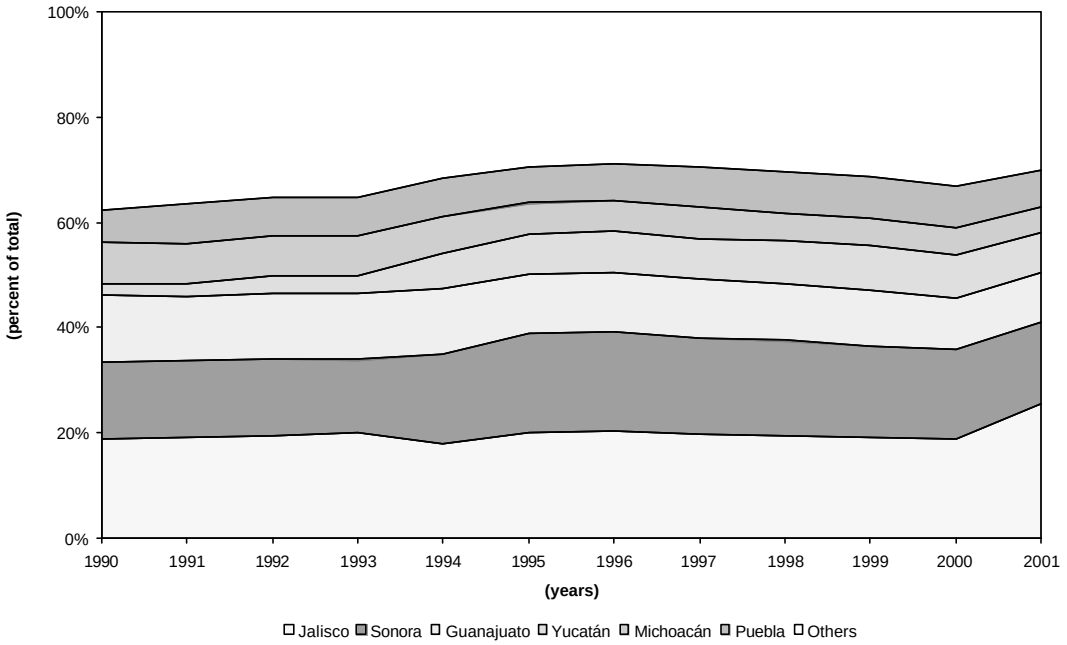
Figure 3. Location of pork production in Mexico
(Source: Southard (1999, 28))

Pork production trends for the six major production states are presented in figure 4. As can be seen there is an overall upward trend in production for these more production intensive areas. The percentage distribution from total output reported on figure 5 also shows a greater proportion of the total in the six states identified as major locations for hog production in Mexico. Clearly, more recent production figures show a general steep upward trend between 1994 and 2001 of 31 percent for the country overall. During the 1994 – 2001 period the six major production states have experienced mixed growth patterns. For instance, Jalisco, already Mexico's largest pork producer, has grown by 87 percent during that period, while Yacatán's output has risen by 46 percent, and Sonora by 20 percent. Two of the largest production states of Michoachán and Guanajuato's have declined in output by 12 percent and 2 percent, respectively. The remainder of the country's production growth has increased by 33 percent. Other areas of the country have witnessed increases in hog production between the 1994-2001 period. These states include: Tamulipas (95 percent), Nuevo Leon (13 percent), Quintana Roo (41 percent), and Hidalgo (7 percent).

The hog industry in Mexico has loosely been described as comprising three types of operations (Southard, 1999). These are technology enhanced production systems, small commercial production systems, and traditional backyard production systems (SAGAR, 1998; Southard, 1999). These production systems are characteristic of the geographical location and also are defined by varying degree of upward vertical and horizontal coordination with the remainder of the supply chain. There are large differences between these regions.

The most technologically advanced swine production units are based in north central state of Sonora and to a much lesser extent Sinaloa. But also, some are emerging in non-traditional areas as well (Southard, 1999). These operations use state of the art technology such as three-site production techniques. The production process helps maintain some degree of conformance to production standards, including the maintenance of nutritional consistency. The product tends to be standardized. Efforts are being make with respect to sanitation and biosecurity measures in order to maintain the zones disease free. If these production facilities are downstream integrated with a slaughter facility they may be part of the TIF ("*Tipo Inspection Federal*") model, the only ones allowing for pork meat exports. Roughly a third of the national herd was slaughtered through these facilities in 1997 (SAGAR, 1998).

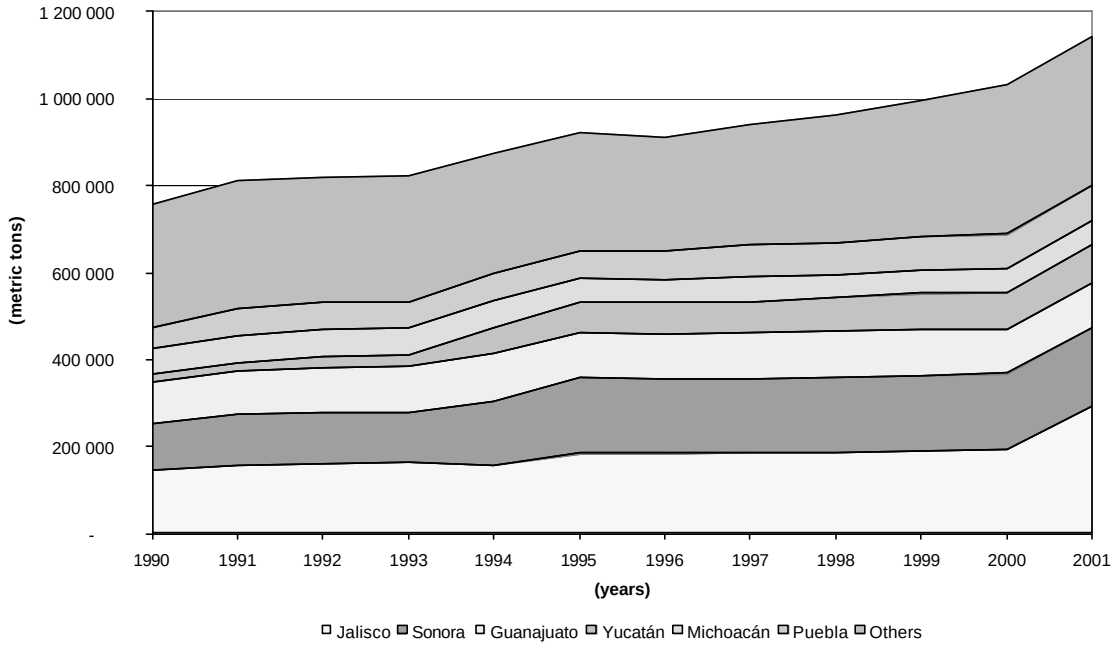
Figure 5. Pork Production Distribution Trends for Six Major States in Mexico 1990 - 2001



The region Pacifico-Centro responsible for 40% of the country's pork production in 2001 includes the states of Jalisco, Guanajuato, and Michoacan. These states include operations that use middle to advanced production technology. Efforts are made to use balanced feed diets and to develop specialized facilities. Only a small proportion of the operations use three-site production methods. These operations are located near Mexico City and are a main source of supply into that market. Animal feeds also are produced locally and this contributes to maintaining input and transportation costs at a lower level (Mendez and Lara, 1996). About one third of pork was slaughtered in that area in 1997 (SAGAR, 1998). The consistency of hogs is not maintained and slaughter facilities used are municipal or private ones serving the local market. These slaughter facilities do not necessarily meet the standards found in TIF models.

The "backyard" type production is found everywhere in the country and constitute a sizable contribution of national output accounts for about one third of the national output. This mostly involves family labor and does not use specialized facilities. It helps generate complementary income for these families. This production does not enter traditional distribution channels, but efforts are underway to improve sanitary conditions associated with this type of production.

