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# Executive Summaries

## RESEARCH

### Lessons from the Canadian Cattle Industry for Developing the National Animal Identification System *Ryan G. L. Murphy, Dustin L. Pendell and Gary C. Smith.*

The continued development of new markets, outside of the U.S., is creating incredible opportunities for livestock and meat firms. However, with increasing movement of people and trade of animals and animal products across international borders, the risk also increases of inadvertently introducing foreign animal diseases into the U.S. Animal identification programs are information systems, which—if developed appropriately—can minimize the potentially devastating effects that an animal disease outbreak would have on a nation's economy. In addition, these systems can be integrated into a firm's production operations as a valuable management tool. The primary objective of this paper is to provide a series of recommendations for the U.S. to consider as it continues to develop the National Animal Identification System (NAIS). The secondary objective is to explain how some progressive operations, spanning all sectors of the live cattle and beef industry supply chain complex in Canada, have utilized the technology of the mandatory cattle identification system to improve management intensity. The authors recommend that an animal identification system should: be a mandatory program; operate with a single national database to avoid creating unnecessary and confusing database differences; standardize radio frequency identification technology and establish specific requirements for tag manufacturers to meet in order to be eligible to sell official animal identification tags; be implemented as a phase-in program; and, be harmonized with the identification programs of trading partners to extend their potential value across borders. Secondary benefits of animal identification include age-, source- and process-verification, improved supply chain and inventory management, as well as reduced labor costs associated with handling and analyzing production data.

## Drivers of Demand for Imported Horticultural Commodities: A Cross-Country Comparison *Bradley J. Rickard, Christine M. St. Pierre, and Gabriel M. Becker*

Horticultural commodities represent a large share of the global value of agricultural production and trade, and international markets for these products are increasingly important in many regions of the world. Part of this growth has been fuelled by the use of horticultural crops as ingredients in a wider range of processed food products. Much research has focused on trade patterns for meat, grain, and oilseed products; however, trade flows of key horticultural crops are understudied in the agribusiness and agricultural economics literature. Using panel data for five developed countries and up to five emerging countries between 1991 and 2005, the drivers of per capita import demand for six horticultural commodities were estimated. Our empirical results show that own-price elasticity estimates were negative in all import demand models and, in most cases, the effects were statistically stronger for importers in emerging countries. Overall, import demand for horticultural commodities in developed countries has been driven primarily by prices and the level of trade openness while income and diet considerations were more important in emerging countries. Results also indicate that trade openness is especially important for commodities that are commonly used as food ingredients (cocoa, tomatoes, and palm oil). In addition, our findings show that the determinants of import demand differed across the six models, and therefore information can be lost if data for horticultural commodities are aggregated.

## The Effectiveness of Facilitated Business-to-Business Word-of-Mouth Marketing Strategies on Target Participants' Information Sharing Behavior *Joan Fulton, Pei Xu, Corinne Alexander and Jay Akridge*

Agribusiness marketers have recognized the importance of facilitated business-to-business (B2B) word-of-mouth marketing (WOM) on firms' decision making. In particular, the impact of facilitated B2B WOM on information transmission decisions among participants and other business buyers has been explored, but little, if any, academic research has validated the link between facilitated B2B WOM and participants' information sharing decisions.

By surveying 202 business participants and investigating the impact of WOM on information sharing about two products, this study identifies the characteristics of participants in facilitated B2B WOM who share information. For example, satisfied participants and participants who view themselves as credible information sources are found to be more likely to transmit information to other firms. Once agribusiness marketers know who is most likely to share information with peers, they can improve the effectiveness of the WOM program to expand customer groups and enhance profits

## CASE STUDIES

### Opportunities for Producing Table Grapes in Egypt for the Export Market: A Decision Case Study *Yaser A. A. Diab, Magdi A. A. Mousa, Daniel F. Warnock and David Hahn*

This case study was developed for use in a capstone course of the Faculty of Agriculture at Assiut University in Upper Egypt. It explores an agricultural situation that can be taught to both classroom and extension learners. The case study discusses the situation of a fruit farm owner located in Nobarya along the Cairo-Alex Desert road, northwest of Cairo, Egypt. The owner produces exportable fruit crops, mainly focusing on table grapes. The challenges faced by the management of Barakat Fruit Farm are similar to those faced by other orchards or horticultural crops including potential market identification, cultivar longevity, production expansion, labor management, using intermediaries effectively, and increasing market share for product. A primary challenge this farm faces is to produce grapes early enough to catch a window of opportunity for fresh table grapes in Europe. The case chronicles how the management decisions for a crop production mix made early in the establishment of Barakat Fruit Farm have negatively affected the farm's ability to effectively compete in the current fruit export market. This case provides production, market, and financial information for evaluating the potential for shifting current grape production practices from a late season crop to an early season crop. The case uses a documentary format, secondary data resources, and interviews with the farm manager and exporters. The farm manager describes his perspectives on the challenges that he faces in producing early grapes. The teaching notes narrative describes the opportunities for producing table grapes in Egypt for export and offers strategies for classroom learning situations. Students completing the case will have a better understanding of grape production systems, gain decision making and analysis skills, and become familiar with using financial analysis principals for strategic business decisions. The Teaching Notes are available upon request.

## INDUSTRY SPEAKS

### Implementation of a Traceability System from Constraints to Opportunities for the Industry: A Case Study of Quebec, Canada
*Gilbert Lavoie and Jean-François Forest*

The laws and regulations governing traceability are not well adapted to the industry. With respect to sanitary control and food security, they are generally embedded in the Government's overall strategy. Accordingly, the implementation is often managed by government veterinarians and human health specialists. Hence, the needs and constraints of the industry, while accounted for, are often treated a posterior in spite of the precedence of public protection objectives. This creates a situation where the introduction of a traceability system leads to large resistance on the part of the industry that takes the tangible and short-term constraints and costs more into consideration than the opportunities that can be generated.

The sustained follow-up and management of farm information relating the links of the agri-food chain offers, in reality, a lot of opportunity to the industry; whether this is to maintain access to international markets, to identify the origin of convenience goods for marketing, to improve livestock or field management practices, or else. However, the main problem is that most of the advantages stay intangible and somewhat hypothetical in the short-run, and become concrete only in the event of an epidemiological or food safety crisis or in the long-run when various opportunities will arise.

The implementation of a traceability system is challenging to the industry in terms of optimally reducing of the associated costs and constraints, and perceiving the potential benefits from the opportunities thereof. It is, therefore, essential that the decision-makers responsible for the setup of such a system be aware of this challenge. They should also pay attention to and account for the priorities of the industry. This article presents the case of Quebec's traceability system where the cooperation between the industry and the Government has been the key factor used to facilitate the implementation process.

## EXECUTIVE INTERVIEW

### Global Supply Chain
### An Interview with Mary Shelman

*Doug Joses*

Mary Shelman discusses forces driving higher food prices and some of the changes which are impacting the global food supply chain. Shelman coordinates Harvard Business School's premier Agribusiness Seminar attended annually by more than 200 CEOs and top managers from global firms. She also organizes and teaches similar programs in Europe, Latin America and Asia. Her research focuses on the forces shaping global agribusiness. Her experience bridges academia, as an author and teacher of dozens of case studies on strategic change and challenges in global agribusiness firms, with industry experience.

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# Lessons from the Canadian Cattle Industry for Developing the National Animal Identification System

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## Abstract

The primary focus of animal identification programs, which are rapidly developing throughout the world, is to effectively respond to animal health emergencies that have the potential to cause devastating consequences to animal and public health. Additional benefits of an animal identification program include maintaining or expanding international trade, increased consumer confidence, and improved supply chain management. The primary objective of this paper is to provide a series of recommendations for the U.S. to consider as it continues to develop the National Animal Identification System. The secondary objective is to explain how some progressive operations, spanning all sectors of the live cattle and beef industry supply chain complex in Canada, have utilized the technology of the mandatory cattle identification program to improve management intensity.

**Keywords:** Animal Identification, Canadian Cattle Identification Agency, National Animal Identification System

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## Introduction

Incredible population and economic growth in developing regions of the world and their need for animal protein has spurred export market expansion in order to capitalize on these opportunities. However, to expand export markets, it has been necessary to liberalize international trade practices. As a consequence, live animals and animal products—as well as people—are crossing international borders at unprecedented levels. The risk of introducing a foreign animal disease into the U.S.—via an unintentional circumstance or an intentional terrorist event—has increased significantly over the past decade. History has demonstrated that even countries with well-established disease prevention and response programs are not impervious to outbreaks or their debilitating repercussions. More importantly, their experiences have shown that appropriately developed farm-animal identification programs can significantly enhance disease eradication efforts. Such information systems can be used to facilitate more informed decision-making during difficult times.

Animal identification programs can enable animal industries and their partners to respond rapidly and effectively to animal health emergencies; support ongoing disease control and eradication programs; protect and, potentially, expand important export markets by satisfying the growing demands of trading partners for access to animal health-related information; protect domestic markets, as well as consumer confidence; and, above all, protect animal health and minimize the hardships associated with an animal disease outbreak (USDA-APHIS, 2007). Furthermore, animal identification programs—developed with consideration for the needs of animal production industries—will encourage the integration of this technology into everyday business operations, which can help management personnel become more responsive, flexible, and effective in dealing with industry changes. The Canadian cattle industry has operated with such an identification program since 2001.

