Farm Classification Systems for North American Agriculture

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ABSTRACT

As international agricultural markets become increasingly more integrated, internationally harmonized farm classification systems could become more useful for international comparisons of agricultural industries, as a tool for summarizing and analyzing micro-level data. Canada, Mexico, and the United States currently do not have a common farm classification system beyond the harmonized North American Industrial Classification System (NAICS), which the three countries developed and adopted shortly after the implementation of the North American Free Trade Agreement (NAFTA). While common policy themes exist among the three countries, such as competitiveness, innovation and sustainability, they have yet to be reflected in a comprehensive farm classification system.

This paper compares farm structures in North America, using the NAICS and farm size. Additional classifications that are used in North America are summarized. Additional farm characteristics that could enhance the comprehensiveness of farm classification systems are discussed. Finally, data constraints which limit the ability to develop a harmonized classification system in the three jurisdictions are discussed.

Keywords: Farm structure, farm classification, micro-level data, farm typology

1. Introduction

Farm classifications[1] are helpful when analyzing farm-level data within an agricultural policy context. Classifications serve as a framework for organizing heterogeneous farm businesses into relatively homogenous groups, according to specific criteria, for economic and policy research and analysis, such as analysis of the distribution of impacts of programs and policies.

Most commonly, farms are classified using a single indicator. For example, farm type or commodity specialization classifications are used to analyze the distribution of impact of a particular program or policy across different types of production, i. e. livestock producers versus crop producers, or mixed farming operations versus specialized farms. While these approaches provides a method for grouping farms into relatively homogeneous groups, classifications using multiple indictors may provide a more comprehensive grouping of farms.

There are several arguments for creating a classification system based on an integrated set of indicators. This type of classification offers a tool to synthesize and assess farm indicators as an integrated set, thus highlighting linkages among the various indicators of interest, as well as

[1] Farm classifications are also frequently referred to as farm typologies. In the context of this report, it will refer to classification.

evaluating and designing more differentiated farm-level policies taking into account the wide range of differences (Andersen et al., 2007).

The farm characteristics selected for classification are typically based on key indicators identified as relevant to policy discussion (Andersen et al., 2007). Farm classifications have largely focused on the size and type of the farm. The most commonly used measurements of size include the land area of the farm, gross sales or gross expenses (Hanson, Stanton, and Ahearn, 1989).

Since 1998, Canada, Mexico and the U.S. use the common North American Industry Classification System (NAICS) to collect industry statistics in the respective countries. While the classification was not designed specifically for agriculture, this classification offers standardized categories where farms are assigned a NAICS code based on their most important production activity. Currently, this is North America's only harmonized classification system for agriculture. While NAICS is useful from a production standpoint, it does not contribute to discussion of any of the emerging issues in agriculture. Today the objectives of the agricultural policies have been broadened and increasingly focus on additional indicators.

Research suggests that additional indicators outside of the size and type of farm could help capture the complexity and diversity of farm behaviour and performance, such as for instance income of farm operator families, degree of production specialization and production intensity of land use, (Briggeman et al, 2007; Galbraith et al., 2013, Andersen et al., 2007). A classification system can only be developed based on available data or, ex ante, it could guide data collection.

This message resonates in the Global Strategy to Improve Agricultural and Rural Statistics (FAO, 2010), which was jointly developed based on input from a large number of stakeholders, including national statistical institutes, ministries of agriculture, and regional and international organizations. The framework recognizes the linkages between rural households, agricultural holdings and the land and other natural resources that they use and impact.

A more comprehensive harmonized classification system could help facilitate cross-country comparisons, allow regions to learn for one another, help identify best practices, and help recognize cross country similarities (and differences) that may not be obvious at first glance.

The paper first provides background on the agricultural industries and agricultural policies of Canada, Mexico and the U.S, to give context to the discussion of farm classifications. The paper then shows the farm structure in the three countries based on NAICS classifications and farm size. This is followed by a discussion of additional indicators that have been used to classify farms for policy discussions, as well as a discussion of the benefit of multi-dimensional farm classification systems, and related data requirements.

2. Background

Canadian, American and Mexican agriculture operate in different economic environments (see Annex 1), including structure of their industries. This impacts the type of farm classification system that could be relevant to policy analysis.

The population of Mexico and Canada are respectively about one third and one tenth that of the U.S. In all three countries around one fifth of the population is rural. The size of the Canadian and Mexican economies are each about one-tenth of that of the U.S., measured in Gross Domestic Product (GDP). GDP per capita, however, is very similar in Canadian and U.S. economies, $47,283 and $46,215, respectively, while the Mexican GDP per capita is $9,566 (2010, FAO).

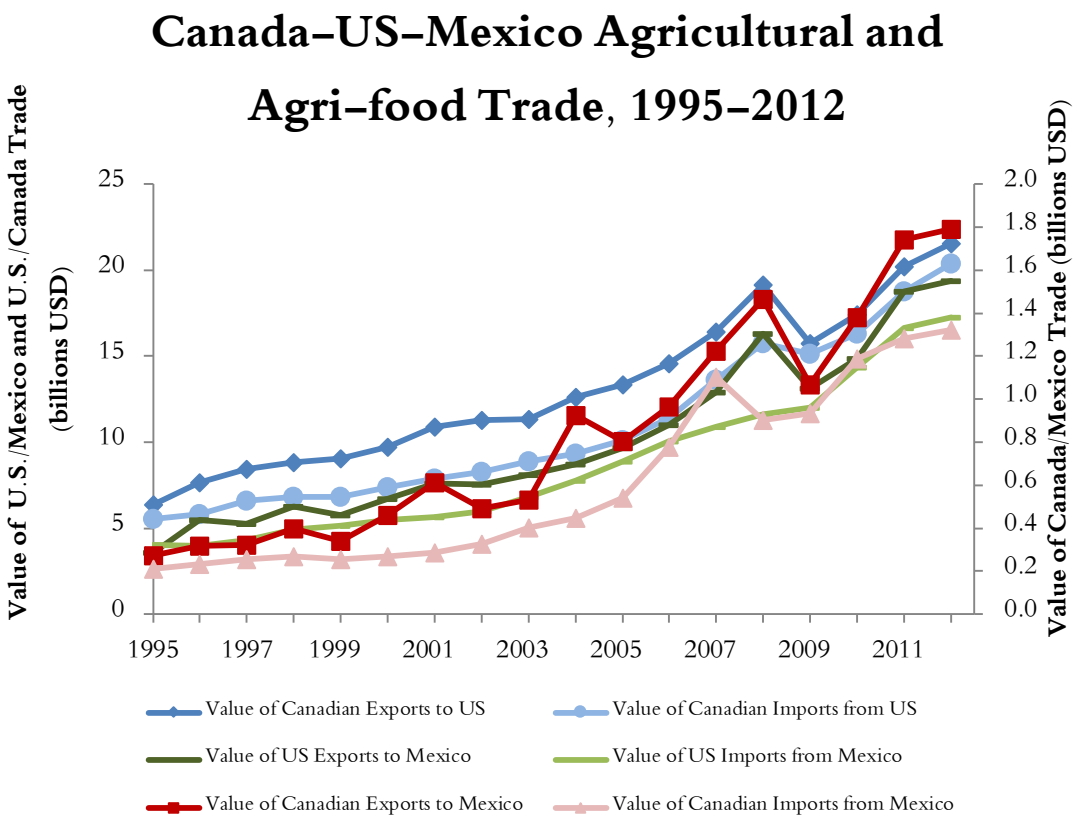
Agricultural value-added contributes 1.6% of GDP in Canada, 4.3% in Mexico, and 1.2% in the U.S. Value-added per agricultural worker was highest in the U.S., with Canadian value-added per agricultural worker 90% of the U.S. and Mexico 7 % of the U.S. (2009, FAO). Agricultural Total Factor Productivity grew the most between 1992 and 2009 in Mexico and least in the U.S. (Fuglie, 2012).

Total trade among the three North American countries has steadily increased since the North American Free Trade Agreement (NAFTA) between Canada, the United States, and Mexico became effective January 1, 1994[2].

The U.S. is the most important trading partner for both Canada and Mexico. Canada is the second most important destination for Mexican vegetables, and Canada follows the U.S.as the second most important source for wheat, beef and pork to Mexico. The most important destination for U.S. exports is currently China, but Canada and Mexico rank second and third, respectively (ASTI, 2011).

[2] NAFTA followed the Canada-US Free Trade Agreement, which had become effective January 1st, 1989. NAFTA was signed under the General Agreement on Tariffs and Trade (GATT) framework; the purpose was to liberalize and increase trade between the three partners beyond what would be possible under the most favored nations (MFN) status of GATT, and later the World Trade Organization (WTO). NAFTA and the WTO were negotiated roughly around the same time, and consequently, in the vast majority of cases, NAFTA provisions are in line with the various WTO Agreements.