Figure 4. Pork Production Trends for Six Major States in Mexico 1990 - 2001



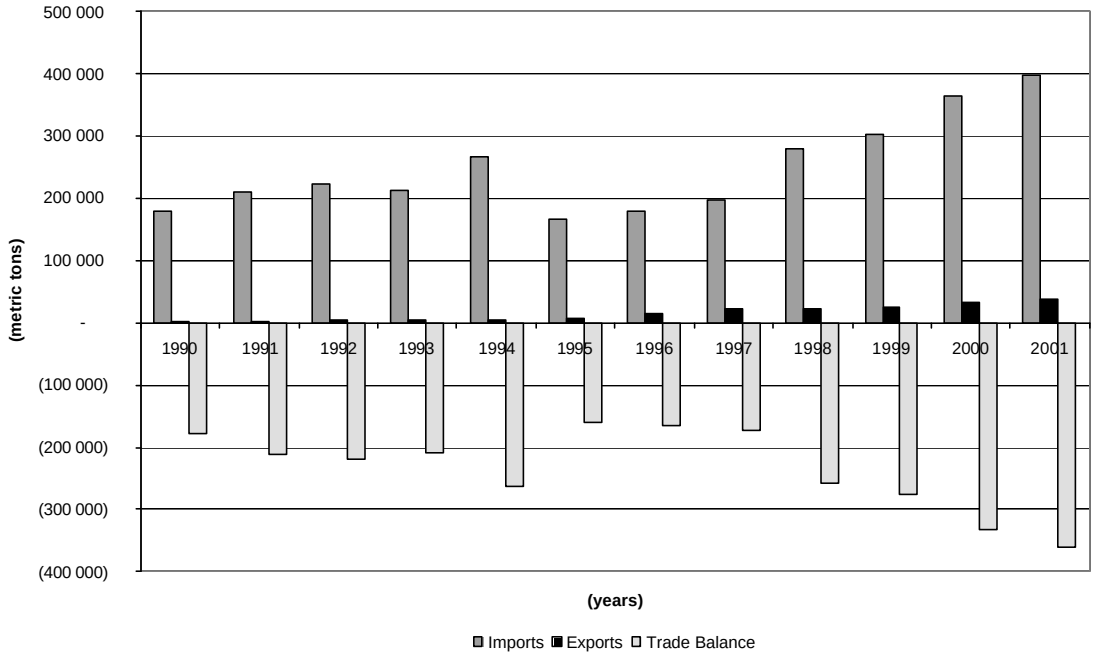
Although, there has been a constant upward trend in pork production since 1990, it is clear that the total domestic disappearance also has risen by 32 percent between 1994 and 2001, from 1.135 million tons to 1.503 million tons. As a result, the country has been increasingly reliant on imports as can be seen in figure 6. From 19.2 percent of the total apparent consumption in 1990, pork meat imports have reached 26.4 percent in 2001. The trend in pork meat trade balance deficit can be seen on figure 6. During the same time period, pork meat exports have risen by an incredible 7041% percent. But the export figures are really small relative to imports and the trade deficit is increasing sharply. This even if poultry meat has become an important substitute in pork meat processing as can be seen from the poultry production trend in figure 1 (Sagarnaga et al., 1999).

Preoccupation with NAFTA and Environmental interventions means creates more pressure to establish production standards similar to the ones found in the Unites States and in Canada. The operations have become more preoccupied with financial viability. There have been only a handful of enterprises from Canada and the US that have established hog production facilities in Mexico.

With respect to link between trade and the preservation of the natural resources and of the environment, there are no concrete limitations at the present time (Pérez Espejo, 1998). The most important aspect is sanitary that can restrict exports to the United States. But the fact that the environment is not currently a limitation to trade does not mean that is may not become one in the near future (Pérez Espejo, 1998).

It appears to be an objective to maintain a significant increase in pork production in Mexico. As things stand, hog inventories will have to increase to meet these goals and this means greater pressure on natural resources and the environment. One can also anticipate that operations that could help meet these production levels would be larger in size and more technologically enhanced, which in turns implies more intensive production methods. As reported in Southard (1999), larger hog operations are advantaged by the cost structure and other credit access conditions, unavailable to smaller operations. Smaller operations also have seen their margins squeezed because they are not vertically coordinated with upstream feed milling activities allowing them to gain from high volume throughput.

Figure 6. Imports and Exports Trends in Mexico
1990 - 2001



Since 1989, gains in hog production have been realized by increasing hog inventory rather than by the widespread introduction of new farming techniques. If these trends were to continue, more pressures are likely to result on water and land resources (Pérez Espejo, 1998). The diffusion of management techniques to reduce the environmental impacts is slow and not sufficiently known.

4.1 Mexico's Legal Response to Environmental Impacts

In Mexico, the General Law on Ecological Balance and Environmental Protection (LGEEPA) has regulated environmental protection since 1988. Similar to the Quebec Agriculture Act, the LGEEPA was significantly revised in 1996 to better allocate resources and establish delegation of environment-related powers.

The LGEEPA marginally applies to the protection of the environmental resulting from agricultural activities. For example, agricultural wastes and odors from agricultural sources are not included within its scope. However, farming wastewater discharges as well as other forms of wastewater discharges that could infiltrate the soil or subsoil, must not pollute the recipient body and not disturb, impede or alter the natural function and capacity of any water reservoirs owned by the Nation. While its article 28 provides for an environmental impact assessment process in the case of intensive livestock operations, this requirement has never been implemented.

Another major federal instrument regulating environmental protection resulting from agricultural activities is the National Water Law. This act requires permits and licenses for water use and discharge, to which conditions are attached.

Initially centralized at the national level, environmental laws are increasingly becoming a state or local competence. However, none of the states have amended their environmental laws to reflect the 1996 LGEEPA amendments.

Conditions to the operation of agricultural activities are established under state legislation. An example is the requirement of an environmental impact assessment for the operation of waste treatment facilities, sanitary landfills, and wastewater or non-hazardous solid waste disposal. However, as in other matters, state powers related to environmental impact assessment are often delegated to municipalities through the signature of coordination agreements. It is believed that local governments will achieve the end goal. Therefore, unlike Quebec, the trend in Mexico is a process of "municipalization" with a development of municipal environmental protection by-laws applicable to livestock activities.

As for substantive law, Mexico differentiates itself from Quebec in several ways. First, no MDS are required in Mexico although exceptions are to be found in some municipal by-laws on livestock activities in urban areas. Second, there are no environmental requirements associated with livestock building permits issued by municipalities. Third, although restrictions on discharges into water bodies exist, waste management is generally unregulated.

Mexico is similar, however, to Quebec in that neither has a moratorium on new facilities or expansions, though the construction or expansion of new facilities is prohibited in a few zones.

In conclusion, the Mexico's legal response to environmental concerns resulting from hog production appears minimal. While a general low priority given to environmental policy partially explains this situation, the political and economical context plays a major role as well. One example of this is the reluctance to make long-term investments necessary for effluent treatment systems resulting from the fast growing towns and small cities, which force farmers to move

away.

5.0 Hog Production in Quebec

Hog production is a key economic activity of overall agricultural production in Quebec (MAPAQ, 1998; Van Nieuwenhuyse, 2002). Producers are grouped into the *Fédération des producteurs de porc du Québec* ("Federation of Quebec pork producers") and horizontal coordination is practiced for the commercialization of live hogs. The Quebec government has been increasingly involved as a regulator in the environmental management of that production.

Following pressures from the public over the years, the production has experienced increasing environment stringency. A moratorium on the expansion of hog production was introduced in Quebec on June 14, 2001. The *Bureau d'audiences publiques en environnement* (BAPE – "Bureau of public hearings in the environment") is currently running hearings on the environmental sustainability (including economic and sociological) of hog production in Quebec. These hearings began on October 22, 2002, and the final report of the BAPE is due on September 15, 2003 (see <www.bape.gouv.qc.ca/sections/mandats/prod-porcine/index.htm>.)