Canada and, specifically, the Canadian cattle identification program was chosen for this study because of Canada's proximity to the U.S.; for the many production similarities that exist between the two countries; and, because the highly integrated cattle industries in Canada and the U.S. function very much like a single market. The primary objective of this paper is to provide a series of recommendations for the U.S. to consider as it continues to develop the National Animal Identification System (NAIS). The secondary objective is to explain how some progressive operations, spanning all sectors of the live cattle and beef industry supply chain complex in Canada (excluding the province of Quebec), have utilized the technology of the mandatory cattle identification program to improve management intensity. The information presented in this study was largely collected during a trip to Canada in June 2007. Interviews and site-visits were completed for a number of operations, which included the Canadian Cattle Identification Agency (CCIA), cow/calf producers, feedlot operators, and beef packing plants. Agri-Traçabilité Quebec, which is the organization in the province of Quebec that is responsible for administering the mandatory identification and traceability system of Quebec agri-food products, was excluded from this study because, although it operates with a certain level of autonomy, it still concedes authority to the CCIA on national identification and traceability issues. A review of the Agri-Traçabilité Quebec animal identification system can be found in Murphy et al. (2008).

This paper begins with a review of the existing status of NAIS in the U.S., followed by brief reviews of bovine spongiform encephalopathy (BSE) in Canada and of the development of the CCIA. These sections are then followed by a discussion of how the Canadian cattle identification program has impacted traditional management practices and enhanced the ability of some firms to manage operations with greater efficiency and intensity. Finally, a comparison of the U.S. and Canadian beef industries is presented, followed by a series of recommendations for consideration by the U.S. as it continues to develop NAIS.

## Animal Identification and Traceability Systems in the United States

The U.S. has utilized cattle identification programs since the 1940s as part of an effort to eradicate brucellosis from the national cowherd. However, as the disease neared eradication the need for a control program disappeared and the program was scaled-back without an identification system in place to finish the program (USDA-APHIS, 2005). In 2003, the first draft of the U.S. Animal Identification Plan, the product of a government and industry collaboration, was released, thereby establishing the foundation for NAIS (USDA-APHIS, 2005). The USDA initiated the implementation of NAIS in 2004 shortly after the discovery of the first U.S. case of BSE in Washington State in December 2003. According to Murphy et al. (2008), NAIS was originally written as a mandatory program, but in the face of strong opposition, the USDA changed directions and published a revised "User Guide" in November 2006, which stated that NAIS would become a voluntary program at the federal level (USDA-APHIS, 2007). Today, NAIS remains voluntary at the Federal level and is administered by Veterinary Services of the USDA-Animal and Plant Health Inspection Service (APHIS). Smith et al. (2005) reported that the U.S. is "lagging behind many countries in developing traceability systems for food in general and especially for livestock, poultry and their products (page 174)."

Premises registration, the foundation of NAIS, was originally targeted for 100% compliance by 2009, but the USDA conceded that the decision to pursue a voluntary animal identification program would likely make this goal unattainable (USDA-APHIS, 2006). According to USDA-APHIS (2007), approximately $118 million in Federal funds to develop and implement NAIS had been made available by the end of fiscal year 2007, of which roughly 60% of these funds were administered to States and Tribes to carry out NAIS activities at the local level.

 

There are currently no mandatory beef traceability systems in the U.S., but voluntary traceability systems, such as USDA Process Verified and USDA Quality System Assessment Programs, are growing in popularity as firms along the beef supply chain try to satisfy consumer demands for more information about the origin, production, and processing of their food products (Souza-Monteiro and Caswell, 2004; Smith et al., 2005).

## Bovine Spongiform Encephalopathy in Canada

Canada has used animal identification programs since the 1920s to contain outbreaks of foot-and-mouth disease and to eradicate bovine brucellosis and tuberculosis from the national cow herd. The program was decommissioned in 1985 and traceability remained inactive until 1990 when the National Advisory Board on Animal Health was created to assess the vulnerability of the Canadian livestock industry to animal health-related concerns, such as the BSE crisis that had emerged in the United Kingdom (Canadian Livestock Identification Agency, 2005). Per the suggestions of the National Advisory Board, Agriculture and Agri-Food Canada (Canadian equivalent to the USDA) implemented a national BSE surveillance program in 1992.

In 1997, the U.S. and Canada enacted similar preemptive feed bans to prohibit feeding ruminant-derived protein (i.e., ruminant meat and bone meal) back to ruminant animals as a strategy to reduce the risk and, ultimately, to prevent the unintentional spread of BSE. However, on May 20, 2003, Canada reported its first case of indigenous BSE. Shortly thereafter, on December 23, 2003, the U.S. reported its first case of BSE in Washington State that was later traced back to its Canadian herd-of-origin. At the time of the researchers' visit, Canada had reported 10 additional cases of indigenous BSE and the U.S. had reported two additional cases of the disease—both indigenous—in cows thought to be from Alabama and Texas.

Investigations into Canada's other cases of BSE revealed that some of the animals that tested positive for the disease were born after the feed ban was enacted (Sanderson and Hobbs, 2006; Canadian Food Inspection Agency, 2007). Furthermore, epidemiological evidence indicated that an extremely low level of infectivity persisted in Canada's feed system during the late 1990s and early 2000s (Canadian Food Inspection Agency, 2007). It was presumed that poor initial compliance and weak enforcement of the ban permitted the feeding of banned materials after the ban-enactment date, which caused the cases of BSE in cattle that were born post-feed ban (Sanderson and Hobbs, 2006).

The Canadian cattle industry is so heavily dependent on export markets (i.e., 50% of live cattle sold in Canada pre-BSE were exported as either live animals or meat

 

[Boame, Parsons, and Trant, 2004]) that when the U.S. and other international markets closed their doors to live cattle and beef products on May 23, 2003 due to fears of BSE—live cattle prices fell into a devastating tail-spin. Fed cattle prices in Canada fell 65%, from $108 (CAD) per hundred-weight in April to $38 in July (Livestock Marketing Information Center, 2008). Boame, Parsons, and Trant (2004) reported that in 2002, 99.6% of Canadian live cattle exports and 84% of Canadian beef exports went to the U.S.

The loss of valuable export markets for Canadian beef products following its first case of BSE, compounded with Canada's dependence on these foreign markets, prompted the Canadian Food Inspection Agency (CFIA) to enhance the feed restrictions of the original 1997 feed ban. The new regulations prohibit the inclusion of bovine specified risk materials (SRMs) in all animal feed, pet food, and fertilizer (Canadian Food Inspection Agency, 2007). The "enhanced feed ban" became effective on July 12, 2007. Its primary goal is to prevent more than 99% of potential BSE infectivity from entering the feed system.

Keddy (2008) said that under the enhanced feed ban, Canadian beef packers must segregate and dispose of SRMs at a cost ranging from $10 to $50 per head. The U.S. Food and Drug Administration's enhanced feed ban was published on April 25, 2008 and will take effect on April 27, 2009. The new feed regulations prohibit certain cattle-derived materials such as the brains and spinal cords from cattle 30 months of age and older (among other identified materials) from being included in the food and feed of all animals (DHHS-FDA, 2008). Dessureault and Myles (2008b) reported that the Canadian cattle industry is lobbying the government of Canada to harmonize its feed ban regulations with those of the U.S. in order for Canadian beef packers to remain competitive. It is argued that Canada's more stringent feed ban regulations, which ban more SRMs from feed than does the U.S. rule (and also applies to fertilizer, while the U.S. rule does not) put Canadian beef packers at a competitive disadvantage with U.S. plants (Dessureault and Myles, 2008b).

In early 2008, a producer-owned cull cattle packing plant in Ontario, which started operations during the BSE crisis, filed for bankruptcy due to unfavorable financial conditions. The company reported that one of the contributing factors which led to its demise was the rigorous SRM regulations that imposed additional costs on Canadian plants that provided American processors a $39 (CAD) per cow cost advantage (Dessureault and Myles, 2008a). In addition to the aforementioned plant in Ontario, the costs of complying with the new regulations also have been noted as contributing factors in the closure of cattle producer-funded beef plants in Alberta and Quebec that started operations post-BSE (Keddy, 2008).

 

## The Canadian Cattle Identification Agency

The CCIA was incorporated in 1998 as a collaborative effort between the Canadian beef industry and the CFIA to proactively protect the safety and integrity of the Canadian cattle herd. It achieved full operation as a voluntary program in 2001. The CCIA began—and remains today—an industry-owned, industry-led initiative, operating as an independent subsidiary of the Canadian Cattlemen's Association with a board of directors representing all sectors of the Canadian cattle industry. The CFIA, as well as government officials from Agriculture and Agri-Food Canada and other pertinent federal agencies, serves on the CCIA's board, but all serve as non-voting members. Lawrence et al. (2003) states that the Canadian government is responsible for enforcing industry participation and compliance, and has the authority to access the CCIA's database for animal health investigations. The history and development of the CCIA are explained in greater detail in Murphy et al. (2008).

The CCIA became a mandatory program on July 1, 2002. Under the mandatory program, all bison, cattle, and sheep leaving the herd-of-origin or upon importation into Canada are required to bear an official CCIA ear tag. McConkey (2007) explained that the CCIA was developed at a total cost of $4 million (CAD), which was absorbed by the Canadian government, and is able to retain its self-sufficient autonomy by collecting $0.20 from the sale of each ear tag—regardless of the ear tag purchase price—to cover administrative costs.

In September 2006, the CCIA transitioned from visual dangle-tag bar code technology to radio frequency identification devices (RFID). To facilitate this transition, bar code tags were recognized in young animals until December 31, 2007, and will be recognized indefinitely on mature breeding stock (Stitt, 2007). Under rare occurrences, when cattle mistakenly bear both a bar code tag and an RFID tag, the bar code tag takes precedence as it is assumed that it was applied first (McConkey, 2007). Initially, a 5% allowance for lost CCIA tags was acceptable, but following the first case of BSE in 2003, this policy was changed to zero-tolerance (McConkey, 2007). One exception to the zero-tolerance policy applies to cattle arriving at packing plants without proper CCIA identification because it is possible that tags could be lost during transport and, under such conditions, it would not be feasible to re-tag animals (McConkey, 2007).