Figure 1



Source: Foreign Agricultural Trade of the United States (FATSU)
Note: The left axis refers to the value of import/exports between Mexico and US and Canada and US reported in billions USD.
The right axis refers to the value of import/exports for Canada and Mexico, reported in millions USD.

According to OECD data, the total value of agricultural production, at the farm gate, in the three countries was $467.4 billion in 2011, with 10 % produced in Canada and Mexico, each, and 80 % produced in the U.S.

Public investment in agricultural research and development (R&D) in absolute dollars is significantly greater in the U.S. than in Canada and Mexico, which are approximately 20 % and 5 % of those in the U.S., respectively. Total support to farmers as a share of agricultural production at the farm gate was higher in Canada than Mexico while the U.S. had the lowest share[3], according to the OECD (2011).

The agricultural land base encompasses 64.8M ha in Canada and 91.5M ha in Mexico, compared to 365M ha in the U.S. At the same time, Canada has just under one-tenth of the number of farms as the U.S., while Mexico has over twice as many farms as the U.S. (Table 1). The definition of a farm differs somewhat across countries, see Box 1). Between 1991 and the most recent census, the number of farms declined in Canada by 26 %; however, both Mexico and the United States saw an increase between those two years in the number of farms, of 10 % and

[3] Due to market support to dairy, poultry and egg producers through the supply-management system in Canada.

14 %, respectively (Table 1). For the U.S., this increase is a recent reversal of a long-time trend of declining farm numbers.

Table 1: Change in number of farms

Canada	**1991**	**2011**	**Change**
Number of farms [thousands]	280	205.7	- 26.5%
Mexico	**1991**	**2007**	**Change**
Number of farms [thousands]	4,407.9	4,848.3	10.0%
U.S.	**1991**	**2007**	**Change**
Number of farms [thousands]	2,116.7	2,204.9	4.0%

Source: Canada: 2011 Census of Agriculture, Mexico: VIII Agriculture, Livestock and Forestry Census 2007, US: Farms, Land in Farms, and Livestock Operations 2011 Summary.

The share of farms operated by women is 27% and 30% respectively, in Canada and the U.S., where up to three farm operators can be reported per farm. In Mexico, the share of women operators is 16%, with only one operator per farm reported. In the U.S. the share of women among "principal" farm operators is 14% (see Annex 1).

These basic indicators set the context in which the farm classifications based on micro-data demonstrate the diversity within each country's agricultural sector.

2.1 Current policies for the agricultural sectors

In order for farm classifications to be effective tools for policy analysis, they need to be aligned with the policy issues at hand. Although policies differ between Canada, Mexico and the US, some common themes exist, such as competitiveness, productivity and innovation.

2.1.1. Canada

In Canada, a new five-year agricultural policy framework, Growing Forward 2 (GF2), came into effect April 1, 2013. GF2 represents C$3 billion ($2.96 billion) of government funding over the following five years, which includes significant resources allocated toward programming related to innovation, competitiveness and market development. This programming supports private sector R&D, the commercialization and adoption of innovations; industry-led efforts to expand domestic and export markets and to respond to emerging food trends; as well as the development of Canadian national assurance systems and attribute standards4. In addition to these program activities, GF2 includes a suite of Business Risk

[4] The Assurance Systems stream will support the development of Canadian national assurance systems and standards, such as food safety systems, animal and plant health surveillance systems, market attribute/quality standards and traceability systems, and their related tools.

Management programs that help farmers in managing risk due to severe market volatility and disaster situations.

2.1.2. Mexico

In Mexico, the objectives, strategies and priorities for development are assessed at the beginning of each federal administration, and they are established in the National Development Plan, as well as through regulations as per the Planning Law. The objective, as outlined in National Development Plan for the years 2013 to 2018, is to build a productive agricultural and fisheries sector that provides food security for the country.

Strategies have been developed to advance this objective. This includes (1) promoting productivity in the agri-food sector by investing in the development of technological, physical and human capital, including research and development, modernization of infrastructure, promotion of trade, support for increased farm production and income, and development of the capacity of primary producers in Mexico; (2) promoting partnership models that generate economies of scale and greater value-added for agri-food sector producers, such as the development of agri-business clusters that link smallholders with integrating enterprises, and implementing new agri-business models that generate increased value-added throughout the supply chain and improve farmers' income; (3) promoting increased certainty in the agri-food sector by promoting risk management mechanisms, establishing a comprehensive insurance mechanism against climatic and market risks, promoting financial inclusion and efficient risk management, and strengthening food safety to protect the health of the population and enhance the sector´s competitiveness; (4) promoting the sustainable use of natural resources, by promoting sustainable irrigation technology and efficient water use, tools for preserving and enhancing genetic resources, and use of bio-technology to protect environmental and human health; and (5) modernizing Mexico's regulatory and institutional framework, to help promote a productive and competitive agri-food sector.

2.1.3. U.S.

Agricultural policy in the U.S. is established under the so-called Farm Bill. The Farm Bill is legislation redesigned approximately every five years and includes numerous Titles covering a variety of programs relating to the agricultural and the food system, including conservation programs, food and nutrition programs, rural development programs, and investment in the land grant colleges and agricultural research and development. The latest farm legislation was signed into law as the Food, Conservation, and Energy Act of 2008. The 2008 Farm Act expired September 30, 2012. In order to establish new legislation, the U.S. Senate and U.S. House of Representatives (House) must agree on the legislation and the President must sign it into law. In 2012, while the Senate passed its version of the legislation, the House did not, so the 2008 Act was simply extended for one year. To date, the Senate has again passed new legislation, and the

House has passed a significantly different bill, leaving farm legislation in question for 2013-2018.

Aside from lack of new legislation it is difficult to characterize U.S. policies affecting agriculture because such a wide variety of policies are addressed in the farm legislation and the details of the policies change approximately every five years. In general, beginning in 1985, the farm legislation moved toward greater market orientation following concerns with liberalizing world trade and competing in world markets, encouraging producers to make decisions based on supply-and-demand conditions. However, the issue receiving the greatest support among politicians in the current debate is the elimination of direct payments, which were established to increase market orientation. Direct payments have been highly criticized because they largely go to farmers in a financially strong position due to currently high market prices. Another area of general agreement is to strengthen risk management programs for farms, for example, through subsidized premiums for crop insurance. Still other policies of great importance to agriculture are not treated in the context of farm legislation, such as policies affecting interest rates and the recently passed Food Safety and Modernization Act (signed into law on January 4, 2011). State and local levels of government also establish policies affecting agriculture, such as education programs for beginning farmers and farmland tax advantages to preserve farmland within their jurisdiction.

2.3 Sources of agricultural statistics

The development of farm classification systems depends on and is limited by available data sources. In all three countries the censuses of agriculture build the foundation of the agricultural statistics programs. In Canada and the U.S., agricultural censuses are conducted every five years and in Mexico every ten years. The most recent censuses were undertaken in 2011, 2007, and 2012, in Canada, Mexico and the U.S., respectively[5].

2.3.1 Canada

In Canada, the Census of Agriculture data can be linked with Census of Population data, enabling analysis of farm operator household characteristics as well as the Farm Environmental Management Survey (FEMS), which collects data on farm-environmental practices. Other sources of micro-level farm data include the Farm Financial Survey (FFS), the Agricultural Taxation Data Program (TDP), and program administrative data6. FFS is a biannual survey that collects data on farm characteristics, balance sheet information, and farm revenues and expenses. The survey also includes a limited number of changing questions on policy relevant topics (e.g. on-farm food safety, business management practices), and thus allows for cross-tabulation of the responses with farm financial performance. The TDP data set consists of detailed farm financial

[5] U.S. census data will be released in February 2014.

[6] Program administrative data refers to data collect from producers apply for support programs. For example, under the current suite of programs, program administrative data is collected for participation in the Business Risk Management programs.

information from income tax returns, and also provides information on the family income of the owners of unincorporated farms.

Since 2007, Agriculture and Agri-Food Canada (AAFC) has been developing a more comprehensive and integrated data base and a micro-simulation model to estimate current and future behaviour of farm businesses. The model, called the Canadian Agriculture Dynamic Micro-Simulation Model (CADMS) utilizes the data from the FFS, TDP, Census of Agriculture and program administrative data to create a simulated longitudinal data set of income statement and balance sheet data, as well as physical farm inventories and assets. The CADMS is used to produce 2-year forecasts of farm-level income, wealth and financial indicators. It is also used for scenario analysis related to proposed program development and/or market conditions and for program performance measurement. In addition, it is used to analyze the structure and competitiveness of the individual agricultural sub-sectors, and the impact of innovation adoptions, such as new crop varieties.