The consumption of pork meat in Quebec is about 25 kg per capita per year. This is about twice the amount reported for Mexico (see figure 2).

Looking back at the evolution of production in this sector provides some perspective of its importance to the province's agrifood accounts. It is first important to note that Quebec's agrifood trade balance is positive since 1995, mostly due to exports of products from the hog industry.

Figure 7. Total Hog Marketed in Quebec and Number of Operations
1990 - 2001
(Source: Statistics Canada)

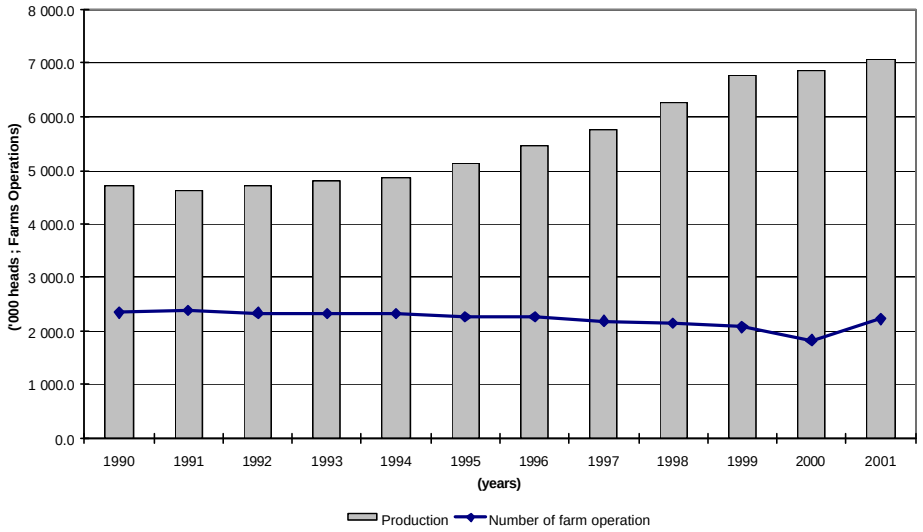
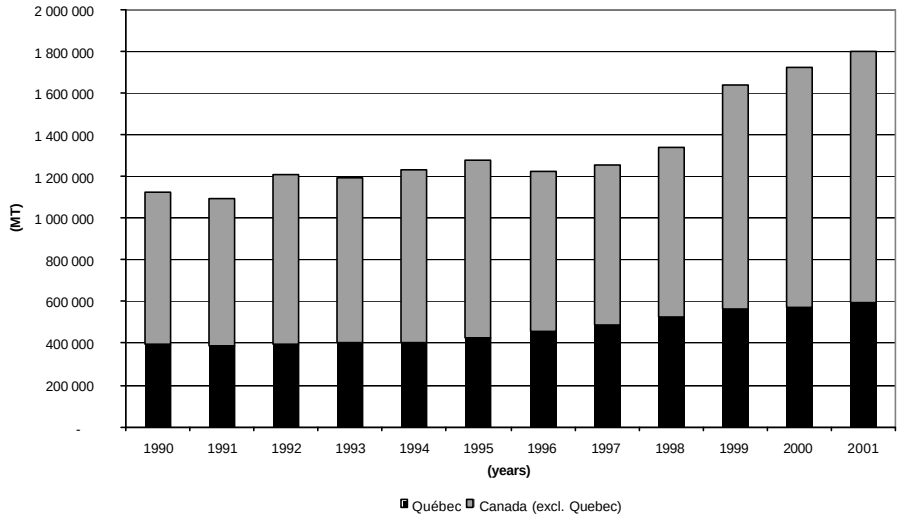


Figure 7 shows the trends in total hog marketing in Quebec compared with the trend in the

number of farm operations in the sector. As can be seen, since 1994, the year of reference for the introduction of NAFTA, the number of farm units had, by 2001, slightly declined by 4 percent. However, the number of hogs marketed during the 1994 – 2001 period has risen by 46 percent,

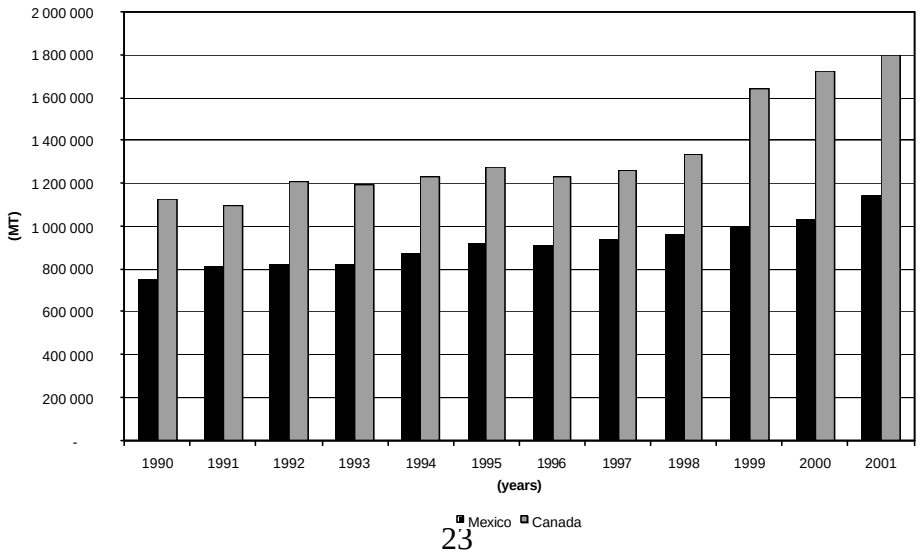
Figure 8. Pork Production: Quebec and Canada (excl. Quebec)
1990 - 2001
(source: Statistics Canada)



and revenue by 79 percent. These trends clearly show how the industry has progressed in terms of output and that production units have become larger.

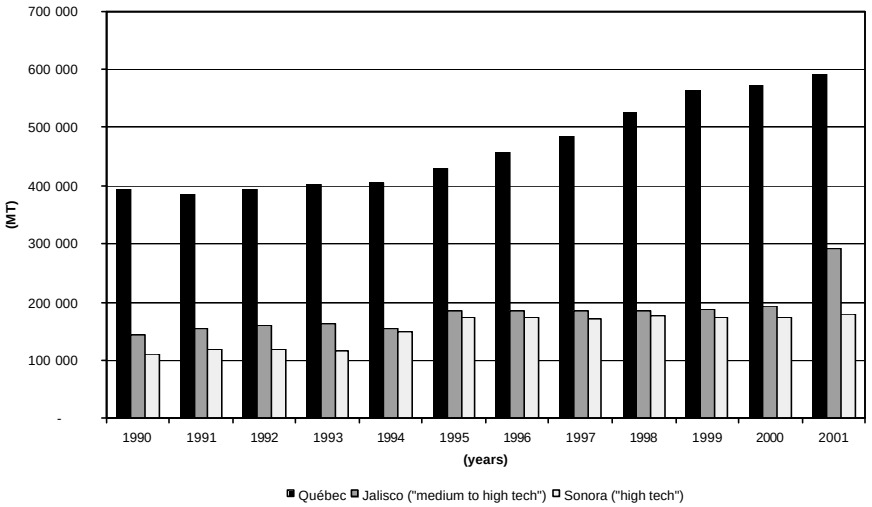
The share of Quebec hog production represents about 35 percent of overall production in Canada. From the data displayed in figure 8, we see that production trends in Quebec are parallel over time to the ones observed at the national level, as they both have increased by 46 percent during the 1994-2001 period. Total pork products for Quebec had reached 592,5 metric tons in 2001, while in Canada (excluding Quebec) 1 207,1 metric tons of pork products were marketed. Overall national output was 1 800 metric tons in 2001.