As an industry-led initiative, the CCIA has the innate ability to conform its services to satisfy ever-changing market demands. Cow/calf producers can submit birth date information to the CCIA database to age-verify their calves using one of two options, which acknowledges the different levels of management intensity practiced in the industry (McConkey, 2007). Producers can submit birth date information for individual calves or for a group of calves.

 

The CFIA recognizes CCIA birth certificates as an alternative to dentition for age-verification of domestic meat, as well as for live animal and meat exports (McConkey, 2007). Purebred registration papers, as stand-alone documents, are not an accepted alternative to birth certificates for age-verification. Purebred animals must be verified by the CCIA. However, registration papers can provide supporting information should a discrepancy arise to avoid unnecessary over-thirty-months of age designation (McConkey, 2007). Auction markets, feedlots, packing plants, and producers can query the CCIA database for birth certificates, but during the queries, no identifying information (i.e., herd-of-origin) is released and users are unable to search for random information (McConkey, 2007).

McConkey (2007) explained that when an animal dies, either on-farm (with disposal on-site or at a rendering plant) or harvested at a packing plant, the responsible party is required to "retire" the individual tag numbers within 30 days of the event using one of three approved electronic reporting methods: (1) direct retirement using the CCIA web service; (2) electronically submit a Microsoft Excel® spreadsheet file to the CCIA, which is then entered into the database by CCIA office personnel; or (3) use CCIA web service programming to connect to private databases through the internet using a back-door approach to retrieve and retire tag numbers[1]. Originally, the CCIA permitted producers and small abattoirs to retire tag numbers by submitting (by phone or fax) the required information, but as part of their mandate to move to total electronic reporting, they have discontinued this service. Producers that do not have access to the internet can assign a third-party to submit animal records on their behalf (McConkey, 2007).

The CCIA was developed using the "bookends" analogy; with the birth record representing the left bookend and the reporting of animal death or export (tag number retirement) representing the right bookend. More specifically, the CCIA is a farm-of-origin to point-of-slaughter, -export, or -death cattle identification and traceability system (Lawrence et al., 2003). Identity preservation of individual animals beyond the point of harvest (i.e., as meat) is not mandatory, but as will be explained in the following sections, is a service that some firms in the beef industry are developing in order to satisfy consumer concerns about the source of, and/or the use of specific production-practices in generation of their food. McConkey (2007) believed that the bookends approach accounts for 90% of the pertinent details of traceability while the remaining 10% of traceability accounts for 90% of the work. Additionally, McConkey (2007) believed that incorporating the bookends approach with feedlot reporting of animal movements would account for 99% of the pertinent details of cattle traceability. In other words, he believed that filling in the information between the bookends, which would most likely be achieved through animal movement reporting, would place a heavy burden on cattle producers that would disproportionately outweigh the gains achieved in traceability. Smith et al.

[1] Tag number "retirement" is the Canadian equivalent to tag number "termination" in the U.S.

 

(2005) said that "it is easy to identify, very difficult to accomplish traceability, and even more difficult to verify identity, traceability and claims about livestock and meat (page 176)."

## Cattle Industry Interviews and Site Visits

The cattle industry in Canada has had to endure tremendous adversity over the past few years as a result of the occurrence of BSE and, more recently, because of labor shortages due to unprecedented expansion in the oil and gas industries, as well as because of a rapidly appreciating Canadian dollar.

*Cow/Calf Operations*

From the moment the CCIA was created, outspoken criticism by mainly cow/calf producers and auction market operators questioned the need for, and relevance of, an identification system (Lawrence et al., 2003). However, following the discovery of a case of BSE in May 2003, most of the vocal opposition quietly changed to cautious optimism as cattlemen hoped that the Canadian cattle identification program would expedite the reopening of international markets to Canadian beef. Murphy et al. (2008) states, "although the influence that the CCIA had on expediting the normalization of foreign beef markets might not be known, there is general consensus within the Canadian beef industry that it was an invaluable tool during the BSE investigations (page 281)." Furthermore, Murphy et al. (2008) believed the existence of the CCIA sends a very clear message to the world that Canada takes the identification and traceability of its animals very seriously. Lawrence et al. (2003) and McConkey (2007) believed that the CCIA was a valuable tool in the trace-back of infected animals to their herd-of-origin and the trace-forward of potentially exposed herd-mates and offspring away from the herd-of-origin. It also facilitated the trace-back of the BSE-positive cow found in Washington State to its herd-of-origin in Canada.

The interviewed cow/calf operations indicated that the use of RFID tags and its associated technology had improved the efficiency of managing and maintaining production data because it enabled them to electronically record mating choices, vaccination protocols, calving and veterinary records, as well as any other information they deemed important to herd management. Furthermore, individual histories were created for each cow, which they used to identify animals with low fertility, dystocia problems, poor milking, etc., for culling from the herd. They strongly believed that managing animal records electronically improved their profitability by identifying inferior cows and sires faster than a traditional paper-based record management system. Overall, it was clear during the interviews and site visits that the more progressive cow/calf producers (and feedlot operators) were exploiting the benefits of the cattle identification program to stream-line collection and analysis of production data, which enabled them to make more effective and efficient management decisions.

*Cattle Feeding Operations*

Depending on the operation, in Canada, the first tag number entry for each animal occurs when the animal arrives at the feedlot. RFID panel readers located on the loading/unloading chutes automatically record the CCIA tag number for each animal. It was explained that this initial step facilitated easier load-number reconciliation, electronically identified the origin of the shipment, and created the basis for individual animal passports or feeding histories, which minimized unintentional transcription errors of animal data and significantly reduced labor costs associated with collecting and managing this information. One feedlot manager explained that their operation did not practice an "all-in, all-out" philosophy when marketing their finished cattle and used individual animal passports to identify cattle that were mixed with different groups during the latter stages of finishing.

Cattle that arrive without proper CCIA identification are given a new tag and that number is reported to the CCIA with any identifying information (i.e., owner, herd-of-origin, etc.) that is available to the feedlot. The cost of purchasing and administering the new CCIA tag is transferred back to the animal owner. Similar to what is done by the progressive cow/calf operations, the feedlots also electronically record vaccination and growth implant protocols, as well as veterinary medical records, which are used to satisfy the verification requirements of different feeding programs (e.g. "Never Ever 3" and organic beef program cattle) [2]. The protocols initiated by these Canadian feedlots for managing animal records are very similar to the record keeping requirements of USDA Process Verified and USDA Quality System Assessment Programs.

When finished cattle leave the feedlots, they are identified upon exit by the same RFID-panel readers located on the loading/unloading chutes that initiated their passport on arrival. This method is used to not only identify the animals that are destined for harvest each day and to automatically record their CCIA tag numbers, but it also circumvents the need to excessively handle and stress finished cattle before loading. Absolute reconciliation of CCIA tag numbers occurs at the packing plant and is reported back to the feedlot.

[2] According to USDA-AMS (2007), the "Never Ever 3" marketing program, which would be applied under an approved USDA Process Verified Program, is a verified marketing claim that guarantees a said program animal did not, at any point in its life, receive antibiotics, growth promotants, or animal by-products (mammalian or avian). Any animal that receives or is fed any of the "Never Ever 3" components must be identified as non-conforming and removed from the program (USDA-AMS, 2007).

 

*Cattle Packing Plants*

In the aftermath of the BSE crisis in Canada, some of the cattle producers frustrated with the lack of progress in reopening international markets to exports of Canadian live cattle and beef products, decided to invest in ventures that would reduce their dependency on the U.S. Several state-of-the-art, vertically-integrated beef packing plants were built across the country with money that was invested by producers who purchased shares in the company and, in return, were guaranteed "hook space" for their animals. The number of "hooks" each producer was guaranteed was correlated to the number of shares they purchased in the company. However, delayed access to important export markets, ever-increasing input costs, severe labor shortages and—consequently—the need to pay higher wages to attract and retain employees, as well as a rapidly appreciating Canadian dollar has put the financial stability of many of these operations into question.

Packing plants, ranging in daily slaughter capacity from several hundred to several thousand head, were toured and their management personnel were interviewed to clarify the process of integrating the Canadian cattle identification program into their daily operations. Likewise, it was important to establish if and how management used the mandatory identification program to improve production and distribution efficiency.

At each plant, an employee on the line was responsible for hand-scanning the CCIA bar code tags and for re-scanning any RFID tags missed by the panel reader that was positioned ahead of the workstation and immediately following stunning and exsanguination. If an animal did not have a tag, an arbitrary carcass identification number was assigned to the animal for in-house production records. All of the plants that participated in the study practiced real-time age-verification. Company computer systems would query the CCIA database for birth certificates, and responses were usually received within seconds of the initial query. Specifically, CCIA tag numbers were scanned after exsanguination and, by the time the carcass crossed the hot-weight carcass scale and was assigned a carcass tag, the birth date of that animal was available to be printed on the carcass tag.

A few of the more modern facilities (or those that had been renovated recently) used carcass rail trolleys embedded with RFID-microchips to maintain individual animal identification up to and, for some plants, past the point of fabrication. The carcass identification number was cross-referenced with the trolley RFID number at numerous points during processing and the trolley RFID number was used to identify carcasses at fabrication.