2.3.2 Mexico

The current agricultural statistical system in Mexico collects, compiles, analyzes and publishes a wide range of information on the agricultural sector in the country. Two information capturing methods are fundamentally converged in this system: the agricultural censuses, conducted by the National Institute of Statistics and Geography (INEGI) and the use of administrative registers mainly by the Ministry of Agriculture. Information related to cultivated lands, animal species and the means of production used by the producers of all the production units that exist in the national territory are captured with the census. The census is conducted generally every ten years.

During the period between censuses, INEGI, the Ministry of Agriculture (through the Agri-food and Fisheries Information Service (SIAP) and other institutions conduct surveys that complement the census information. For example, SIAP makes use of the administrative registers to obtain information periodically. The information includes planted area, harvested area, damaged area, the observed crops and estimations, the observed and estimated production, and the rural average price. Data on livestock includes stock, production, weight and prices of livestock (cattle, pigs, sheep, goats and poultry); as well as production and prices of the agricultural and animal products, such as milk, eggs and others.

Currently in Mexico there is demand for agricultural information that has not yet been satisfied. Although the agricultural census is generally performed every ten years, sixteen years past between the last two census, which were conducted in 1991 and 2007. There is currently no a continuous survey system in Mexico. For this reason, INEGI is working on the design and development of an Agricultural Information System that will integrate the Agricultural Census, a continuous Survey System and information from Administrative Registers. INEGI has the support of the FAO for this project.

2.3.3 U.S.

The major agricultural statistical agency in the U.S. is the National Agricultural Statistics Service (NASS) of United States Department of Agriculture (USDA). NASS conducts hundreds of surveys every year and prepares reports covering virtually every aspect of U.S. agriculture, in addition to conducting the Census of Agriculture every five years.

To complement and expand the economic detail of the Census, the Economic Research Service (ERS) of USDA partners with NASS to conduct the annual Agricultural Resource Management Survey (ARMS). The ARMS was created in 1996 by merging two previous surveys, the Farm Costs and Returns Survey (FCRS) with the Cropping Practices Survey. The former survey provided whole farm economic information while the latter survey provided field-level environmental practice data. The FCRS was established in 1984 by merging the Farm Production Expenditure Survey, a whole farm survey, with the Costs of Production Survey, a survey of individual commodity production costs and returns. Both the 1984 and the 1996 merger were implemented to improve the richness of the farm-level data, to minimize data collection costs, and to minimize respondent burden. Beginning with the FCRS in 1985, ERS was permitted access to individual farm records to allow it to expand its program of research beyond what was possible from the published tabulations of the Census of Agriculture. This advancement has allowed researchers to engage in international comparative analysis, which requires that data sets be tailored to harmonize with the statistical conventions and systems of other countries.

While the available data sources differ in the three North American countries, in all rely on the census of agriculture as the foundation of their agricultural statistics programs. For comparative analysis, differences in the definitions used and limitations need to be kept in mind, such as for instance the inclusion of forested land and receipts of forest products (Box 1).

Box 1: *Concepts and definitions*

Canada	Mexico	US
Farm A census farm is defined as an agricultural operation that produces at least one of the following products intended for sale: crops (hay, field crops, tree fruits or nuts, berries or grapes, vegetables, seed); livestock (cattle, pigs, sheep, horses, game animals, other livestock); poultry (hens, chickens, turkeys, chicks, game birds, other poultry); animal products (milk or cream, eggs, wool, furs, meat); or other agricultural products (Christmas trees, greenhouse or nursery products, mushrooms, sod, honey, maple syrup products). The sample frame of the Farm Financial Survey (FFS) is the population of farms with gross revenues of C$10,000 or more, as per the most recent census of agriculture, and updated by survey programs. Excluded are institutional farms, community pastures, farms on First Nations reserves, and farms that are part of multi-holding companies.	**Agricultural Production Unit** It is the economic unit that in a specific reference period and with certain production means performs agricultural activity under the same administrative control. This economic unit is determined by: one or more land plots in the same municipality in which at least in one of them the agricultural activity is performed; the ownership of animals for the exploitation of meat, milk, egg, skin, honey or work, independently of the place where they are located, including those that are located in backyards and that are generally bred in a limited scale, constituting an occupation and income source for families	**Farm** The National Agricultural Statistics Service, USDA defines a farm as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the year. Since the definition allows for farms to be included even if they did not have at least $1,000 in sales, but normally would have, a system is developed for determining when a farm normally would have. These are called point farms. If a place does not have $1,000 in sales, a "point system" assigns dollar values for acres of various crops and head of various livestock species to estimate a normal level of sales. Point farms are farms with fewer than $1,000 in sales but have points worth at least $1,000. For farms with production contracts, the value of the commodities produced is used, not the amount of the

Canada	Mexico	US
The sample frame of the Agricultural Tax Data Program (ATDP) consists of incorporated farms with revenues from agricultural activities (according to NAICS) of C$25,000 or more and unincorporated and communal farms with operating revenue of C$10,000 or more.		fees they receive. The Economic Research Service, USDA defines a family farm as one in which the majority of the business is owned by the operator and individuals related to the operator by blood, marriage, or adoption, including relatives that do not live in the operator household. Since the inception of this definition in 2005, family farms have been at least 97% of all U.S. farms.
Farm Operator The Census and the FFS define farm operators as the persons responsible for the management decisions of the agricultural operation. The Census allows for up to three operators, without identifying a primary operator. For the TDP, the persons of reference are those who declare positive gross farm income or non-zero net farm income on their income tax return, accompanied by the statement of farming activities. Personal and family income data is only available for unincorporated farms, and the data set is limited to those with gross operating revenues of C$10,000 or more.	**Producer** It is the natural or legal entity that has the responsibility of the production unit's administration. It is the one in charge of decision making for the activities related to the production unit, it can be the owner or the leaseholder of the unit's land plots. Any person designated by the owner for decision making in the production unit is also considered as the producer or responsible.	**Farm Operator** The farm operator is the person who runs the farm, making the day-to-day management decisions. The operator could be an owner, hired manager, cash tenant, share tenant, and/or a partner. If land is rented or worked on shares, the tenant or renter is the operator. In the case of multiple operators, the respondent for the farm identifies who the principal farm operator is during the data collection process. See USDA, ERS (2013) for more information.
Land Area Census and FFS: Land area equals Land owned minus land rented to other plus land rented from others. Includes crop land, fruit trees, Christmas trees, summer fallow, pastures, woodlands and wetlands, and all other land.	**Land Area** Total area that occupies the area sum of the land plots that constitute the production unit. The area that the producer took as leased, borrowed, bartered or other. But the one the producer leased lent, bartered or other is excluded.	**Land Area** Land in farms equals Land owned minus land rented to other plus land rented from others. Includes crop land, fruit trees, Christmas trees, summer fallow, pastures, woodlands and wetlands, and land in farmsteads and with farm buildings. Excludes land rented on an AUM basis.
Gross Farm Receipts / Gross Farm Revenues Census: Gross Farm Receipts consist of receipts from all agricultural and forest products sold, program payments, custom work receipts. It does not include sales of capital items (quota, land, machinery, etc.) or receipts from the sale of any goods purchased only for retail sales. Taxation Data Program: Gross Farm Revenues consist of livestock and crop revenues, program payments and insurance proceeds, custom wok and machine rental, rental income forest products, sand and gravel, sale of agricultural inputs and outputs bought for resale.		**Gross Cash Farm Revenues** Includes gross farm receipts of farming operations, including sales of agricultural commodities, farm-related income such as indemnities from insurance and income from farm recreational and agri-tourism, and government payments. For production contracts, the fee the grower received is included, but the value of the commodity removed is excluded.
Market revenues Market revenues are Gross farm receipts / gross farm revenues less program payments		**Market revenues** Market revenues include only the cash sales of crop and livestock commodities
Program payments Available in the FFS and ATDP. Includes provincial crop, production insurance, AgriInsurance, AgriStability, other direct program payments, rebates (e.g. on hail insurance, fuel tax and property tax) subsidies, etc.	**Program payments** Includes all government support received to enhance production and natural disaster programs.	**Program payments** Includes all government payments received under commodity, conservation, and disaster programs.
Off-farm income Available in the Census as non-farm income linkage of Census of Agriculture and Census of Population provides accurate off-farm income. FFS data is less reliable because it is self-declared.	**Off-farm income** It should also be noted that, information on gross revenues and incomes are not included in Mexico's Census of agriculture questionnaire, so this information is not provided.	**Off-farm income** Includes earned and unearned sources of income for the principal operator and the principal operator's household. This item is not collected for the 2-3% of farms classified as nonfamily farms.