Figure 9. Pork Production in Mexico and Canada
1990 - 2001
(Source: SAGAR, Satistics Canada)



A comparison between trends in overall output between Canada and Mexico shows varying speed of growth between 1994 and 2001. During that period, Mexico's pork production has increased by 31 percent, while Canada's production has risen by 46 percent. Recall that in 1984, Mexico's output was 1,4 million metric tons, a level that Canada has achieved only by 1999. As seen on figure 9, since 1990, Mexico's production represents, on average, 68 percent of Canada's production measured in metric tons.

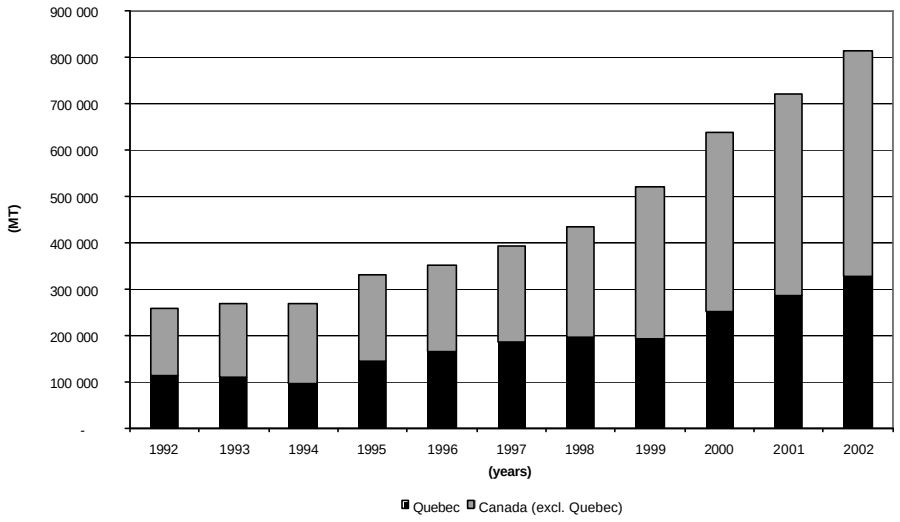
Figure 10. Pork Production in Quebec vs. Jalisco and Sonora
1990 - 2001
(Source: SAGAR, Satistics Canada)



Another interesting point is that Quebec's output in pork meat is on average half of that of Mexico's. However, it is interesting to compare overall Quebec production with two states in Mexico. On Figure 10, production trends compare Quebec with Jalisco, the most important production state in Mexico, and with Sonoma, another important production area located in the north of the country. Recall that Sonoma possesses state of the art production facilities and these operations tend to be vertically upstream coordinated for feeds and they can export their products to the United States. Jalisco, on the other hand, has a larger production volume, but its production is destined to the markets of large cities. As can be seen, the output in Jalisco, has skyrocketed by 87 percent during the 1994-2001 period, while the growth in Sonoma, has followed a more modest growth pattern of 20 percent. The production levels of Jalisco and Sonoma represent about 40 percent and 29 percent that of Quebec on average, respectively, for the period considered.

The increase reported in pork production in Canada and in Quebec has translated into important gains in exports. The data on figure 11, highlights that during the 1994 – 2002 period, Quebec exports have increased by 190 percent, to reach an actual export level of 326 024 metric tons in 2002. In Canada, the increase in exports was even more fast-paced at 216 percent for the same period. Quebec's share of Canadian exports of pork products is about 42 percent.

Figure 11. Total Pork Exports: Quebec and Canada
1992 - 2002
(source: Statistics Canada)



Quebec pork exports to Mexico are about 1,5 percent of total exports. Recent trends related to these quantities are displayed in figure 12. As can be seen in figure 13, the overall share of Quebec's exports to Mexico within Canada is declining. Thus, the lack of infrastructure for delivery makes is difficult (MAPAQ, 1998).

Figure 12. Total Pork Exports to Mexico: Quebec and Canada (excl. Quebec)
1999 - 2002
(source: Statistics Canada)

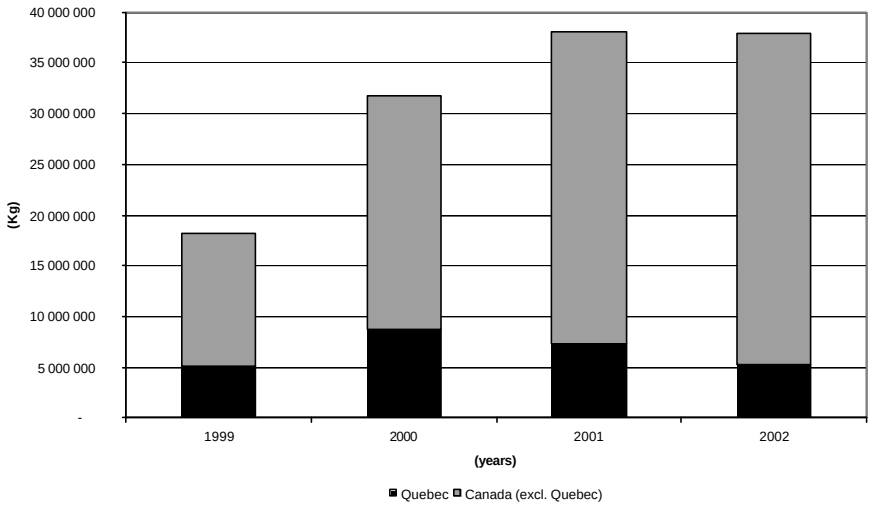
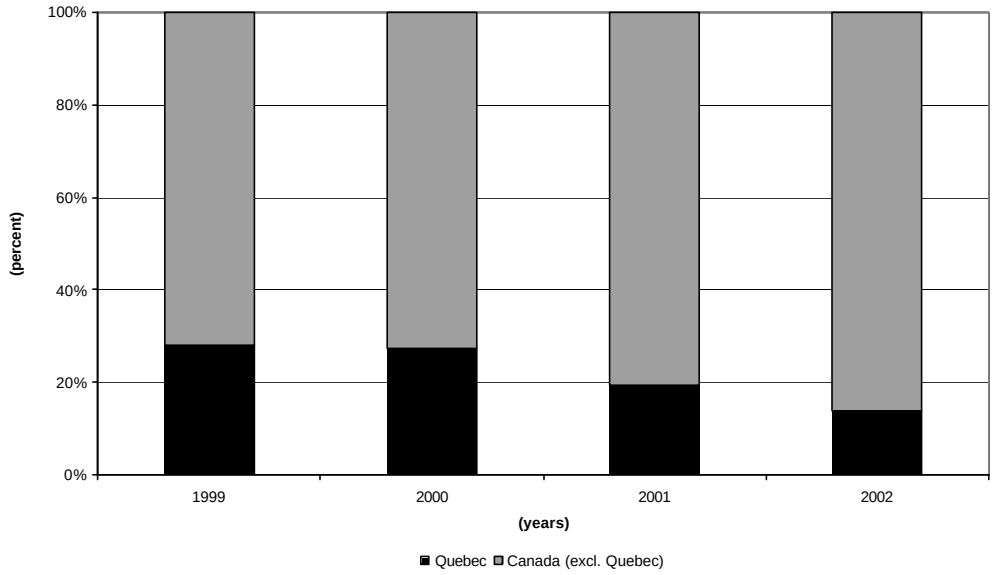


**Figure 13. Total Pork Export Shares: Quebec and Canada (excl. Quebec)
1999 - 2002
(source: Statistics Canada)**



5.1 Quebec's Legal Response to Environmental Impacts

The combined application of three legal instruments in Quebec regulates environmental impacts resulting from agricultural practices: the Environment Quality Act1, the Act respecting land use planning and development2 and the Act respecting the preservation of agricultural land and agricultural activities3 (Agriculture Act). While the first two Acts are of general application, the last deals specifically with agricultural activities.