Several packing plants were electronically recording quality grades and yield grades, as well as chilled-carcass weights for each carcass at the chilled-carcass weight scale. This information was entered into the company's computer system by an employee working at the scale, which was then reported—electronically—back to producers to assist with future management decisions. This step was completed by the packing plants with minimal effort due to the electronic identification.

In one packing plant, RFID-embedded carcass rail trolleys were scanned upon entry to the fabrication area and, using mechanized cutting boards embedded with RFID-microchips, was able to maintain the identity of each muscle-cut from an animal to a single box of product. A comparable trolley-tracking system for edible offal (e.g., liver, heart, tongue, etc.) retained the identity of such product destined for export. At retail, consumers could enter a number from the box label into the company's website and identify the ranch, feedlot and packer that produced that product.

In an assessment of traceability in the U.S. food supply, Golan et al. (2004) reported that financial incentives—and not government regulations—were the main drivers behind private sector endorsement of traceability systems. They concluded that private firms implemented traceability systems to improve supply chain management and coordination, to increase safety and quality control, to reduce recall expenses, and to expand sales of high-value products. At the time of our visit, one packing plant was sharing the rewards of traceability with their cattle suppliers by paying a premium for age-verified cattle.

A few packing plants also used the CCIA tag numbers to facilitate payment to producers that sold cattle on grid-value systems or for cattle that were designated to "Never Ever 3" and organic beef programs. Tag-loss rates within lots of cattle were recorded because quality and/or program information for animals without CCIA tags had to be entered manually into a computer before payment could be issued to the selling parties. The observed tag-loss rates were reported to the CFIA for review and enforcement purposes.

## Comparisons of the U.S. and Canadian Cattle Industries

In consideration of the recommendations we present for developing NAIS, which are based upon our review of the Canadian cattle identification program, it is necessary to provide a fair comparison of the cattle industries in each respective country. In terms of size, the U.S. cattle industry is significantly larger. According to USDA-NASS (2008), in 2007 the U.S. had: approximately 757,900 beef cow operations, 32.9 million beef cows, and an average herd size of 43 head. The total inventory for cattle and calves was 97.0 million, and 34.3 million head of cattle were slaughtered in commercial facilities in 2007.

In contrast, Canada has 60,947 beef cow operations, almost 4.9 million beef cows, and an average herd size of approximately 80 head (Statistics Canada, 2006; Canfax, 2008). Canada's total inventory for cattle and calves was 14.3 million, and 3.4 million head of cattle were slaughtered in 2007 (Canfax, 2008). In addition, Canada exported to the U.S. almost 825,000 cattle for slaughter and roughly 516,000 feeder cattle and calves in 2007 (Agriculture and Agri-Food Canada, 2007).

Compared to cattle production in the U.S., the Canadian cattle industry has significantly fewer operations and, consequently, fewer people to educate about implementing an animal identification program. Furthermore, because exports make up a large proportion of total Canadian beef production, the average producer is probably more aware of the changing dynamics of the international beef trade and is probably more willing to implement changes that are needed to secure access to these important markets than a typical U.S. cattle producer, where exports are a smaller portion of the U.S. beef industry.

## Recommendations for Implementing the U.S. National Animal Identification System

Based upon our observations of the Canadian cattle identification program, we offer a series of suggestions for the U.S. to consider as they continue to develop the National Animal Identification System (NAIS):

- NAIS should eventually be mandatory;
- A phase-in implementation of NAIS should be initiated;
- A national database should be developed to avoid database and regional differences that could create unnecessary confusion;
- Radio frequency identification device (RFID) technology should be standardized and specific requirements should be established for tag manufacturers to meet or exceed in order to be eligible to sell official NAIS tags;
- NAIS should be harmonized between North American Free Trade Agreement (NAFTA) partners to extend their potential value across borders.

Identification programs are a partnership that begins with producer participation and acceptance. If one of these elements is missing, the integrity of the entire program is disrupted. Unfortunately, producer participation needs to be mandated. It was reaffirmed by many of the interviewees that if participation in the CCIA became voluntary tomorrow—compliance would plummet. According to Lawrence et al. (2003), cattle identification in Canada declined from roughly 95% during the brucellosis eradication program to around 10% shortly after the program was decommissioned. Voluntary participation permits holes to exist within the information system that could seriously compromise its ability to respond to an animal disease outbreak. Furthermore, we believe that as the program establishes itself and producers become more receptive to its existence, the secondary merits of NAIS, which are intended to improve management practices, will become more evident to producers, and acceptance will grow.

 

Secondary benefits of a mandatory animal identification system that were observed in this study included age-, source- and process-verification, the ability to collect, store and analyze live animal performance data in an electronic format, and the ability to link carcass data to individual animals. Furthermore, some of the more progressive firms reported that the CCIA traceability system has improved inventory management and has reduced labor costs associated with handling and analyzing production data. Therefore, it is believed that the integration of these services into management practices could result in significant improvements in the management of supply chains that, as expressed by Golan et al. (2004) and Hobbs (2006), would translate into financial incentives substantial enough to encourage participation in traceability systems even without regulatory intervention. However, Hobbs (2006) characterized the capability of individual firms within the beef supply chain to provide consumers with credence attributes—which are product attributes that cannot be detected visually or evaluated after consumption without labeling—as limited in the absence of congruent information. But by integrating traceability systems with other firms and sectors of the beef supply chain complex, as could be achieved with a national mandatory traceability system, information asymmetries could be resolved easier and product quality and safety assurances could be validated through streamlined certification or verification processes, which would communicate these attributes to consumers with greater cost efficiency and confidence (Hobbs, 2006; Brocklebank et al., 2008). In other words, all sectors (i.e., cow/calf producers, feedlot operators, and beef processors) would have a shared responsibility to work together in a coordinated fashion to ensure credible and complete transfer of information among all firms in the supply chain (Meuwissen et al., 2003; Brocklebank et al., 2008).

Furthermore, it is recommended that NAIS should be implemented as a phase-in program that would evolve to eventually include full industry-wide participation. When the Canadian cattle identification program became mandatory in July 2002, all cattle leaving their current place of production—which was not necessarily their herd-of-origin—required a CCIA tag. For example, feedlots sending finished cattle to harvest were forced to comply with these requirements, even though the "history" for these animals did not extend backward (chronologically) from the feedlot. Forced compliance at the feedlot level was viewed as an unnecessary expense for feedlot owners. It was suggested to the researcher's during an interview that NAIS should be implemented as a three-year phase-in program. The first year of implementation would require cow/calf producers to tag the current year's calf crop before they left the herd-of-origin. The second year would mandate that feedlots and packers accept only animals with official NAIS tags onto their premises. The third and final year of implementation would then extend to all other animals traveling through the system.

The aforementioned benefits would be more attainable to ordinary producers if only one centralized database existed. A single database would reduce confusion among producers with regard to their obligations for complying with a mandatory NAIS and for shipping cattle into other States with different or more advanced identification programs. Moreover, producers would be ensured equal access to educational and technological support, free animal record transactions, easier reporting of—and access to—information that could improve management decision making (e.g., carcass data), as well as many other efficiencies inherent to a centralized database.

The CCIA, in its infancy, established stringent quality and technology requirements that manufacturers had to satisfy or exceed in order to gain authorized manufacturer status. This initiative, instantly harmonized technology across Canada (excluding Quebec). It eliminated unnecessary confusion relating to compliance responsibilities and encouraged operations to move forward with equipment purchases because it was known that a single set of equipment would function with all tags, regardless of manufacturer.

The final recommendation pertains to the importance of harmonizing NAIS with the pre-existing animal identification programs of its North American Free Trade Agreement partners—Canada and Mexico. Ensuring that each country's technology is compliant with its trading partners would facilitate cross-border exchange of valuable production data (e.g., age-verification, feedlot performance, carcass data, etc.) that would strengthen the integral relationship within the North American live cattle and beef industry supply chain complex. More importantly, harmonized programs would facilitate a quicker response to an animal disease outbreak and, possibly, minimize its deleterious impact on commerce. For a review of the structure, organization and current status of the National Individual Cattle Identification System in Mexico, see Murphy et al. (2008).

Tonsor and Schroeder (2006) performed a study of the Australian National Livestock Identification System similar to the study reported in this paper, which produced a list of recommendations that were consonant with our recommendations. Tonsor and Schroeder (2006) concluded that NAIS eventually needs to be: (1) mandatory, (2) free of regional differences, (3) able to support meat traceability and other advancements, (4) as simple as possible while ensuring sufficient traceback capabilities, (5) supplemented with adequate educational and support resources, and (6) possibly subsidized by the U.S. government to encourage implementation.

## Conclusion

The development of NAIS is a priority of the U.S. Department of Agriculture. However, it was reaffirmed during the interviews and site visits that NAIS will eventually need to be a mandatory program. First and foremost, a mandatory animal identification program can protect animal health by facilitating a quick and decisive response to an animal health emergency and potentially minimize its devastating consequences on the economy. However, the secondary benefits of a mandatory animal identification program also have to be considered because of their immense potential to improve the efficiency and the global competitiveness of all sectors involved in the U.S. live cattle and beef industry supply chain complex.

The Canadian cattle identification program has facilitated more intensive management systems for those operations willing to invest the resources needed to integrate this technology into their operations. The ability to access and manage production data in an electronic format can improve supply chain management and coordination; substantiate claims of value-added credence attributes (e.g., in natural and organic beef programs) and, thereby, differentiate their products from those of their competitors; and, assure the safety and wholesomeness of their products to domestic consumers. Furthermore, animal identification programs are becoming pre-requisites to international trade, and if the U.S. intends to regain and expand export markets that were lost following the discovery of a case of BSE in the U.S. (in 2003), it might be necessary to take a more aggressive stance on animal identification and traceability.