3. Comparative agricultural economic analysis

3.1 Farm Type

In recent decades, agricultural markets and value chains have become increasingly integrated, including the Canadian, Mexican and U.S. agricultural markets, partly through the North American Free Trade Agreement (NAFTA). The North American Industry Classification System (NAICS) was developed by the statistical agencies of Canada, Mexico and the United States, against the backdrop of NAFTA. The NAICS is a production oriented classification system. It provides common definitions of the industrial structure and a common statistical framework to facilitate the analysis of the three North American economies (Statistics Canada 2012)[7,8].

The NAICS classifies businesses and other organizations that produce goods and services according to the similarity of production processes (Statistics Canada, 2012). The hierarchical structure of the NAICS divides the whole economy into 20 sectors (2-digit level)[9]. Agriculture is part of 2-digit sector "11," "Agriculture, Forestry, Fishing and Hunting", and consists of two 3-digit sub-sectors (Crop Production, 111, and Animal Production and Aquaculture, 112), which are in turn divided into eleven 4-digit "industry groups" and 34 "industries" at the 5-digit level. Up to the 5-digit level data are comparable among Canada, Mexico and the United States. An additional 6-digit level enables each country to separate specific industries that are of importance to that country[10].

Farms are classified based on the production activity that generates the majority of estimated production. Farms with diversified production are classified as "Other Crop Farming" or "Other Livestock Farming." The revenues received for production of commodities other than the one that defines the farm is not separately accounted for.

In all three countries, there is no requirement that the agricultural activity is the dominant revenue generator for an enterprise to be included in agricultural statistics, and therefore the

[7] The NAICS aims to also maintain cohesion with the International Standard Industrial Classification of All Economic Activities (ISIC), and international efforts are under way towards greater harmonization with the European classification system, NACE (Nomenclature statistique des activités economiques dans la Communauté européenne (Statistics Canada, 2012).

[8] Canada, Mexico and the U.S. established the North American Tripartite Committee for Agricultural Statistics (NATCAS), which consists of representatives of the three statistical agencies. Its objectives are to develop and publish North American agriculture and agriculture-related statistics and to promote the adoption of common classification systems and standards. http://webpage.siap.gob.mx/

[9] While the NAICS uses the terms "sector" and "industry" very specifically in the hierarchical classification of production activities, this paper uses the terms for the most part interchangeably.

[10] In agriculture, Canada and the U.S. have specific industry 111211 for potato farming, while Mexico designated that code for tomato farming. In addition, Canada has 111993 for combination fruit and vegetable farming and 111994 for maple syrup and products production, while the U.S. classification has specific industries 111991 sugar beet farming and 111992 peanut farming. Mexico has additional codes 112131 for cattle raised for both milking and meat production and 112139 for cattle raised for other purposes, which includes working cattle, cattle for bullfights or bull-riding, as well as other purposes not considered in other NAICS codes.

enterprise can fall into other NAICS codes. Rather, the requirement is that the enterprise satisfies minimum levels of agricultural characteristics, as described in the definition in Box 1. They are then included in the total number of farms (Canada, U.S.) and production units (Mexico). In Canada and the U.S., non-farm NAICS codes are not assigned to farms, because the Census in Canada does not gather information on non-agricultural receipts, and the U.S. census includes only questions of a limited number of other on-farm activities, such as forestry, on-farm value-added production (e.g. jams), and tourism. In Mexico, data enables identification of non-agricultural NAICS codes. In the 2007 census, the total number of agricultural production units included 20.9% that were engaged in the majority in non-agricultural activities (Table 2b).

In both Canada and Mexico, the largest group of farms are involved primarily in Oilseed and Grain Farming (1111), represent 30 % of all farms in Canada and 33 % of all production units in Mexico (Tables 2a – c). In the U.S., the largest groups of farms were beef farming (30%). In Canada, oilseed and grain farmers also managed the largest share of agricultural land (48.8%), while in the U.S., farms specializing in Cattle Ranching and Farming managed the largest share of land (42.8%). In Mexico, most land was managed by production units that did not have the majority of their production from agricultural activities.

Table 2a: *Canada: Share of farms, their land area, share of gross cash revenues, commodity market revenues, program payments, and program participation rate, by NAICS code, 2007*

	Share of Farms [%] (1)	Share of Land [%] (1)	Share of Total Revenues [%] (1)	Share of Market Revenues (2)	Share of Program payments (2)	Percentage of farms receiving program payments (2)
1111 Oilseed and grain farming	30.0	48.8	35.7	34.4	57.4	68.2
1112 Vegetable an melon farming	2.3	1.0	4.2	3.9	3.9	62.5
1113 Fruit and tree nut farming	4.0	0.5	1.9	1.8	2.4	47.9
1114 Greenhouse, nursery and floriculture production	3.9	0.4	6.6	6.7	2.6	41.1
1119 Other crop farming	18.2	10.0	3.9	2.4	2.5	43.3
11211 Cattle ranching and farming	18.2	29.5	14.3	19.2	15.1	50.8
11212 Dairy cattle and milk production	5.9	3.3	12.3	12.0	3.7	69.4
1122 Hog and pig farming	1.7	1.0	8.1	8.2	8.3	77.4
1123 Poultry and egg production	2.2	0.4	7.8	8.0	1.2	37.6
1124 Sheep and goat farming	1.9	0.3	0.3	--	--	--
1129 Other animal farming (3)	11.7	4.8	5.0	3.4	2.8	36.3
Total	100.0	100.0	100.0	100.0	100.0	57.9
Totals, absolute values (4)	205,730	64.8M ha	$60.6 B	$57.2B	$3.4B	99,670([5])

Note: Highlighted boxes refer to the most frequently reported category.
Sources:
(1) 2011 Census of Agriculture, 2010 reference year
(2) TDP, 2011 Reference year

(3) Includes sheep and goat farming
(4) C$61.2B (Gross Revenues); C$57.8B (Market Revenues); $3.4B (Program Payments)
(5) The number of farms that received program payments in 2011 is a subset of the TDP file for the 2011 reference year, and therefore is not 57.9 % of the 2011 census farms.

Table 2b: *Mexico: Share of production units, their land area, and program participation rate, by NAICS Code, 2007*

	Share of Farms [%]	Share of Land [%]	Share of farms receiving program payments [%]
1111 Oilseed and grain farming	33.4	12.6	48.66
1112 Vegetable an melon farming	2.5	1.6	42.93
1113 Fruit and tree nut farming	10.2	3.5	35.81
1114 Greenhouse, nursery and floriculture production	0.5	0.1	22.31
1119 Other crop farming	5.7	4.6	31.31
11211 Cattle ranching and farming	5.7	30.6	51.33
11212 Dairy cattle and milk production	2.7	3.4	46.90
1122 Hog and pig farming	3.8	0.7	35.14
1123 Poultry and egg production	3.4	0.8	31.26
1124 Sheep and goat farming	4.3	1.3	44.69
1129 Other animal farming	6.9	2.6	53.13
11 Total	79.1	61.8	
Other NAICS codes*	20.9	38.2	13.02
Total	100.0	100.0	37.77
Totals, absolute values	4,847,818	97.1 M ha	1,831,461

Note: Highlighted boxes refer to the most frequently reported category.
* "Other NAICS" consists of the following: 'Production units with no agricultural activity' 16.47%; 'Exploitation of milk and meat cattle' (2007 NAICS code 112131), 0.01; 'Exploitation of cattle for other purposes' (NAICS code 112139), 3.86%; 'Collection of forestry products' (NAICS code 113212), 0.21%; and 'Felling of trees' (NAICS code 113310), 0.31%, Total 20.86%.
Source: VIII Agriculture, Livestock and Forestry Census 2007

Table 2c:
U.S.: Share of farms, their land area, share of gross cash revenues, commodity market revenues, program payments, and program participation, by NAICS code, 2011

	Share of farms [%]	Share of land [%]	Share of gross cash revenue [%]	Share of commodity market revenues [%]	Share of program payments [%]	Share of farms receiving program payments [%]
1111 Oilseed and grain	14.6	29.4	37.0	37.0	51.9	84.3
1112 Vegetable and melon	1.5	0.8	5.2	5.3	1.1	17.7
1113 Fruits and tree nuts	2.9	1.0	6.9	6.8	1.3	11.7
1114 Greenhouse, nursery, and floriculture	2.3	0.3	3.8	4.1	0.2	5.9
1119 Tobacco, cotton, peanut, and general crop	22.6	13.3	8.6	7.5	23.4	48.4
11211 Beef cattle	30.1	46.7	15.1	15.1	15.0	25.6

11212 Dairy	2.5	2.3	13.8	16.0	2.9	59.9
1122 Hogs	0.8	0.6	3.3	3.3	1.3	36.2
1123 Poultry	2.4	0.7	3.6	2.4	0.9	13.0
1124 Sheep and goat	2.7	1.7	0.3	0.3	0.2	7.8
1129 General livestock	17.4	3.3	2.5	2.3	1.6	5.9
All	100.0	100.0	100.0	100.0	100.0	35.1
Absolute level	2,172,843	365.0M ha	$299.5B	$247.6B	$8.0B	762,141

Note: Highlighted boxes refer to the most frequently reported category.
Source: 2011Agricultural Resource Management Survey, ERS, USDA

3.2 Farm Size

Farm size using farm land area operated is a common classification system, which provides indication of the farm size distribution. Cross-tabulating land area with farm type provides an indication of the differences in production systems of commodities.