Section 20 of the Environment Quality Act establishes a general prohibition against polluting, the violation of which requires two elements: the substance causing the pollution must fall within the definition of "contaminant"4 and the concentration or quantity of this contaminant must be greater than the permissible level determined by Government regulation. The Agriculture Act establishes legal limits under which pollution resulting from agriculture activities is accepted. No specific legislation or regulation applies to the particularities of hog production.

Initially adopted in the 1970's, the Agriculture Act aims at ensuring the sustainable development of agricultural activities. In other words, it attempts to encourage agriculture while protecting the environment from potential harm resulting from this activity. In order to achieve

[1] *Environment Quality Act* , Chapter Q-2.
[2] *An Act respecting land use planning and development,* Chapter A-19.1.
[3] *Act respecting the preservation of agricultural land and agricultural activities,* Chapter P-41.1.
[4] Section 1(5) of the Environment Quality Act defines a "contaminant" as "a solid, liquid or gaseous matter, a microorganism, a sound, a vibration, rays, heat, an odour, a radiation or a combination of any of them likely to alter the quality of the environment in any way".

this balance within the context of the Quebec economy, the Agriculture Act went through three major changes over the last decade: in 1989, 1996 and 2001. The end result of these changes is to (1) "loosen" environmental requirements for agricultural producers in order to facilitate their operations, and (2) switch regulatory control over agricultural operations from municipalities to the provincial government. These changes affect hog producers in the same manner as other agricultural producers.

The timing of those changes is of interest. The 1996 major amendment to the initial Agricultural Act occurred two years after the entry into force of the new Quebec Civil Code and of the North American Agreement on Environmental Cooperation.

5.2 The 1996 Effort to Better Protect the Environment

The protection of the environment resulting from agricultural activities underwent a major revision in 1996 with respect to water and soil protection. The previous regime[5] on manure spreading control was replaced by a longer and more complex regime on manure spreading control through the new 1997 Regulation respecting the reduction of pollution from agricultural sources[6]. No major changes occurred with respect to air, dust and noise pollution.

5.2.1 Water and Soil Pollution from Hog Production

Water pollution resulting from agricultural activities was the first environmental concern to be regulated under the Environment Quality Act and its regulation[7]. This was accomplished in 1981 through the creation of distance separation requirements[8] (MDS) for manure spreading.[9] The scope of MDS was significantly enlarged in 1997 through a regulation that not only protects water, but also neighbors from odor pollution. This regulation establishes not only a general prohibition against depositing or discharging waste (including manure) into water or soil but also a general prohibition against the deposit, receipt or storage of livestock waste other than at a site authorized for that purpose under the Environment Quality Act or at a site exempted from such authorization[10].

The conditions and limits on the spreading of fertilizing substances[11] were also extended in 1997. For example, the MDS requirements for the field storage of solid manure from watercourses were set at 300 meters, which is one of the more rigorous standards in Canada. The period of authorized use, authorized areas, and so on were similarly changed.

The regulation also introduced requirement to create an "Agro-environmental fertilization

---

[5] *Regulation respecting the prevention of water pollution in livestock operations*, c. Q-2, r. 18, division VI.
[6] *Regulation respecting the reduction of pollution from agricultural sources*, c. Q-2, r. 18.2.
[7] *Regulation respecting the prevention of water pollution in livestock operations, supra,* note 5.
[8] Distance separation requirements create physical zones within which manure cannot be spread in order to protect neighboring land. Several criteria apply to the determination of this zone, as indicated in section "odour pollution".
[9] *Regulation respecting the prevention of water pollution in livestock operations, supra,* note 5.
[10] The waste still must be deposited in accordance with the specific provisions of the 1997 regulation dealing with general manure management standards, *Regulation respecting the reduction of pollution from agricultural sources* s*upra*, note 6.
[11] Prescribed in Division III of the *Regulation respecting the reduction of pollution from agricultural sources.*

plan" (Plan) that helps determine the limit of manure spreading for each parcel12. Specific requirements also apply to the elaboration, preparation and retention of this Plan13.

The third main change brought about in 1997 was the introduction of a stronger distinction between (1) the construction and development of livestock facilities and livestock waste storage sites, and (2) their exploitation. Location, construction and development standards were created with respect to the construction and development of these facilities.14 Expedition, transportation, spreading, storage and discharge permits in respect of livestock waste are required for the exploitation of these facilities. A ministerial authorization is also required for a wide range of activities.15

Finally, it is worth noting that the 1981 Regulation imposed a temporary ban on hog production in certain areas of Quebec. Although the moratorium was due to end in 1990, it was in fact revoked in 1988. More recently, a temporary ban on hog production facilities has been imposed in certain areas of Quebec for a two-year period.

5.2.2 Odor Pollution

Odor is a contaminant as defined by the Environment Quality Act. Similar to the protection of water resulting from manure spreading practices, the odor control regime created a set of MDS requirements.

While the initial draft of the 1997 regulation aimed at covering air, water and soil pollution, the odor control regime was established by the 1998 Guidelines for determining minimum distances to ensure odor management in rural areas16 which replaced the 1996 version17. Those Guidelines do not have the status of regulation; they only apply to government officials with a mandate to apply the Environment Quality Act.

While the 1997 regulation falls within the scope of the Environment Quality Act and, as a consequence, under the power of the Quebec Minister of the Environment, the 1998 Guidelines fall within the power of regulation of each municipality as established by the Act respecting land

[12] Sections 14 to 26. According the regulation, *supra*, note 6, the spreading of livestock waste or farm compost is permitted only for the purpose of fertilizing the soil of a parcel in an agricultural operation

[13] The Plan must be retained for two years after the end of its termination. In addition, the farmer must maintain a spreading register for each parcel in the agricultural operation for each annual growing season.

[14] Section 27 to 48.

[15] The erection of a livestock facility and the erection or laying-out of a storage or a yard; the operation of these facilities; alterations to a livestock building in order to increase the capacity for housing livestock; alterations to or enlargement of a yard; enlargement of a livestock building; alterations to or enlargement of a storage; an increase in the number of livestock units beyond the defined maximum; the replacement of livestock in a livestock building or a yard by other livestock if it results in an increase in the volume of waste or an increase in the number of livestock units, or replacement by suidae; and the replacement of solid manure management by liquid manure management in a livestock building or storage.

[16] Guidelines for determining minimum distances to ensure odor management in rural areas, c. P-41.1, r. 1.1v Directive relative à la détermination des distances séparatrices relatives à la gestion des odeurs en milieu agricole, (1998) 130 G.O.Q., partie 2, 1582.

[17] Directive du ministère de l'Environnement et de la Faune relative à la protection contre la pollution de l'air provenant des établissements de production animale, (1996) 128 G.O.Q., partie 2, 5438, mod. (1997) 129 G.O.Q., ptie 2, 6911.

use planning and development18. However, the municipal powers have now to be shared with the government in respect of agricultural areas.

The Guideline establishes MDS for livestock facilities, farm manure storage sites located more than 150 meters from livestock facilities and for spreading farm manure. The MDS for livestock facilities are computed using formulas combining seven parameters specific to the category of neighboring unit in question: number of animal units, base distance, odor load, type of manure, project type, attenuation factor and usage factor. Under the project type parameter, the vested rights related to expanding small existing farms is recognized. Vested rights are also recognized for operations with 100 animal units or fewer under certain circumstances.

A reciprocity principle contained in the Guidelines implies that MDS requirements must be respected by both the agricultural operator and his or her neighbors. In other words, "if there already exists an agricultural use at the time a non-agricultural use is being planned in a non-agricultural land adjacent to a agricultural land, the distance to be respected is the same as if the reverse situation had occurred, that is, the distance to be respected is the same if the adjacent non-agricultural use had existed prior to the implementation of the said agricultural use." As will be explained below, this reciprocity rule was changed in favor of farmers.