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# Drivers of Demand for Imported Horticultural Commodities: A Cross-Country Comparison

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## Abstract

International trade of horticultural commodities is increasingly important in many regions of the world, yet relatively little research has studied import patterns of key horticultural crops. Using data between 1991 and 2005, we find that import demand for horticultural commodities in developed countries has been driven primarily by prices and the level of trade openness while income and diet considerations were more important in emerging countries. Furthermore, our results show that the determinants of import demand differed across the selected crops, and therefore information can be lost if data for horticultural commodities are aggregated.

**Keywords**: Emerging markets; Horticultural commodities; Import demand; International trade

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## Introduction

Over the last four decades there have been significant increases in global production and trade of agricultural products. Myriad studies highlight historical patterns and provide forecasts for production and trade of specific agricultural products; nearly all of these studies have focused on coarse grains and animal products. Horticultural trade patterns have largely been ignored in the agribusiness and agricultural economics literature, yet horticultural commodities represent a large share of the total value of agricultural production and trade in many regions of the world. Horticultural trade has expanded significantly since 1990, and part of this growth has been driven by the use of these crops as ingredients in a wider range of processed food products. The purpose of this article is to estimate the determinants of import demand for horticultural commodities in both developed and emerging countries.[1] Understanding the underlying drivers of trade, coupled with expectations about the direction and magnitude of change among the determinants, will shed some light on future patterns of trade for horticultural commodities in different regions of the world.

Table 1 lists the most valuable traded horticultural commodities in 2005.[2] The total value of trade for the twenty products shown in Table 1 is $73.8 billion; the total value of trade for all horticultural commodities was approximately $96 billion in 2005 (FAO, 2008). In 2005, the value of trade for key meat products (pig meat, chicken meat, and cattle meat) was $21.4 billion and trade in the top grain products (wheat, corn, soybeans, and rice) was valued at approximately $60 billion (FAO, 2008). Although the horticultural sector described here includes many commodities, its importance in international markets is highlighted when compared to traded values of major meat and grain products. The final column in Table 1 shows the increases in nominal value of trade for the selected horticultural commodities between 1991 and 2005; the nominal value of trade increased as little as 26% for tea and as much as 313% for pineapples. On average, the nominal value of trade across the horticultural commodities listed in Table 1 increased by 110% between 1991 and 2005.

Our analysis considers trade in six commodities that are widely produced and consumed in various countries; three of the six horticultural commodities are widely used as ingredients in further processed food products. Based on the ranking shown in Table 1, and to reflect a range of importing countries from different regions in the world, we chose to examine trade patterns for cocoa, coffee, tomatoes, oranges,

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[1] Importers are grouped following country classifications established by the IMF (2008) that separate developed countries from emerging and developing countries. Given the importers included in our analysis, we simply use the term *emerging countries* to describe the second group.

[2] Here *horticultural commodities* includes all fruit, vegetable, and tree crop commodities. Palm oil is not always considered a horticultural commodity; however, we include palm oil in our analysis for three reasons. Palm oil is an important commodity with a significant amount of international trade, it is typically ignored in studies that include oilseeds, and it is the only commodity listed in Table 1 that is heavily traded among emerging countries.

 

bananas, and palm oil. In addition, for five of the commodities examined, we consider the impact from a change in the price of a related horticultural commodity. As a result, our analysis includes economic information about eleven of the twenty horticultural commodities listed in Table 1.

**Table 1:** Value of global trade for horticultural commodities

| Commodity | Total import value 2005 ($ billion) | Increase in nominal trade value 1991 to 2005 (%) |
|---|---|---|
| Palm oil | 11.42 | 284.6 |
| Coffee | 10.09 | 29.4 |
| Bananas | 8.32 | 58.7 |
| Tomatoes | 5.04 | 119.9 |
| Cocoa beans | 4.86 | 102.9 |
| Grapes | 4.62 | 134.2 |
| Apples | 4.11 | 46.2 |
| Tea | 3.29 | 26.4 |
| Oranges | 3.11 | 42.3 |
| Peppers | 2.77 | 188.3 |
| Almonds | 2.31 | 238.3 |
| Tangerines and mandarins | 2.26 | 73.7 |
| Lettuce and chicory | 1.78 | 94.2 |
| Pears | 1.62 | 82.9 |
| Pineapples | 1.46 | 313.2 |
| Peaches and nectarines | 1.38 | 37.2 |
| Cucumbers | 1.37 | 67.7 |
| Lemons and limes | 1.36 | 115.2 |
| Kiwi | 1.33 | 77.7 |
| Strawberries | 1.31 | 78.7 |
| *Total* | 73.81 | 110.6 |

**Source**: FAO Trade Statistics, 2008.

The article is organized into four sections and each section addresses a separate but related objective. First, an overview of previous work that has examined trends, prospects, and forecasts for trade in agricultural markets is provided. Second, for five different regions in the world, horticultural production and trade patterns between 1965 and 2005 are documented. Third, data describing factors that are expected to have influenced horticultural trade flows in developed and emerging countries are collected. Fourth, an econometric model that quantifies the drivers of change in import demand for selected horticultural commodities is developed.

## Situation and Outlook Reports for Horticultural Commodities

Much work has been completed that organizes data describing historical production and trade patterns for agricultural commodities (e.g., Koo and Taylor 2007; FAO 2008). There also exists a substantial amount of research that uses historical data to develop outlook reports, or forecasts, for production and traded quantities of various agricultural products (e.g., Rosegrant et al., 2001; USDA-ERS, 2008). Brookins (2007) examined the major forces that are shaping global agricultural markets and found that changes in agricultural policy, consumer tastes, emerging markets, supply chains, and risk management strategies are the key drivers. Mattson and Koo (2006) examined forces influencing world grain markets; the authors explained how trade liberalization, research and development, ethanol and bio-diesel production, and supply and demand conditions in emerging countries will dictate future changes in production, prices, and traded quantities. USDA-ERS (2001) examined global consumption and trade patterns for food and agricultural products, including horticultural products, between 1970 and 2000. Changes in consumption patterns of fruits and vegetables were found to be associated with urbanization, transportation costs, diet quality, food safety regulations, and availability of organic products.

Each year the Food and Agricultural Policy Research Institute (FAPRI) employs a computable general equilibrium model to provide a comprehensive analysis of the forces affecting global production and trade patterns in agricultural markets. The FAPRI model incorporates macroeconomic conditions with agricultural policy variables to project global production and trade patterns for coarse grains, oilseeds, cotton, sugar, and animal products for a ten-year period. Recent FAPRI projections (FAPRI, 2008) dedicated a significant amount of attention to the impact that energy policies applied in the United States, Europe, Argentina, Canada, and Brazil will have on global agricultural markets. FAPRI (2008) projected higher nominal prices and production levels for all agricultural commodities; however, price increases beyond 2009 are modest for most of the commodities due to increases in stocks, planted area, and yields.

Demand for horticultural commodities has been linked to diet quality and caloric intake levels; this is a research area that is attracting attention among policy makers, nutritionists, food scientists and economists, and is especially important in developing and emerging countries. Consumption rates of horticultural products are expected to increase due to changes in diet quality and nutrition information (see USDA-ERS, 2001; de Haen et al., 2003), and much of the additional import demand for these products is expected to occur in China and Latin America. There is a growing literature on the relationship between trade and the changing composition of diets in the United States (e.g., USDA-ERS, 2001), other OECD countries (e.g., Srinivasan, Irz, and Shankar, 2006), and developing countries (e.g., Huang, Rozelle, and Rosegrant, 1999; Coyle, Gilmour, and Armbruster, 2004; Pingali, 2004). Our research will estimate the relationship between diet quality and import demand for horticultural products in both developed and emerging markets.

Production and trade patterns are well documented for many horticultural products in key global markets outside the United States. For example, Huong and Quan (2008) examined production and export patterns of coffee in Vietnam; Barros (2007) reviewed the major export markets for Brazilian citrus products, and Beckman and Li (2008) highlighted the quantity of tomatoes that are supplied by, and exported from, China. These studies are representative of research that provides detailed trade flow data, however, does not project traded quantities nor estimate the underlying drivers of trade. Better information about the factors that influence international trade of horticultural commodities will assist in the development of outlook reports for these important yet understudied markets.

## Production and Trade Flows for Selected Horticultural Products

Country-level data between 1961 and 2005 describing production and traded quantities for six horticultural commodities were collected. Given the large number of observations in the initial dataset, country-level data were aggregated to highlight general patterns across five regions.[3] An examination of trends between 1965 and 2005 reveals that there have been substantial increases in global production and traded quantities of many agricultural products including horticultural commodities.