Tables 3a-c illustrate that while the distribution of farms according to size, as measured by land area, is similar for Canada and the U.S. for some farm types, beef, hog and dairy farms tend to have a larger land base in Canada than in the U.S., while poultry farms tend to have a smaller land base in Canada. In contrast, most Mexican farms are significantly smaller. Beef and dairy farms tend to be larger than the other farm types in Mexico.

Table 3a: *Canada: Distribution of farms by NAICS and land area, 2010 (per cent)*

[ha]	1111 Grain & Oilseed	1112 Vegetable	1113 Fruit & tree nut farming	1114 Green-house & nursery	1119 Other crop farming	11211 Beef cattle	11212 Dairy	1122 Hog and pig farming	1123 Poultry & egg	1124 Sheep & goat farming	1129 Other farming	Total
< 2	0.1	10.2	9.0	19.3	9.0	0.9	0.8	7.9	19.1	6.9	6.1	3.1
2 to 5	0.2	14.6	25.0	21.9	25.0	2.2	0.5	6.9	22.7	14.4	11.6	5.4
5 to 20	2.5	18.9	29.0	24.8	29.0	5.0	1.0	11.3	20.0	21.0	20.8	9.5
20 to 50	11.1	17.5	19.1	17.3	19.1	12.1	7.0	18.1	14.2	25.4	22.5	15.3
50 to 100	15.5	11.7	9.1	8.6	9.1	17.4	24.5	18.9	10.2	18.4	18.0	17.8
100 to 200	16.6	9.4	5.3	5.0	5.3	17.7	38.4	17.3	7.5	9.5	10.2	16.6
200 to 500	21.5	11.0	2.8	2.4	2.8	20.7	24.0	14.0	4.9	3.7	6.9	15.8
500 to 1,000	17.9	4.2	0.4	0.5	0.4	12.7	3.1	2.7	1.1	0.5	2.4	9.2
1,000 to 2,500	12.4	2.2	0.2	0.2	0.2	8.0	0.7	1.8	0.2	0.1	0.9	5.8
2,500 to 5,000	1.8	0.4	0.1	0.0	0.1	2.1	0.0	1.0	0.0	0.0	0.5	1.1
> 5,000	0.4	0.0	0.0	0.0	0.0	1.1	0.0	0.2	0.0	0.0	0.3	0.4
Total	100	100	100	100	100	100	100	100	100	100	100	100
Total [thousands]	61.7	4.8	8.3	7.9	37.4	37.4	12.2	3.5	4.5	3.9	24.1	205.7

Source: 2011 Census of Agriculture
Note: Highlighted boxes refer to the most frequently reported category.

Table 3b: *Mexico: Distribution of production units by NAICS and land area, 2007 (per cent)*

[ha]	1111 Grain & Oils-seed	1112 Vegetable	1113 Fruit & tree nut farming	1114 Green-house & nursery	1119 Other crop farming	11211 Beef cattle	11212 Dairy	1122 Hog and pig farming	1123 Poultry & egg	1124 Sheep & goat farming	1129 Other farming	Other codes	Total
< 2	48.49	44.04	46.95	77.42	23.78	12.99	22.29	72.49	69.76	65.02	51.40	41.47	45.32
2 to 5	25.01	24.32	28.1	13.24	26.91	13.01	17.37	16.14	15.77	20.27	27.26	18.90	22.50
5 to 20	21.23	22.64	21	7.04	36.26	36.95	36.45	9.45	11.24	11.91	17.82	24.76	22.64
20 to 50	3.48	5.42	2.76	1.35	8.63	18.16	14.16	1.36	2.3	1.8	2.34	7.47	5.42
50 to 100	1.11	1.96	0.71	0.47	2.67	8.22	5.64	0.38	0.62	0.56	0.64	3.24	2.04
100 to 200	0.42	0.88	0.27	0.22	1.1	4.5	2.51	0.1	0.18	0.23	0.25	0.18	1.00
200 to 500	0.19	0.5	0.14	0.12	0.48	3.22	1.17	0.05	0.1	0.14	0.17	1.28	0.62
500 to 1,000	0.04	0.15	0.04	0.06	0.11	1.33	0.28	0.01	0.03	0.04	0.07	0.51	0.23
1,000 to 2,500	0.01	0.07	0.02	0.07	0.05	0.87	0.09	0.01	0.01	0.04	0.03	0.33	0.14
2,500 to 5,000	0.01	0.02	0.01	0.01	0.02	0.42	0.03	0	0	0.01	0.01	0.14	0.06
> 5,000	0	0.01	0	0	0.01	0.34	0.01	0	0	0	0.01	0.08	0.04
Total	100	100	100	100	100	100	100	100	100	100	100	100	100
Total [thousand]	1,621.8	122.0	496.2	22.8	278.0	274.9	128.7	185.0	165.8	207.7	334,0	1,011.0	4,847,8

Note: Highlighted boxes refer to the most frequently reported category.
Source: VIII Agriculture, Livestock and Forestry Census 2007

Table 3c: *U.S.: Distribution of farms by NAICS and land area, 2011 (per cent)*

[ha]	1111 Oilseed and grain	1112 Vegetable and melon	1113 Fruits and tree nuts	1114 Green-house, nursery, and flori-culture	1119 Tobacco, cotton, peanut, and general crop	11211 Beef cattle	11212 Dairy	1122 Hogs	1123 Poultry	1124 Sheep and goat	1129 General livestock	Total
< 2	<1.0	12.0	10.8	19.3	1.5	0.6	<1.0	4.7	6.9	11.6	8.7	3.2
2 to 5	<1.0	24.4	22.5	28.0	7.0	4.8	1.4	20.6	17.1	23.3	20.7	9.0
5 to 20	6.5	29.6	31.7	32.8	26.7	20.9	4.5	18.8	33.6	36.6	42.1	23.9
20 to 50	14.9	13.2	15.1	11.6	30.6	24.7	17.5	14.8	21.6	17.7	17.6	22.1
50 to 100	17.0	8.0	8.7	4.7	16.8	19.1	26.1	13.1	9.7	5.9	6.9	15.6
100 to 200	17.9	3.1	6.6	1.4	8.9	13.7	28.4	7.9	6.4	0.9	1.9	10.8
200 to 500	25.2	6.7	3.1	1.8	4.8	8.3	17.8	14.0	3.5	2.5	1.6	9.1
500 to 1,000	10.2	1.7	0.8	<1.0	1.9	3.4	3.0	5.5	1.0	<1.0	0.3	3.8
1,000 to 2,500	6.1	0.8	0.5	<1.0	1.6	2.9	1.1	0.7	<1.0	<1.0	0.1	1.9
2,500 to 5,000	1.1	0.2	0.2	<1.0	0.2	0.9	<1.0	<1.0	<1.0	<1.0	<1.0	0.4

[ha]	1111 Oilseed and grain	1112 Vegetable and melon	1113 Fruits and tree nuts	1114 Green-house, nursery, and flori-culture	1119 Tobacco, cotton, peanut, and general crop	11211 Beef cattle	11212 Dairy	1122 Hogs	1123 Poultry	1124 Sheep and goat	1129 General livestock	Total
> 5,000	0.2	0.2	<1.0	<1.0	0.0	0.7	<1.0	<1.0	<1.0	<1.0	<1.0	0.2
Total	99.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total [Thousands]	318.0	33.0	64.0	50.0	490.8	654.2	53.7	18.0	53.0	59.6	378.7	2,172.8

Source: 2011 USDA Agricultural Resource Management Survey.

In Canada and the U.S., the majority of revenues are generated on farms with between 200 ha and 2,500 ha (Table 4a and 4c). These farms generate the majority of market income and also received the bulk of program payments. While in Canada and in the U.S., farms are more likely to receive program payments as land area increases (except for the largest U.S. farms), in Mexico farms with between 2 and 100 ha are more likely to receive program payments.