5.2.3 Dust and Noise Pollution

Dust and noise pollution resulting from agricultural production is not subject to the Agricultural Act. Thus, such pollution is only subject to the general regime of prohibition of introducing contaminants into environment as defined by section 20 of the Environment Quality Act. Draft legislation on noise pollution19 was published in 1997 but was never adopted.

5.3 The 2001 Emphasis on the Right to Produce

While the 1996 Agricultural Act both changed the regime applicable to the protection of agricultural land and introduced a complex regime of odor control, it also introduced the notion of right to produce ("*droit de produire*"). The changes brought about by the 2001 Agriculture Act are based on this right to produce, which are designed to simplify and facilitate agricultural production.

The 2001 amendments to the Agricultural Act responded the Quebec farmers union's concerns (the Union des producteurs agricoles) that the then-existing regime prevented the development and extension of agricultural farms. These amendments aimed at erasing the negative economic effects of the odor control regime implemented by the 1996 amendments. In other words, the 2001 Agricultural Act aimed at facilitating the development and extension of agricultural activities in agricultural zones.

Two measures have been used to facilitate the development of agricultural production. First, the 2001 Agricultural Act aimed at limiting the impact of new non-agricultural construction in agricultural zones. Second, it created specific and explicit rights to install and enlarge livestock facilities in this zone. Third, the Act enlarged the scope of immunity applicable

[18] Section 113 al. 3.
[19] *Projet de règlement sur les bruits résultants d'activités agricoles*, (1997) 129 G.O.Q., partie 2, p. 3525.

to agricultural producers.

5.3.1 New Alternatives to MDS

1. An alternative to distance separation requirement

Section 79.2.1. of the 2001 Act limits the erection or enlargement of a building used or intended to be used for a non-agricultural purpose. This is because such construction could have the effect of modifying the MDS required between the livestock facilities and the non-agricultural facilities, thus limiting the potential to expand agricultural activities. By imposing this restriction, the legislator made the right to extend agricultural activities a priority for the benefit of farmers.

Two types of limitations exist to the construction ban on non-agricultural facilities. First, the non-erection of enlargement applies only on the side of the building facing the breeding unit. Further, "a municipality may not refuse to issue a building permit for the sole reason of non-compliance with that condition".

The second limit to the erection or enlargement of non-agricultural facilities was created where an erection or enlargement made in conformity with the above requirement encroaches upon the space that, under separation distance requirements, must be left open between the land in question and any neighboring breeding unit. In this case, the MDS requirements applicable at the time of the erection or enlargement of the building continues to apply to the expansion of agricultural activities on any neighboring breeding unit without taking into account the location of the building or its enlargement. In others words, the MDS requirements for the extended agricultural activities are calculated as if the erection or enlargement of non-agricultural facilities had not occurred.

This new provision of the 2001 Agriculture Act is another indication of the legislature's intention to facilitate the development and extension of livestock production. This contrasts with the 1996 Act under which a reciprocity rule governed

Another provision reinforces the primacy of the development of agricultural activities over the construction of non-agricultural facilities. No MDS requirement and no other agricultural use standards[20] apply to a residence built by a non-farmer in the reserved area without the authorization of the Quebec Commission for the protection of agricultural land ("*Commission de protection du territoire agricole du Québec"*).

Finally, the 2001 legislation provides livestock producers with an attenuation of the MDS requirements. Notwithstanding MDS requirements, manure storage works and other works aimed at reducing pollution or works aimed at reducing the inconvenience caused by the odors from a breeding unit may be erected on the space that would normally need to be left open under separation distance requirements. The only limitation to this provision is that the works cannot be erected on the side facing the building used for a purpose other than an agricultural purpose the location of which would entail the greatest restriction on the potential for expanding the

[20] Such standards may originate from the exercise of the powers provided for in section 113 of the Act respecting land use planning and development, chapter A-19.1.

agricultural activities of that breeding unit if the separation distance requirements were taken into account.

It should be noted that commentators have criticized the lack of consideration of "dominating winds" in the choice of the place where the works would be erected.

2. The right to extend activities

The 2001 Act also created a right to extend a breeding unit, which is defined as "a livestock facility or, where there is more than one facility, of all the livestock facilities in respect of which a point on the perimeter of one facility is less than 150 meters from the neighboring livestock facility, and of storage works, if any, for the manure from the animals in the facility or facilities."

By using this new terminology, the legislator aimed at not limiting the right to extend activities to the producer. A producer may thus benefit from this right to extend for each livestock facility that is located at a distance of more than 150 meters.

While this right to expand is subject to a number of conditions enunciated in section 79.2.5 of the 2001 Act (i.e. the number of livestock units, the odor coefficient of the categories or groups of animals), no conformity with the Environment Quality Act, the 1997 regulation or with authorization permit granted under this Act or regulation is required.

5.3.2 Civil Liability Immunity

The entry into force of the new Code civil of Quebec in 1994 created a new cause of action to neighbors who suffer harm beyond normal neighborhood annoyances. These are considered to be annoyances that are beyond the limit of tolerance neighbors owe each other, according to the nature or location of their land or local custom.

This cause of action opened the door to claims against annoyances caused by agricultural activities. In 1996, an argument based on abnormal neighborhood annoyances was discussed in the Messier c. Agromex inc. case. The plaintiff, M. Messier, suited Agromex inc, a farm producer, alleging that the spreading of manure by Agromex contaminated his wells and drinking water. The court decided in favor of the plaintiff and held the farmer liable due to the abnormal annoyances caused by the spreading of manure.

The 2001 Agricultural Act sought to reverse this decision. Although the case dealt with water pollution, the new amendments aimed at avoiding the same result in cases dealing with dust, noise and odors as long as the regulatory requirements are satisfied.

Both the 1998 Guidelines on distance separation and the 2001 Act clearly responded to the fear of expanded civil liability for farmers. The first step was taken by the 1998 Guidelines that replaced the former qualification of odors. While orders were originally considered to be a "contaminant", the 1998 Guidelines now define them as "annoyances".

Section. 79.19 of the 2001 Act expressly excludes civil liability for annoyances resulting from agricultural activities by stating that: "In an agricultural zone, the inconvenience caused by dust, noise or odors resulting from agricultural activities does not exceed the limit of tolerance

neighbors owe each other, insofar as the activities are exercised". The 2001 Act also excludes liability for dust, noise and odors when the producer conforms with the Act's various requirements. Neither an injunction nor compensation can be claimed. The burden of proof is borne by the plaintiff. This immunity regime does not apply when there is no gross and intentional fault. The exclusion of the general regime of liability when abnormal annoyances occur – as established by section 976 of the Civil Code of Quebec – highlights the importance of the determination of regulatory norms. The more flexible these norms are, the larger the immunity accruing to the farmer becomes. As already mentioned, this immunity only applies when regulatory requirements have been satisfied. However, in certain circumstances, pollution by dust, noise or odor are not regulated. As a result, an action against the farmer could be based on article 20 of the Environment Quality Act that protects the victim of pollution by a contaminant. The 1995 Giguère v. Turcotte case illustrate this point.[21]

While the immunity of farmers against civil actions related to dust, noise and odor isa justified by the nature of their activities, the absolute nature of the immunity has been questioned.[22] This exclusion of immunity was recommended in the case where agricultural activities causing damage do not constitute a normal agricultural practice,[23] but this change was not integrated in the 2001 Act.

With this "absolute" immunity of the farmers – not limited to normal agricultural practice -, Quebec not only remains the only province in Canada with such a large immunity regime for farmers but also increased this immunity with the 2001 Act.