Figure 1a, 1b, and 1c outline regional production patterns for the selected horticultural commodities in 1965, 1985, and 2005. Coffee production increased by approximately 50% between 1965 and 2005. For each of the other horticultural commodities studied,

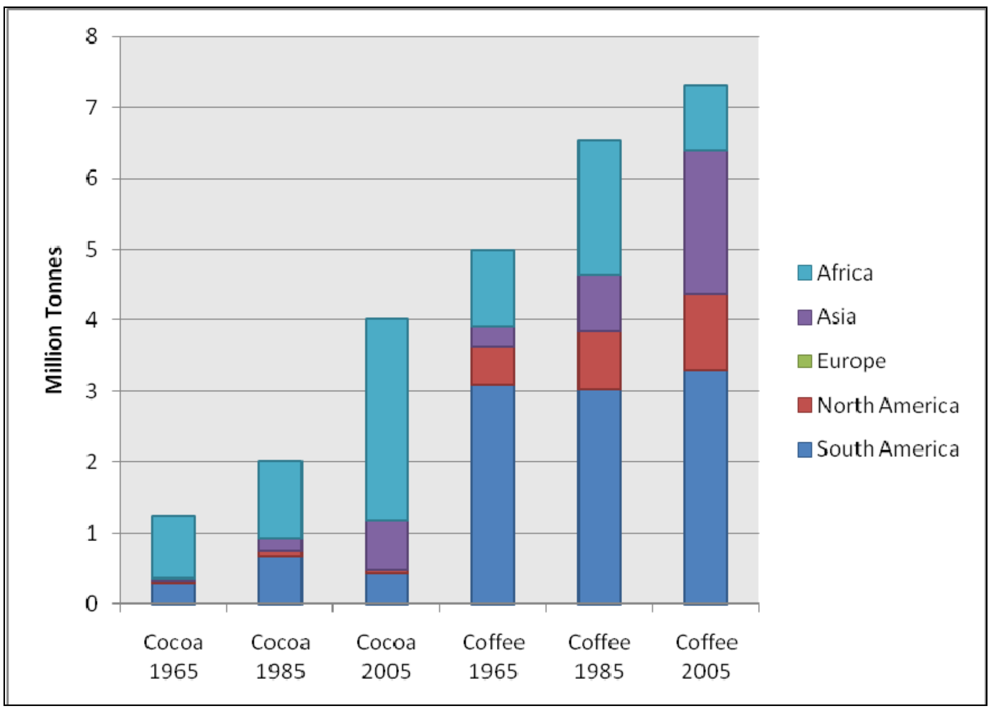


**Figure 1a**: Production of Cocoa and Coffee: 1965, 1985, and 2005

[3] The region denoted Africa includes 54 countries; Asia includes the 50 countries east of the Mediterranean Sea plus 26 countries in Oceania; Europe includes 52 countries; the North American region includes 14 countries and includes 9 countries in Central America; South America includes the 14 countries south of Panama and 25 countries in the Caribbean.

 

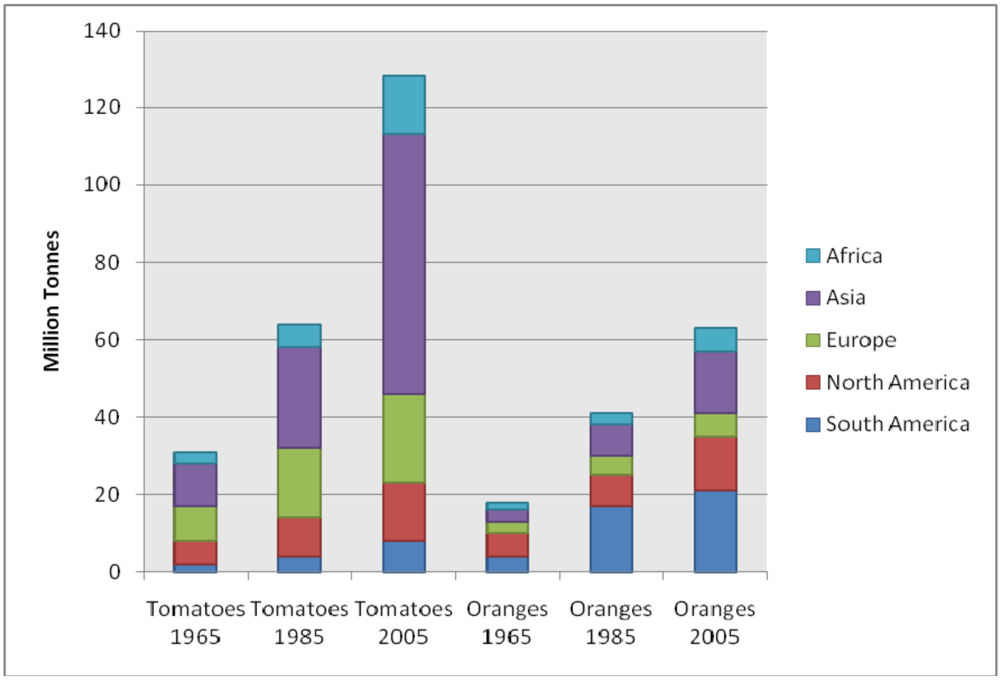


**Figure 1b**: Production of Tomatoes and Oranges: 1965, 1985, and 2005

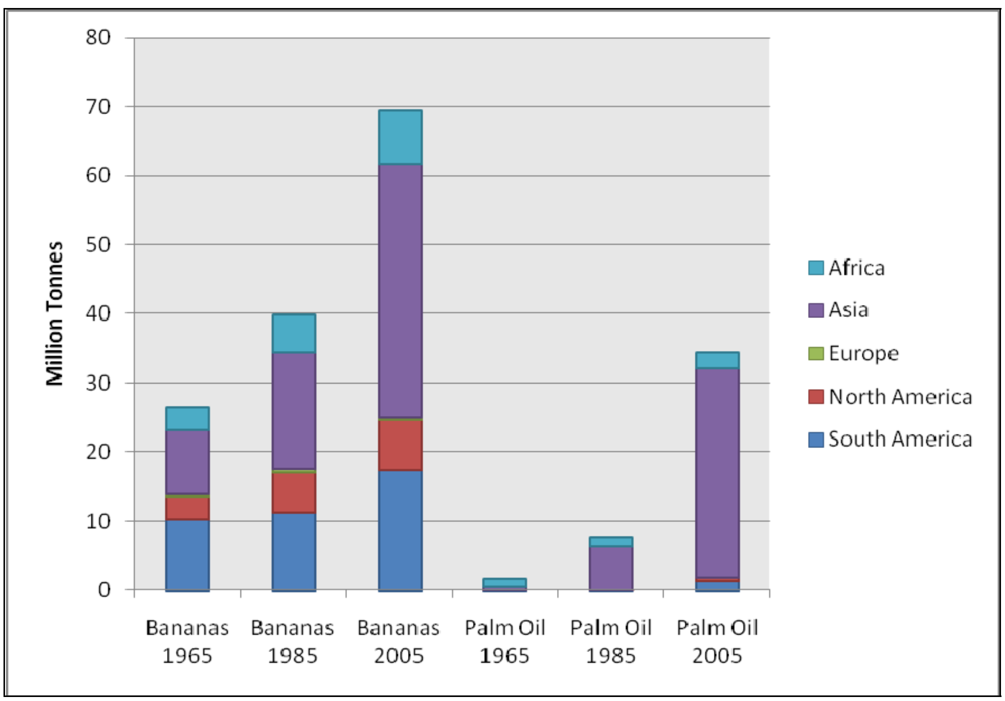


**Figure 1c**: Production of Bananas and Palm Oil: 1965, 1985, and 2005
**Source:** Food and Agriculture Organization of the United Nations, Production Statistics.

 

production increased by at least 160%. Overall, production levels of these commodities increased notably in several regions. Production increases were most significant in Asia and Africa for cocoa while South America experienced the largest increase in orange production. Asia experienced the largest production gains for coffee, tomatoes, bananas, and palm oil. Large production gains also occurred in South America for tomatoes, banana production increased in Africa, and orange production increased in North America and Asia.

Figure 2a, 2b, and 2c show the regional-level trade patterns for the six horticultural commodities. Once again, there have been increases in traded volumes over this time period, yet the increases have been most significant since 1985. Traded quantities of cocoa and coffee have increased, and in the case of coffee, import growth occurred across several regions. Total trade of tomatoes doubled and that of oranges increased 30% between 1985 and 2005; most of the new import demand stemmed from countries in North America and Europe. Substantial increases in the imported quantities of bananas and palm oil occurred between 1985 and 2005. Global trade of bananas rose from approximately 7 million metric tons in 1985 to 15 million metric tons in 2005. The increase in global imports of palm oil was even greater over this time period; total imports of palm oil increased from 5 million metric tons in 1985 to over 24 million metric tons in 2005. Most of the increase in import demand for palm oil occurred in Asia; however, Africa saw the largest percentage increase in import demand for palm oil.

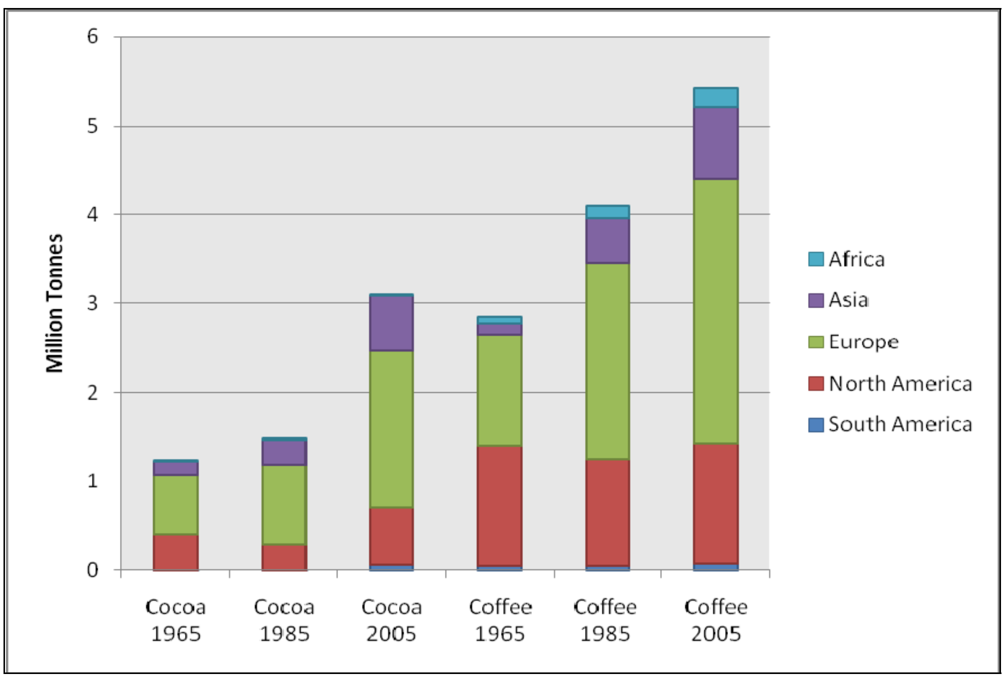


**Figure 2a**: Imports of Cocoa and Coffee: 1965, 1985, and 2005

 