Tables 4a: *Canada: Share of farms, land area, gross cash revenues, commodity market revenues, program payments, and program participation, by farm size, 2010 (per cent)*

[ha]	Share of Farms [%] (1)	Share of Land [%] (1)	Share of Total Revenues [%] (1)	Share of Market Revenues [%] (2)	Share of Program payments [%] (2)	Percentage of farms receiving program payments [%] (2)
< 2	3.1	0.0	3.2	2.3	2.4	16.9
2 to 5	5.4	0.1	2.5	1.6	1.6	13.5
5 to 20	9.5	0.4	5.4	4.5	4.6	17.6
20 to 50	15.3	1.7	6.5	5.8	5.9	27.1
50 to 100	17.8	4.0	8.3	8.4	8.6	35.2
100 to 200	16.6	7.6	12.1	12.1	12.1	44.4
200 to 500	15.8	16.2	17.5	17.7	17.6	52.7
500 to 1,000	9.2	20.6	14.6	15.1	14.9	57.5
1,000 to 2,500	5.8	27.1	17.8	18.5	18.2	59.8
2,500 to 5,000	1.1	11.3	7.9	9.3	9.4	50.4
> 5,000	0.4	11.1	4.1	4.8	4.7	65.2
	100	100	100	100	100	100
Total	205,730	64.8M ha	$49.4B	$46.8B	$2.1B	42.5

Source: (1) Census of Agriculture, 2010
(2) Farm Financial Survey, 2011 Reference year; farms with more than C$10,000 in gross revenues

(3) U.S. amounts are equal to C$50.9B (Gross Revenues), C$48.2B (Market Revenues), and C$2.1B (Program Payments)
Note: Highlighted boxes refer to the most frequently reported category.

Tables 4b: *Mexico: Share of farms, their land area, and program participation, by farm size, 2007 (per cent)*

[ha]	Share of Farms [%]	Share of Land [%]	Share of farms receiving program payments [%]
< 2	45.32	2.33	28.98%
2 to 5	22.50	4.04	44.24%
5 to 20	22.64	11.72	47.13%
20 to 50	5.42	8.57	44.78%
50 to 100	2.04	7.40	42.64%
100 to 200	1.00	7.09	38.89%
200 to 500	0.62	9.75	32.83%
500 to 1,000	0.23	7.96	29.27%
1,000 to 2,500	0.14	10.74	25.36%
2,500 to 5,000	0.06	10.21	25.84%
> 5,000	0.04	20.19	29.19%
Total	100	100	37.78%
Total	4,847,818	97.1 M ha	1,831,461

Source: VIII Agriculture, Livestock and Forestry Census 2007

Tables 4c: *U.S.: Share of farms, their land area, share of gross cash revenues, commodity market revenues, and program participation rate, by farm size, 2011 (per cent)*

[ha]	Share of farms [%]	Share of land [%]	Share of gross cash revenue [%]	Share of commodity market revenues [%]	Share of program payments [%]	Share of farms receiving program payments [%]
< 2 hectares	3.5	<1.0	0.6	0.6	<1.0	1.1
2 to up to 5 ha.	9.7	<1.0	1.7	1.7	<1.0	4.1
5 to up to 20 ha.	24.8	1.7	4.4	3.8	2.2	15.3
20 to up to 50 ha.	22.1	4.4	5.7	5.1	5.5	31.7

[ha]	Share of farms [%]	Share of land [%]	Share of gross cash revenue [%]	Share of commodity market revenues [%]	Share of program payments [%]	Share of farms receiving program payments [%]
50 to up to 100 ha.	14.9	6.3	6.9	6.7	7.7	44.5
100 to up to 200 ha.	10.3	8.7	11.0	11.1	11.1	61.2
200 to up to 500 ha.	8.5	16.0	23.5	24.4	23.4	73.0
500 to up to 1000 ha.	3.2	13.3	17.0	17.1	18.3	75.3
1000 to up to 2500 ha.	2.2	19.4	18.4	18.5	21.6	79.7
2500 to up to 5000 ha.	0.5	10.6	6.2	6.3	6.1	74.5
5000 ha. or more	0.3	19.5	4.6	4.7	3.7	52.1
Total	100.0	100.0	100.0	100.0	100.0	35.1

Source: 2011 USDA Agricultural Resource Management Survey.

These tables generated using available census and other micro-level data and the NAICS codes and land size as classification systems provide an initial comparison of the structure of the three agricultural industries.

3.3 Other Collaborations on Agricultural Classifications

Access to farm-level data has allowed agricultural economists to collaborate across international jurisdictions to develop harmonized cross-country comparisons. This is especially the case for OECD countries, since several member countries have access to micro-level, whole farm data bases. Canada, Mexico and the U.S. all collaborate as members of the OECD. Canada and the U.S. ,for example, collaborate on analysis of farm household income (OECD, 2003), asset capitalization of agricultural programs (OECD, 2008), the potential impact of climate change on business risk management (Kimura, Antón and LeThi, 2010), and agricultural risk management (OECD, 2011). Mexico has participated with the U.S. in comparative analysis of the impact of policy and trade reform on household income (OECD, 2006).

Related more specifically to farm structure, a variety of comparative research projects across select countries (e.g. Canada, U.S., Brazil) have been conducted, such as on cost of production as a mechanism for evaluating international competitiveness (Ahearn, Culver, Shoney, 1990), issues surrounding farm family income (Ahearn, Bollman, and Fuller, 1990), multiple job holdings among dairy farm families (Weersink et al., 1998), farm family dynamics (Kimhi and Bollman, 1999), farm structure (Hoppe et al. 2004), and the role of farm families in agricultural production (Poppe, Ahearn, Salvioni, 2009).

Canada and the U.S. have also developed multi-variate farm classification systems for farm-level analysis, while Mexico does not currently have such a classification system.

3.3.1 Multi-variate classification systems in Canada

AAFC developed its typology in the 1990s, to capture the characteristics of Canada's diverse farm sector and to better understand why particular subsets of farms behave differently than others. The AAFC typology classifies farms into more homogeneous groups based on five factors: organizational structure; age; dependence on off-farm income; total family income; revenue class. By capturing the life cycle or different business intentions among farmers, it is possible to explain some of the challenges facing particular subsets of farms and to develop policies that better target the needs of individual farms. The AAFC farm typology is similar in many respects to the Economic Research Service's (ERS) farm typology for the United States (ERS, 2001), see below.

The AAFC typology distinguishes first between family farms and non-family farms, i.e. communal operations, cooperatives and non-family corporations. Family farms are then distinguished between non-business and business-focused farms[11]. Non-business focused farms are determined according to total family income and age, while the remaining farms are considered based solely on their gross farm revenues. Analysis using AAFC typology shows that groups differ in their contributions to agricultural production, product specialization, program participation and dependence on farm income.

3.3.2 Multi-variate classification systems in the U.S.

Farm structure classification systems in the U.S. have evolved as structural issues have evolved and data collection capabilities have been advanced. However, it is also remarkable how similar issues have been over time. Major farm classification systems have been advanced by NASS and ERS (and their predecessor agencies) based on the Census of Agriculture (the first one conducted in 1840 as part of the Sixth Decennial Census of Population) and farm-level sample surveys. Publications based on the Census data have featured a variety of farm classifications over the years. Early classification schemes were based strictly on single-variable farm criteria, such as farm size or the tenure status of farm operators. The 1930 Census featured farms classified by their commodity specialization, an early precursor to the NAICS.

As early as the 1935 Census, classification systems were based on farm household characteristics, as well as farm characteristics, and based on multiple variables. In particular, in

[11] Non-Business-Focused farms categorized in the following order: First, *Pension Farms*, which are farms with revenues less than $252,524 (C$249,999) in gross farm revenues managed by an operator 60 years of age or older and receiving pension income, with no children involved in the day-to-day operation of the farm; *Lifestyle Farms*, which with revenues of less than $50,505 (C$49,999) managed by families with off-farm income greater than $50,505 (C$50,000); *Low Income Farms*, which have with gross farm revenues of less than $252,524 (C$249,999) managed by families with total income below Canada's Low-Income Measures. The remaining farms are Business-Focused Farms, which are grouped according to gross revenues, in the ranges of less than $101,009 (C$99,999, *Small Business-focussed*); $252,524 (C$249,999 *Medium Business-focussed*);); $505,049 (C$499,999, *Large Business-focussed*); and $505,050 and more (C$500,000 *Very Large Business-focussed*). More recently, the category of *Million-dollar farms* has been added in some analysis recognizing the significant differences in the *Very Large Business-focussed* group.