6.0 Discussion and Conclusion

Quebec hog production has increased substantially over the last 20 years. A growing export market to the United States, Japan, and Russia has driven this expansion. Associated with this increase in production is an increase in the residuals that flow into the environment. Given that the regulation of intensive livestock operation falls under provincial jurisdiction in Canada, the Quebec government has had to adjust its laws over time to take into account the expansion of the sector.

The expansion of hog production has also resulted in an expansion of the regulations that control the impact of this production on the environment. The original Environmental Quality Act restricted the direct deposit of hog manure into watercourses and required a distance set back from watercourses when manure was spread. The 1997 revisions expanded the distance requirements to include not only watercourses but the potential problem of odors affecting neighbors. The 1997 amendment also took into account the potential problem of manure on soil. In this regard, the statute outlined restricting on: (1) the timing of manure spreading (in terms of time of year), (2) the amount to be spread per hectare, (3) the requirement of a fertilization field plan that must balance fertilizer input with soil and crop requirements. This legislation also required that more variables be taken into account when determining distance set backs for odor problems.

[21] *Giguère c. Turcotte*, C.S. Beauce (St-Joseph –de-Beauce), n. 350-05-000131-910, 15 juin 1995.
[22] Rapport Brière, Rapport de consultation sur certains problèmes d'application du régime de protection des activities agricoles en zone agricole, 25 octobre 2000, 69 p. et 6 annexes.
[23] Rapport Brière, p. 27-28.

The revised act also clearly delineates the rules for storage and placing of facilities. The storage facility must be within a certain distance from the livestock facility. The storage requirements includes: (1) the size of the storage facility, in order for it to hold a certain number of days of manure, and (2) must adhere to certain construction requirements.

The site requirements for livestock facilities were increased with the 1997 revision of the law. In particular, the livestock facility location relative to other agriculture and non-agriculture facilities located on adjacent lands must be accounted for.

The 1997 revision to the law is a clear indication that as hog production expanded the concern for its impact on the environment also expanded. These changes are an expansion of mandatory (command and control) regulations on hog production. One would expect that hog producers in Quebec would not embrace the expansion of mandatory regulations and that they would use their political power to modify these regulations.

The 2001 revision of the Agriculture Act was an attempt by agricultural producers and their representatives (UPA) to establish a producer's right to farm and as a result potentially dampens the earlier regulatory control. However, the revision only minimally impacts facility location, distance set backs, and producer liability. Finally, it is interesting to note that 2001 is also the year that the Government introduced a two-year moratorium on hog production expansion in most regions of the province.

An increase in mandatory regulations can have an impact on producer incentives and the incentives of their representative organizations. For example, in 1997 the *Federation des producteurs de porcs du Quebec* (FPPQ - a producer organization) conducted an agro-environmental census on Quebec hog farms to determine the state of environmental management on Quebec hog farms. This information was used to prepare 11 agro-environmental action plans for each region of the province. This information could be used by operations to modify their existing practices (FPPQ, 2003).

This increase in regulation across all provinces in Canada provided the incentive for the Canadian Pork Council (CPC) to take action on developing a Hog Management Strategy in 1997 (CPC, 2002). In 2001, the CPC had the Canadian Standard Association (CSA) develop a detail framework for the implementation of an environmental management (EMS) standard. The draft standard that has been developed follows the principles of ISO 14000 certification. A pilot study on 15 farms has been started to implement this draft EMS standard and should be completed by March 2003 (CPC, 2002).

This increase in mandatory regulation that affects hog production in Quebec and Canada has resulted in producer groups attempting to develop voluntary mechanisms to deal with environmental problems. The theoretical literature has indicated that as the threat or actual implementation of mandatory regulations increases, there will be an incentive for individual producers to take the lead to develop voluntary business lead initiatives. The incentive for doing so is the increase in flexibility for the producer and the cost effectiveness of these solutions. This provides producers with an opportunity to avoid further mandatory regulations.

Hog production was increasing in Mexico with the assistance of a feed subsidy program

from 1979 to 1984. Along with this increase in production was a corresponding increase in the residues going into the environment from this production. The removal of the feed subsidy program resulted in a dramatic decrease in hog production and a similar decrease in environmental impact. By 1989, hog production in Mexico had decreased by 43 percent from its peak in 1985. As a result, the need for environmental legislation specific to hog production had decreased with the decrease in production. Current production trends in Mexico have output approaching the levels produced in 1984. This may explain the relative lack of legislation directed towards hog production in Mexico.

Current industry objectives are to expand the output of the hog sector in Mexico. With this expansion and its corresponding pollution, it can be expected that mandatory and non-mandatory regulations, financial instruments such as taxes and subsidies, will also increase. This increase in regulation will provide an institutional setting that will provide incentives for business decisions. These incentives could follow the Quebec model, with increased restrictions on manure discharge, management and facility location. As with all regulations, enforcement is of particular importance and must be seen as a credible threat if the regulations are to be adhered to.

If mandatory regulations are increased in Mexico, then the choice of voluntary business-led initiatives by firms may be expected if the threat of mandatory regulations is considered real. The NAFTA agreement may provide an additional leaver for providing additional incentives for firms to develop voluntary business-led initiatives if they create either market access or price premiums in the North American market.

The theoretical literature on voluntary business-led initiatives is clear that the threat of mandatory regulations plays an important role in generating the incentives for firms to develop these initiatives. This requires that enforcement of regulations must be undertaken. The institutional structure associated with the mandatory regulation and enforcement will impact on the incentives given to firms. Quebec and Mexico have taken different approaches to this institutional structure. Quebec uses a provincial government approach to address such questions as agricultural zoning and the siting of facilities while Mexico has decentralized this responsibility towards the county/municipal level of government. This approach is similar to other provincial jurisdictions in Canada (CEC, 2002). Whether the institutional structure for regulation and enforcement should be done at higher or lower levels of jurisdiction is an empirical question that is not addressed in this paper.

References

Alberini, A. and K. Segerson. 2002. Assessing voluntary programs to improve environmental quality. *Environmental and Resource Economics* 22:157-184.

ASERCA. 2002. *Perspectivas del Mercado Porcicola Internacional*.

Bansal, P. and W.C. Bogner. 2002. Deciding on ISO 14000: Economics, institutions, and context. *Long Range Planning* 35:269-290.

Batie, S. and D.E. Ervin. 1997. Will business-led environmental initiatives grow in agriculture?. In *Business-led initiatives in environmental management: The next generation of policy*. S.S. Batie, D.E. Ervin and M.A. Schulz, ed., 1-16. Proceedings of the pre-conference workshop to the AAEA annual meeting, Toronto, Ontario, Canada, July 26,1997.

Bouchard, D. 1999. La hiérarchie des normes environnementales entre les lois et règlements provinciaux et les règlements municipaux. In : *Développements récents en droit de l'environnement*, Service de la formation permanente, Barreau du Québec, n. 124, eds. Cowansville, Yvon Blais, 225-262.

Braden, J.B. and S.B. Lovejoy. 1990. Overview. In *Agriculture and water quality: international perspectives*, J.B. Braden and S.B. Lovejoy, ed., 1-5. Boulder:Lynne Rienner Publishers.

CPC (Canadian Pork Producers). 2002. Initiative for a national standardized environmental management system. http://www.cpc-ccp.com/envir/EMS.htm

CSA (Canadian Standards Association). 2002. *Plus 1157: Guide to the implementation of an EMS for the primary agriculture sector based on ISO 14000*. Toronto: Canadian Standards Association.

Cropper, M.L. and W.E. Oates. 1992. Environmental economics: A survey. *Journal of Economic Literature* 30(2):675-740.

Daigneaux, R. 1991. L'environnement dans le secteur agro-alimentaire. In : *Développements récents en droit de l'environnement*, Service de la formation permanente, Barreau du Québec, n. 19, eds. Cowansville, Yvon Blais, 245-274.