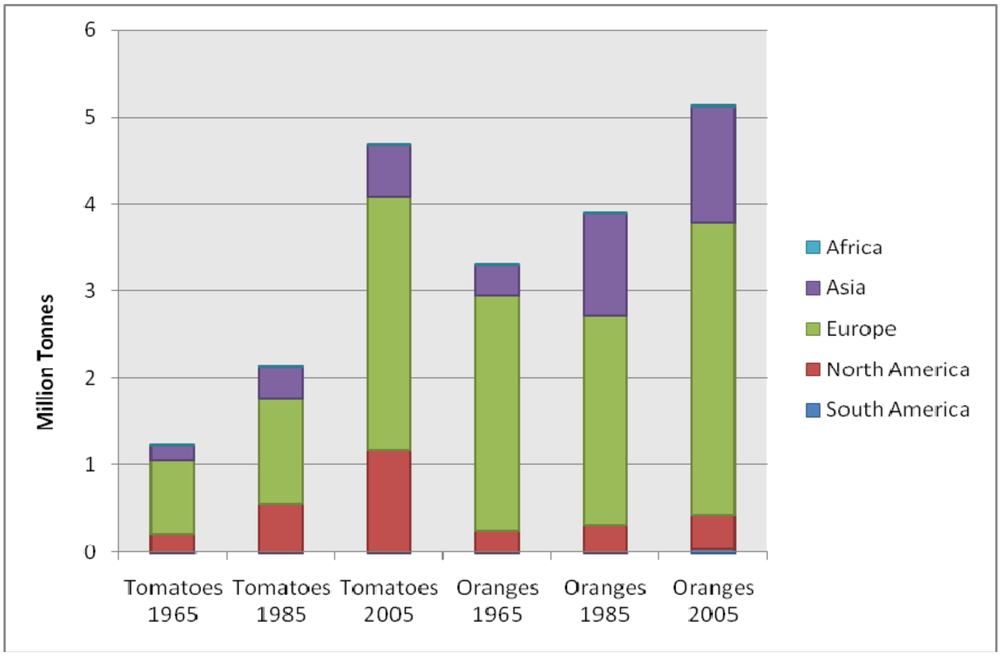


**Figure 2b**: Imports of Tomatoes and Oranges: 1965, 1985, and 2005

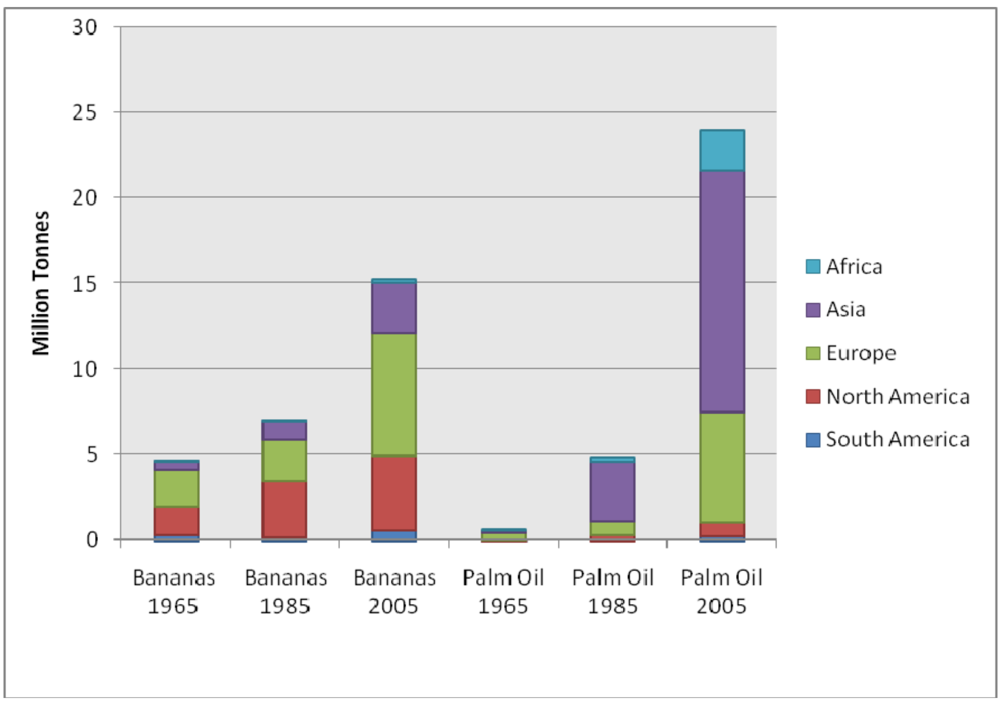


**Figure 2c**: Imports of Bananas and Palm Oil: 1965, 1985, and 2005
**Source:** Food and Agriculture Organization of the United Nations, Trade Statistics.

Relative to meat and grain products, increases in the volume of trade between 1991 and 2005 were bigger for horticultural commodities. The average volume of trade increased by 80% between 1991 and 2005 for the selected horticultural commodities; over the same time period, the average volume of trade increased by approximately

 

66% for meat products and by 73% for grains (FAO, 2008). In 2005, trade's share of total production among the six selected horticultural commodities ranged between 4% and 77%; it was greater than 65% for cocoa, coffee, and palm oil. Trade's share of production in 2005 ranged between 3% and 10% for meat products and ranged between 3% and 30% for grain products. These traded volumes expressed as a share of production reinforce the important role that horticultural commodities play in global agricultural markets.

## Drivers of Import Demand for Horticultural Commodities

Various agricultural economists have developed models to estimate import demand of horticultural commodities; much of this work has used import data from developed countries and focused on the effects of generic advertising efforts in foreign markets. Rosson, Hammig, and Jones (1986) studied import demand for apples in Europe, East Asia, and South America; Halliburton and Henneberry (1995) examined import demand for almonds in Pacific Rim countries; Lanclos, Devadoss, and Guenthner (1997) investigated import demand for U.S. frozen potatoes in Japan and other countries in South East Asia; Kaiser, Liu, and Consignado (2003) studied import demand for U.S. raisins in Japan and the United Kingdom.

In addition to estimating the effect of generic promotion expenditures, many of these studies also estimated own- and cross-price elasticities, and income elasticities, for imported products. Earlier work has typically estimated negative coefficients for own-prices and positive coefficients for income. Furthermore, previous results find a negative and statistically significant relationship between import quantities of horticultural products and trade barriers. This area of research is extended here to assess how trade openness impacts import demand for horticultural commodities in both developed and emerging countries.

For six of the most highly traded horticultural commodities, the impacts that five variables have had on per capita import levels across key importing countries are estimated. The countries selected for each horticultural commodity include major importers from both developed countries and emerging countries. Table 2 outlines the importing countries that were included in the analysis. Each model included data for the top five importers from developed countries. Data for tomato imports in emerging countries were not available; however, data for each of the other horticultural commodities were available in at least four emerging countries. Emerging countries such as Kuwait, Russia, and United Arab Emirates are significant importers of horticultural products, but data describing trade activity in these countries were not available. With the exception of palm oil, the global share of trade was bigger for the group of developed countries relative to the group of emerging countries. Overall, the data collected represented between 50% and 74% of global trade activity for the six horticultural commodities.

 

**Table 2:** Developed and emerging countries[a] included in the analysis[b]

| Crop | Developed countries | Emerging countries |
|---|---|---|
| Cocoa | Netherlands (1) | Malaysia ( 5 ) |
| | United States (2) | Brazil (14) |
| | Germany (3) | Turkey (15) |
| Global import share (%) | United Kingdom (4) | China (16) |
| | France (6) | Czech Republic (23) |
| | 63.1 | 10.5 |
| Coffee | United States (1) | Algeria (11) |
| | Germany (2) | Argentina (23) |
| | Japan (3) | Hungary (24) |
| Global import share (%) | Italy (4) | Morocco (27) |
| | France (5) | |
| | 59.3 | 3.8 |
| Tomatoes | United States (1) | |
| | Germany (2) | |
| | France (3) | |
| Global import share (%) | United Kingdom (4) | |
| | Netherlands (5) | |
| | 61.2 | |
| Oranges | Germany (1) | Saudi Arabia ( 8 ) |
| | France (2) | Malaysia (18) |
| | Netherlands (3) | Hungary (19) |
| Global import share (%) | United Kingdom (4) | Czech Republic (22) |
| | Canada (5) | Romania (23) |
| | 41.2 | 8.9 |
| Bananas | United States (1) | China (11) |
| | Germany (2) | Argentina (12) |
| | Japan (3) | Czech Republic (21) |
| Global import share (%) | United Kingdom (4) | Turkey (23) |
| | Italy (5) | |
| | 49.8 | 6.4 |
| Palm Oil | Netherlands (4) | China ( 1 ) |
| | Germany (5) | India ( 2 ) |
| | United Kingdom (6) | Pakistan ( 3 ) |
| Global import share (%) | Singapore (7) | Malaysia (11) |
| | Japan (8) | |
| | 19.7 | 40.1 |

[a] **Source:** IMF, 2008.