1935, the concept of part-time farming was recognized in the statistics and the volume featured a special article on part-time farms, defined as small farms with an operator who worked off the farm at least 100 or more days per year. The 1940 Census introduced a classification system based on the gross value of farm products which is a highly relevant system to this day. Bachman and Jones (1950) of the Bureau of Agricultural Economics (ERS' predecessor agency) published a report based on the 1945 Census where they classified farms based on the gross value of sales and introduced the terms part-time farms and nominal farms. Beginning with the 1954 Census and continuing until the 1974 Census, the major classification scheme was called the Economic Class of Farms. Under this system, large farms, called commercial farms, were further classified based on their gross value of sales and having an operator who worked less than 100 days off the farm, and smaller farms were classified based on whether or not the operator worked 100 or more days off the farm or having off-farm income less than farm income. The term residential farm was also introduced with the 1954 Census and was defined as those with less than $250 in sales. In 1959, the classification scheme was modified to introduce age into the criteria so that commercial farms excluded those 65 years old or older, who were considered to be of retirement age. It also classified those farms with an operator of 65 years or more as a new category, labelled part-retirement farms. The 1969 Census began collecting data on production contracting on operations and raised new issues on how to classify farms by size who were engaged in production contracting and without market sales. In 1978, the multiple-factor Economic Class of Farms classification was dropped in favor of a simpler classification based solely on gross value of sales, including the value of commodities removed under production contracts.

Access of ERS to individual farm records data in 1985 and the expansion of farm household data in the early years of the Farm Costs and Returns Surveys opened the door for ERS to explore various alternatives for developing policy-relevant classification schemes. In 1991, using the newly-available farm household data Ahearn and Lee (1991) classified farms based on the major occupation of the principal operator and the major income source of the farm household (i.e., farm or off-farm income). Perry and Ahearn (1993) introduced the limited resource farm household categorization, again, made possible by access to the Farm Costs and Returns Survey. Having access to individual farm records meant that ERS recognized that some farms did not have a single household associated with it that would freely share household resources with the farm business since they were not closely held businesses and some farms had more than one household associated with the farm business. To address this issue, presentation of farm household well-being indicators from 1988-1990 classified farms as family farms (Ahearn, Perry and El-Osta, 1993). Rather than relying on age as an indicator of retirement status (as has been done since at least the 1959 Census), ERS added a question on the ARMS to ask whether or not the principal operator consider himself or herself retired from farming.

Based on the 1995 Farm Costs and Returns Data, ERS introduced a classification scheme in 1998 still used today, referred to as the ERS typology of farms, which was based on multiple characteristics of farm businesses and farm households used in previous classification schemes. The most defining farm characteristic in the classification scheme is farm size, measured as gross value of farm sales. Other variables included family farm identifier, major occupation of the principal operator, retirement status, and limited resource status. The ERS typology has been used in a variety of publications, such as the Family Farm Report series (see Hoppe and Banker (2010) for the latest) and occasional studies such as (Hoppe and Newton, 2001). Very recently,

the ERS typology classification system has been updated in various ways, including dropping the limited resource farm category (Hoppe and MacDonald, 2013).

5. Discussion

Farm characteristics, as well as demographic, socioeconomic and regulatory conditions are continually changing, and therefore classifications must evolve to meet the policy challenges and the economic and structural changes over time to remain an effective tool for analysis. Individual countries have developed classification systems over time that meet the requirements of their domestic users, whether classification systems are based on single indicators of farm structure or multi-variate classification systems. Historically, basic farm classifications have largely been focused on the size and type of the farm income. For the multi-variate classification systems of Canada and the U.S., farm size based on gross sales has been used as one of the main variables.

Development of an inclusive classification system for North America will remain a challenge, as it must simultaneously recognize the policy, economic, and structural issues of the whole continent, as well as the data systems of each nation. At the same time, development of a useful classification system must look to the future and assess what the future needs are likely to imply for a classification system. A case must be made in each country to allocate the resources to collect the necessary data to develop a harmonized classification system. Though challenges will continue, the integration of the economies through NAFTA has facilitated the progress towards an integration of our statistical systems that is very likely to continue into the future. Issues include availability and harmonization of farm financial information, given the importance of an economic-based measure of size, i.e., based on gross sales. Furthermore, developing an integrated classification of national agricultural industries as different as Mexico compared to Canada and the U.S., in terms of current per capita productivity and the share of small subsistence farms, may very well provide some lessons for the development of a harmonized classification system for the world, with agricultural systems at every stage of development.

Bonnen (1977) identified systematic data deficiencies in agricultural economics; he suggested that these deficiencies arise from two main causes, (1) changes in the organization and nature of the agri-food industry, and (2) shifts in the agricultural policy agenda. Bonnen (1977) suggested that when the issue or question changes, it is often the case that the conceptual base of data is no longer completely appropriate and also that data critical to the new questions are not being collected. Evidence of this is found when we assess the data that is currently being collected against the backdrop of current policy agendas. These have broadened and increasingly focus on issues like competiveness, productivity, innovation and environmental sustainability.

For example, in the context of innovation, further empirical analysis is warranted to better understand farmers' decisions to innovate (Nossal et al, 2011). This could include the effort allocated to innovation, the adoption of innovations, and the impacts of these decisions on farm productivity. Certain farm characteristics have been previously identified as influencing innovation, such as age, education, farm size, and investment (Nossal and Lim, 2011; Sauer and Zilberman, 2009). However, these findings are based on how data is currently being collected. A

more precise measure of innovation efforts would be preferable, along with the necessary data collection effort.

Environmental sustainability is another important emerging policy issue across international jurisdictions. In order for agricultural economists to address these policy needs, a better understanding of the drivers that motivate producers to implement environmentally sustainable practices is necessary (e.g. efficiency, regulatory, market, management of social licensing, supply-chain). Furthermore, information on the level of adoption is required. An added challenge in developing a classification system focused on environmental sustainability is the regional specific nature of environmental sustainability. Regional characteristics (e.g. soil properties, soil hydrology, air and water quality, climate) may play a larger role than farm-level characteristics. Previous research has shown farm characteristics like farm size, education, and soil zones were significant factors correlated with the adoption of environmentally sustainable practices (Smith et al, 2013). However, similar to research on farm-level innovation, these findings are based on currently available data resource, and may not capture the necessary characteristics. Developing proper linkages between regional characteristics and farm-level characteristics may help enhance our understanding of environmental stewardship at a farm level.

Given the increasing complexity of farms, classification systems that incorporate farm characteristics outside of size and type should be explored. There are several arguments for creating a classification system based on an integrated set of indicators. This type of classification offers a tool to synthesize and assess farm indicators as an integrated set rather than as single indicators, thus highlighting linkages among the various indicators of interest (Andersen et al., 2007). Most multi-variate classification systems include farm size, along with other variables often characterizing the personal characteristics of farm households, depending on the targeted goal of the classification system. Multi-dimensional classification systems recognize the linkages of farm business and farm household decision making and can therefore be an effective tool in policy design. Multi-variate farm classifications have been developed in the U.S. and Canada; however, they do not currently reflect the emerging policy issues such as innovative capacity or adoption of environmentally sustainable practices.

Freshwater (2012) suggests that for the most part, the data collected in the context of the agriculture industry seems 'trapped' in the use of the older concept of the family farm. While farms remain the basic production unit of agriculture, and the vast majority of farms are family owned and operated, they are now production units integrated into more complex decisions making environments. Also, while larger farms behave differently than smaller farms, they are both complex in their motivations and structures. This is evident when we incorporate for example factors like types of off-farm income into farm classifications. Multi-variate classifications systems allow us to dissect the large group of small complex farms into smaller more homogeneous groups, like business focused small farms, pension farms, lifestyle farm etc. To develop better information on how these farms behave, it is necessary to think of them differently than in the past.

To be useful in a policy context, the data collected, as well as the farm characteristics included in farm classification, should be based on indicators identified as being relevant to

policy discussion. To develop an effective classification that addresses these emerging policy issues, context is key. For example, if the purpose of a classification system is to analyze farm-level innovation, it should be designed with this specific purpose of analyzing farms from an innovation standpoint. To do this, data specific to the issue of innovation is required, in addition to data that will provide insights into behavioural incentives for adoption. This is a challenging issue given that in many instances, such as when focussing on innovation and environmental sustainability, also data on production and regional characteristics are important.

The issue of data requirements is addressed by the World Bank, the FAO, and the United Nations jointly-produced publication "Global Strategy to Improve Agricultural and Rural Statistics" (FAO, 2010). The Global Strategy to Improve Agricultural and Rural Statistics assessment found a serious decline in the quantity and quality of agricultural statistics, which is occurring at the same time as many new data requirements are emerging. Among these emerging data requirements are those relating to global warming, land and water use, the increasing use of food and feed commodities to produce biofuels, poverty and food security. The evaluation also found a need to improve the coordination between national statistical organizations and the other national agencies that produce agricultural statistics (FAO, 2010). The focus of the Global Strategy was to identify the minimum core data that should be collected, but left unexplored the issue of farm classifications.