FPPQ. 2003. Development of agro-environmental action plans for hog production in Quebec. http://www.cpc-ccp.com/HEMS/AGRO-Environment.htm

Field, B.C. and N.D. Olewiler. 2002. *Environmental economics, 2nd. Canadian ed.*, Toronto:McGraw-Hill Ryerson.

Giroux, L. 2002. Le droit environmental et le secteur agricole (prise 2): la Loi agricole de 2001. In : *Développements récents en droit de l'environnement*, Service de la formation permanente, Barreau du Québec, n. 175, eds. Cowansville, Yvon Blais, 265-363.

Giroux, L. 1997. Où s'en va le droit québécois de l'environnement ? In : *Développements récents en droit de l'environnement,* Service de la formation permanente, Barreau du Québec, n. 90, eds. Cowansville, Yvon Blais, 381-457.

Giroux, L. 1998. Le droit environnemental et le secteur agricole : développements législatifs et réglementaires récents. In : *Développements récents en droit de l'environnement,* Service de la formation permanente, Barreau du Québec, n. 108, eds. Cowansville, Yvon Blais, 155-197.

Giroux, L. 1996. La Loi sur la qualité de l'environnement : grands mécanismes et recours civils. In : *Développements récents en droit de l'environnement,* Service de la formation permanente, Barreau du Québec, n. 77, eds. Cowansville, Yvon Blais, 263-349.

Giroux, L. 1997. Ou s'en va le droit québécois de l'environnement. In : *Développements récents en droit de l'environnement,* Service de la formation permanente, Barreau du Québec, n. 90, eds. Cowansville, Yvon Blais, 381-457.

Haley. M., E.A. Jones, and L. Southard. 1998. World hog production: Constrained by environmental concerns? *Agricultural Outlook*. Washington, DC: Economic Research Service, March, pp. 15-19.

Karl, H. and C. Orwat. 1999. Economic aspects of environmental labelling. In *International yearbook of environmental and resource economics 1999/2000: A survey of current issues*. H. Folmer and T. Tietenberg, ed., 107-170. Cheltenham, UK and Northhampton, MA:Elgar.

Khanna, M. 2001. Non-mandatory approaches to environmental protection. *Journal of Economic Surveys* 15(3):291-324.

Kuhre, W.L. 1995. *ISO 14001 certification: environmental management systems*. Upper Saddle River, NJ:Prentice Hall PTR.

Lussier, G. L.B.B. Baker and P.J. Thomassin. 1997. *An environmental management system for agricultural production in Quebec*. A Canada-Quebec Entente Final Report. Agriculture and Agri-Food Canada.

Macleod, C.J. Personal communication. Canadian Pork Council. January 31, 2003.

MAPAQ. 2002. Le programme prime-vert 2002. Available at: http://www.agr.gouv.qc.ca/primevert/.

Méndez, M., and V. Lara G. 1996. *Rentabilidad y paramétros técnicos de las empresas porcinas en el Estado de Sinaloa*. Tesis de Licenciatura. Departamento de Zootecnia. Universidad Autónoma Chapingo. México, noviembre.

Metcalfe, M. 2001. Environmental regulation and implications for competiveness in internaltional pork trade. *IATRC symposium on International Trade in Livestock Products*, Auckland, New Zealand, January 18-19.

Ministère de l'agriculture, des pêcheries et de l'alimentation du Québec (MAPAQ). 1998. *Monographie de l'industrie porcine au Québec*. Quebec City, QC.

Ministère de l'agriculture, des pêcheries et de l'alimentation du Québec (MAPAQ) and Institut de la statistique du Québec. 2002. *Le profil sectoriel de l'industrie bioalimentaire au Québec, Édition 2002*. Quebec City, QC.

Moon, W., W.J. Florkowski, B. Bruckner and I. Schonhof. 2002. Willingness to pay for environmental practices: implications for eco-labeling. *Land Economics* 78(1):88-102.

Pérez Espejo, R. 1998. Porcicultura Intensive y Medio Ambiente en México Situación Actual y Perspectivas. Available at: <www.cipav.org.co/cipav/confr/espejo.htm>.

Perman, R., Y. Ma, J. McGilvray and M. Common. 1999. *Natural resource and environmental economics*, 2nd ed. New York:Pearson Education Ltd.

Porter, M. 1991. America's green strategy. *Scientific America.* (April):168.

Ramírez, P., and M. Sagarnaga. 1998. Proyección del consume de carne en cerdo en México para el ano 2000. CIESTAAM. Universidad Autónoma Chapingo. México.

Randall, A. 1987. *Resource economics*, 2nd ed. New York:Wiley.

Ribaudo, M. and M.F. Caswell. 1999. Environmental regulation in agriculture and the adoption of environmental technologies. In *Flexible incentives for the adoption of environmental technologies in agriculture.* F. Casey, A. Schmitz, S. Swinton and D. Zilberman, ed., 7-25. Norwell,M.A.:Kluwer Academic Publishing.

Rivest, R.L., M.-A. Thomas. 1995. La Loi sur la qualité de l'environnement et sa réglementation annotées, eds. Cowansville, Yvon Blais.
Runge, C.F. 1995. Trade, pollution, and environmental protection. In *The handbook of environmental economics.* D.W. Bromley, ed., 353- 375. Cambridge, M.A.:Blackwell Publishers Ltd.

SAGAR. 1998. *Situación Actual y Perspectiva de la Producción de Carne de Porcino en México 1990 – 1998.*

Sagarnaga, M., Ochoa, R.F., Salas, J.M., Anderson, D.P., Richardson, J.W., and Knutson, R.D. 1999. *Granjas Porcinas Representativas en México Panorama Económico 1995-2004*. Agricultural & Food Policy Center Research Report 99-16. College Station, TX: Texas A&M University.

Segerson, K. and N.L. Dawson. 2001. Environmental voluntary agreements: participation and free riding. In *Environmental contracts: comparative approaches to regulatory innovation in Europe and the United States.* E. Ortes and K. Deketelaere, eds., 369-388. Dordrecht:Kluwer Law International.

Segerson, K. and T. Miceli. 1998. Voluntary approaches to environmental protection. *Journal of*

Environmental Economics and Management 36(2):109-130.

Southard, L. 1999. Mexico's pork industry structure shifting to large opertations in the 1990's. *Agricultural Outlook*. Washington, DC: Economic Research Service, September, pp. 26-29.

Teisl, M.F., B. Roe and R.L. Hicks. 2002. Can eco-labels tune a market? Evidence from dolphin-safe labeling. *Journal of Environmental Economics and Management* 43(3):339-359.

Tietenberg, T. 2000. *Environmental and natural resource economics*, 5th edition. Reading,MA:Addison-Wesley Longman Inc.

Ulph, A. 1997. International trade and theenvironment: a survey of recent economic analysis. In *The international yearbook of environmental and resource economics 1997/1998: a survey of current issues.* H. Folmer and T. Tietenberg, eds., 205-242.Cheltenham,UK:Edward Elgar Publishing Co.

Van Nieuwenhuyse, P. 2002. *La dynamique de développement économique d'une industrie: Le cas de la filière porcine*. Ministère de l'agriculture, pêcheries et alimentation du Québec (MAPAQ), Quebec City, QC.

Videras, J. and A. Alberini. 2000. The appeal of voluntary environmental programs: which firms participate and why? *Contemporary Economics Policy* 18(4):449-461.

Wall, E. A. Weersink and C. Swanton. 2001. Agriculture and ISO 14000. *Food Policy* 26(1):35-48.

Weersink, A., J. Livernois, J.F. Shogen and J.S. Shortle. 1998. Economic instruments and environmental policy in agriculture. *Canadian Public Policy* 24(3):309-327.

Wu, J. and B.A. Babcock. 1999 The relative efficiency of voluntary vs mandatory environmental regulation. *Journal of Environmental Economics and Management* 38(2):158-175.