For Canadian and the U.S., broad set of data currently exist, which include detailed farm-level data related to farm and farm operator characteristics, farm assets, liabilities, revenues, expenses, capital investments, capital sales and environmental practices. Nevertheless, in Canada the accuracy of certain variables, namely off-farm income and labor resources dedicated to agriculture, could potentially be improved. While environmental management information is collected at a farm level, this information is not collected in conjunction with demographic information, making it challenging to establish a classification based on environmental sustainability and farm characteristics. Currently, limited information is collected related to farm level innovation, and data that does exist tend to focus on specific activities, which may not be applicable to all farm types (e.g. conservation tillage practices). These shortcomings could potentially be addressed by improving linkages across data resources (i.e. Census of Agriculture and other surveys). In this way, the information collected could be used more effectively, particularly in the absence of longitudinal data.

In Mexico, within the context of the national statistical system, it is difficult to collect information on variables related to revenues, farm assets, liabilities, capital investments and profit margins for the agricultural production units due to the characteristics of these units, as well as producers' socio-demographic conditions. This has been highlighted in the different census editions that have been conducted since 1930. For this reason, the classification criteria of the production units used in Mexico so far have been the NAICS, the size in terms of area and the type of unit: agricultural, livestock and forestry. However, in order to support both the development and evaluation of public policies, multi-variate classification alternatives are being analyzed, considering labor, purchase of machinery and the volume of production, among other variables. INEGI is initiating the development of an Agricultural Information System, which will consist of the Agricultural Census, a Continuous Survey System and Administrative Registers. This system will aim to meet the current and emerging major demands of information. In

addition, Mexico is working with FAO in the implementation of the Global Strategy. These Mexican challenges will take time to address, but progress is being made in the right direction, so that in the future there may be additional information for additional classifications.

To achieve a harmonized classification system across jurisdictions will require collaborative efforts to ensure that the data requirements are met. A harmonized classification system would facilitate cross country comparisons and add context to discussions pertaining to the structure and performance of agriculture across regions. It could facilitate the identification of best management practices across regions, and identify similarities which might otherwise be overlooked at first glance.

The current approach under the FAO's World Programme for the Census of Agriculture (2005) places emphasis on conducting agricultural censuses within the framework of the system of integrated agricultural censuses and surveys and in the broader context of the national statistics system. The programme recognizes the high cost of conducting an agricultural census and emphasises the coordination of the agricultural census with other censuses, especially the population and housing census, which can result in considerable cost savings and added value (FAO, 2005).

In Canada, Mexico and the U.S., efforts are currently under way to reduce the cost of data collection, reducing response burden especially for large farms, and the search for efficiencies without impacting the usefulness of data collected, for monitoring and policy analysis.

6. Conclusion

While farm structure and policy environments differ among Canada, the U.S. and Mexico, all three countries aim to increase the productivity, innovative capacity and environmental sustainability of their agricultural industries.

An effective way to analyze these emerging policy issues is to use farm-level classification systems. The most common classification systems for farms are typically based on size, or production type. An example of this is NAICS, which is based solely on the main type of production of a farm. Perhaps, the next most basic classification that could be developed is a classification of farms based on size, measured as gross sales or revenue, rather than land area as is compared here. Moving beyond a land area measure of size is especially important for a harmonized classification system across countries because of the great diversity in the climatic and resource characteristics of land. Moreover, looking to the future, multi-variable classification systems, including those that link farm and household characteristics, developed with current policy priorities in mind, would provide more in-depth insight.

As agriculture continues its path to global integration, the value of harmonized farm classification systems across borders may increase. However, the cost of data collection and data discrepancies across international jurisdictions are challenges. The use of administrative data and targeted surveys may facilitate access to the data required to develop farm classifications that are effective tools to address current policy questions and analyze industry trends at the farm level,

but these sources of data also interject definitional differences that must be overcome in a harmonized system.

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ANNEX 1

Selected Country Statistics for Canada, US, Mexico

	Canada	Mexico	US	Source and Notes
Population, 2010 [millions]	34.0	113.4	310.4	The values shown are midyear estimates. Source: World Bank (WDI)
Population rural – share, 2010	19.4%	22.2%	17.7%	Rural population refers to people living in rural areas as defined by national statistical offices, calculated as the difference between total population and urban population. Source: World Bank (WDI)
GDP [$B], 2010	1,574.0	1,039.1	14,657.8	Source: World Bank (WDI)
GDP per capita, 2010	46,214.9	9,566.0	47,283.6	GDP per capita is gross domestic product divided by midyear population. Source: World Bank (WDI)
Share of world GDP, 2010	2.4%	1.6%	26.2%	Source: http://usda01.library.cornell.edu/usda/current/AES/AES-05-30-2013.pdf
Agricultural value added % of GDP, 2009	1.6%	4.3%	1.2%	Source: World Bank (WDI)
Total value of production (at farm gate), 2011 [$B]	$46.5	$48.6	$372.3	OECD StatExtract (http://stats.oecd.org/Index.aspx?DataSetCode=MON20123_3) Accessed: July 4, 2013) Exchange rate used: Source: Worldbank http://data.worldbank.org/indicator/PA.NUS.FCRF
Agricultural land [ha millions]	64.8	91.5	365.0	Canada: 2011 Census of Agriculture Mexico: VIII Agriculture, Livestock and Forestry Census 2007 U.S.: 2011 ARMS
Number of farms	205, 730	4,847,818	2,204,792	Canada: 2011 Census of Agriculture; Mexico: VIII Agriculture, Livestock and Forestry Census 2007 US: 2007 Census
Share of farm operators by gender [women / men]	27% / 73%	16% / 84%	30% / 70% [14% / 86%]	Canada: 2011, all operators (up to three per farm) Mexico: 2007, one operator per farm (http://webpage.siap.gob.mx/) US: 2007, all operators (up to three per farm)
Employment in agriculture, 2010 [% of total]	2.4%	13.1%	1.6%	World Bank (WDI), ILO
Agricultural Value added per worker, 2009	$44,800	$3,360	$49,500	Data are in constant 2000 $ Source: World Bank (WDI)
Agricultural Total Factor Productivity, 2009, 1992=100	157	143	140	Source: Fuglie, Keith. (2012) "Productivity Growth and Technology Capital in the Global Agricultural Economy." Chapter 16 in Productivity Growth in Agriculture: An International Perspective, K.Fuglie, SL Wang, and VE Ball, eds. CAB International, Oxfordshire, UK.
Agricultural Exports, 2011 [$B]	$40.4	$21.1	$127.8	Statistics Canada; SIAP; U.S.Census Bureau, Foreign Trade Statistics (http://webpage.siap.gob.mx/ (accessed: June 7, 2013)
Agricultural Export -- share of total exports,	8.9	6.0	8.63	Same a above (http://webpage.siap.gob.mx/)

	Canada	Mexico	US	Source and Notes
2011				
Most important export commodities, 2011	(1) Wheat (2) Canola & canola meal (3) Pork meat	(1) Tomatoes (2) Beer (3) Sugar	(1) Soybeans (2) Corn (3) Wheat	Same a above (http://webpage.siap.gob.mx/)
Most important purchasers of country's agricultural commodities, 2011	(1) U.S. (2) Japan (3) China (4) Mexico	(1) U.S. (2) Japan (3) Canada	(1) Canada (2) Mexico (3) China	Same a above (http://webpage.siap.gob.mx/)
Agricultural Imports, 2011 [$B]	$30.9	$26.6	$98.1	Same a above (http://webpage.siap.gob.mx/)
Agricultural Import – share of total imports, 2011	6.9	7.6	4.4	Same a above (http://webpage.siap.gob.mx/)
Most important import commodities, 2011	(1)Wine (2) Coffee (3) Bread & pastry	(1) Corn (2) Soybeans (3) Wheat	(1) Coffee & coffee husks (2) Liquor and spirits (3) Wine	Same a above (http://webpage.siap.gob.mx/)
Most important source for agricultural imports, 2011	(1) U.S. (2) Mexico (3) China	(1) U.S. (2) Canada (3) Chile	(1) Canada (2) Mexico (3) Brazil	Same a above (http://webpage.siap.gob.mx/)
Public Expenditures on Agricultural R&D, 2006, [2005 PPP] [12]	$687.9	$517.6	$5,129.5	The public sector is defined, in this context, as government, higher education, and non-profit agencies engaged in agricultural research. Source: Agricultural Science and Technology Indicators (ASTI) / International Food Policy Research Institute (IFPRI)
Producer Support Estimate [PSE, US$ B], 2011	7.012	6.182	30.579	Producer Support Estimate (PSE) is an indicator of the annual monetary value of gross transfers from consumers and taxpayers to support agricultural producers, measured at farm gate level, arising from policy measures, regardless of their nature, objectives or impacts on farm production or income. http://stats.oecd.org/glossary/detail.asp?ID=2150
PSE, share of agricultural production	14.2	11.56	7.66	OECD

[12] Purchasing Power Parity (PPP) rates reflect the purchasing power of currencies more effectively than do standard exchange rates, because they compare the prices of a broader range of local—as opposed to internationally traded—goods and services.