[b] Numbers in parentheses denote overall calculated rankings in terms of the total quantity imported over the period 1991 to 2005.

The variables used in the import demand models were selected to identify factors that help to explain changing patterns of traded quantities; variables included the price of the commodity, the price of a related commodity, per capita income, the level of trade openness, and per capita calorie intake. The quantity of domestic production was considered as a sixth explanatory variable; however, it was omitted for two reasons. First, data characterizing domestic production of horticultural commodities in emerging markets were often limited, and second, top importers of the selected horticultural products typically did not supply a significant quantity domestically.

Rather than assess the impact that factors have had on total import quantities or the total value of imports, per capita import quantities are examined. Estimating per capita import quantities allows the model to attach more weight to large importing nations with relatively low population levels. The per capita quantity of commodity *i* imported into country *k* in time period *t* is denoted as $M_{kt}^{i}$. In the import demand specification shown in equation (1), superscripts *i* and *h* denote agricultural commodities where *h* is related to *i* in consumption, subscript *k* denotes a country, and subscript *t* denotes time.

$$(1) \qquad M_{kt}^{i} = f\,(P_{kt}^{i}, P_{kt}^{h}, I_{kt}, C_{kt}, O_{kt})$$

The price of the imported commodity *i* into country *k* in year *t* is denoted as $P_{kt}^{i}$ and the price of commodity *h*, which is a substitute in consumption, is denoted as $P_{kt}^{h}$. The related commodity in consumption for cocoa is sugar; it is tea for coffee, cucumbers for tomatoes, tangerines and mandarins for oranges, apples for bananas, and soybean oil for palm oil. All prices used in the import demand models are unit prices and were calculated by dividing the total value of imports by the total quantity of imports (FAO, 2008). In addition to price effects, several other variables were considered including per capita income, denoted as $I_{kt}$, diet quality measured as per capita calorie consumption, denoted as $C_{kt}$, and the level of trade openness, denoted as $O_{kt}$, in year *t* for country *k*.

The per capita gross domestic product (total gross domestic product divided by population) was used as a proxy for per capita income (IMF, 2008). Per capita calorie consumption is the average calories available per person per day in country *k* (FAO, 2008); data for per capita calorie consumption rates were only available from 1991 to 2003, so data between 2000 and 2003 were used to extrapolate rates for 2004 and 2005 in all countries. The level of trade openness was characterized by the total value of imports as a share of gross domestic product in country *k* (World Bank, 2008). All financial data was deflated into real 2000 U.S. dollars using the Consumer Price Index (USDOL-BLS, 2008).

## Estimating Import Demand

Single equation models were developed to estimate per capita import demand for each of the six horticultural commodities. Each import demand model included fifteen time periods (1991 to 2005) for up to ten countries. Table 3 shows that the number of observations included in each model ranged from 75 to 150. Two datasets (cocoa and oranges) included information from ten importers, three datasets (coffee, bananas, and palm oil) included nine importers, and the tomato dataset included only the top five importers from developed countries. Our estimations are based on information from six balanced datasets.[4] All variables used in the import demand models were taken from time period *t*, the same time period that per capita import quantities were observed.

The model used to estimate the per capita import demand quantity of commodity *i* is specified in Equation (2) and employs a double logarithmic functional form; this allows the resulting coefficients to be approximately interpreted as percentage changes (or elasticities). Here the estimated coefficients for horticultural commodity *i* ($\beta_n^i$) and the associated p-values were used to assess the statistical relationships that exist between the explanatory variables and per capita quantities of imports in developed countries. The model also included an indicator variable, denoted as *E*, that was equal to 1 when importer *k* was from an emerging country and equal to 0 otherwise. The indicator variable was used to construct interaction terms that enabled the model to estimate coefficients that are specific to the group of emerging countries. The emerging country estimates ($\gamma_n^i$) should be interpreted as the statistical relationships that exist in addition to the baseline estimates found for the developed countries. Intercept terms were estimated for each importer. In equation (2) $\alpha_k^i$ is the baseline intercept for importer *k*; the dummy variable, denoted as $DV_j^i$, is used to identify the other importers of commodity *i* and $\alpha_j^i$ is the intercept term specific to importer *j*.

$$(2)\quad \ln M_{kt}^i = \alpha_k^i + \sum_{j\neq k}\alpha_j^i DV_j^i + \beta_1^i \ln P_{kt}^i + \beta_2^i \ln P_{kt}^h + \beta_3^i \ln I_{kt} + \beta_4^i \ln C_{kt} + \beta_5^i \ln O_{kt}$$

$$+ \gamma_1^i\, E\ln P_{kt}^i + \gamma_2^i\, E\ln P_{kt}^h + \gamma_3^i\, E\ln I_{kt} + \gamma_4^i\, E\ln C_{kt} + \gamma_5^i\, E\ln O_{kt} + e_t^i$$

It was expected that higher import prices of commodity *i* would lead to lower levels of per capita imports of commodity *i*; furthermore, this relationship was expected to be stronger in the emerging countries. The relationship between the price of commodity *h* (the related commodity in consumption) and per-capita imports of commodity *i* will indicate whether commodity *h* is a substitute or a complement commodity. Similar to the own-price effects, the cross-price effects are expected to be statistically stronger among the importers in emerging countries. Higher levels of income and calorie consumption were expected to have a positive relationship with per capita import quantities. However, depending on the horticultural commodity and the importing country, it might be the case that higher levels of caloric intake will be linked to lower levels of per capita imports. The level of trade openness was expected to be positively related with import demand.

[4] In a limited number of cases, particularly for emerging countries, missing data were imputed to construct a balanced dataset. When data were imputed we used a simple model that considered observations immediately before and after the missing values. Data describing the Czech Republic during the period between 1991 and 1993 were estimated using data from Czechoslovakia prior to 1991 and the Czech Republic after 1993.

 

## Econometric Specification Tests

Error terms from the time series component in our panel data were expected to exhibit first-order autocorrelation; therefore the Lagrangian multiplier test was used to measure the existence of autocorrelation in each import demand model (Greene, 2003). Equation (3) outlines the simple regression model used to examine the statistical relationship between the lagged error, denoted as $e_{t-1}^{i}$, and the error in the unrestricted full model, denoted as $e_t^i$. The estimated coefficient for the lagged error, denoted as ρ, is interpreted as the true autocorrelation coefficient; a statically significant value for ρ indicates the presence of first-order correlation. Tests were performed to check first-order autocorrelation in the six models; in each case country-level data was pooled across the importers from both developed and emerging countries.

(3) $e_t^{i} = \rho e_{t-1}^{i} + v_t^{i}$

The estimated coefficients for ρ from the Lagrangian tests are shown in Table 3. The null hypothesis is that first-order autocorrelation does not exist; a p-value for ρ that is less than 0.05 indicates that we can reject the null hypothesis at the 95% level. In the import demand models that we estimated, the p-value for ρ was less than 0.01 in five of our import demand models; the value of ρ in the model for oranges was statistically significant at the 10% level. In addition, we checked for, but did not find evidence of, higher orders of autocorrelation in any of the import demand models. To circumvent problems with correlations of errors in import demand models for cocoa, coffee, tomatoes, bananas, and palm oil we employed the Parks Method; this method estimates the coefficients using a two-stage generalized least squares procedure that assumes an autoregressive error structure of the first order and contemporaneous correlation among the cross sections (SAS, 1999). Since first-order autocorrelation was only marginally evident in the import demand model for oranges, the coefficients in the orange model were estimated using ordinary least squares.

## Regression Results and Implications

Table 3 also shows the estimated coefficients and the p-values (in parentheses) for the six import demand models. Columns list results for the six horticultural commodities and in each case the dependent variable was the per capita import quantity of commodity *i*. The explanatory variables that apply to developed and emerging countries are listed in the rows; for each explanatory variable, the estimated coefficients for developed countries are immediately followed by coefficients for emerging countries. Our models capture much of the variation among the explanatory variables as evidenced by Adjusted $R^2$ values that range from 0.81 to 0.98.

 

Table 3: Import demand regression results for selected horticultural commodities[a]

| Explanatory variables | Dependent variable Quantity of per capita imports for: Cocoa | Coffee | Tomatoes | Oranges | Bananas | Palm Oil |
|---|---|---|---|---|---|---|
| N | 120 | 135 | 75 | 150 | 135 | 135 |
| ρ | 0.697* (0.000) | 0.293* (0.003) | 0.407* (0.000) | 0.135 (0.096) | 0.593* (0.000) | 0.478* (0.000) |
| Adjusted $R^2$ | 0.978 | 0.969 | 0.810 | 0.988 | 0.863 | 0.946 |
| Import price | –0.129* (0.006) | –0.083* (0.000) | –0.193* (0.014) | –0.513* (0.001) | –0.379* (0.000) | –0.165* (0.004) |
| E*Import price | –0.449* (0.004) | 0.024 (0.539) | | –0.289* (0.002) | –0.879* (0.000) | –0.403* (0.000) |
| Price of related product | 0.159 (0.068) | –0.173* (0.000) | –0.177* (0.026) | 0.511* (0.000) | 0.083* (0.000) | 0.035 (0.434) |
| E*Price of related product | 0.604* (0.000) | 0.001 (0.985) | | –0.119 (0.087) | –0.222 (0.053) | 0.227 (0.109) |
| Per capita income | 0.175 (0.212) | –0.078 (0.097) | 0.627* (0.000) | –0.027 (0.710) | 0.418* (0.000) | 0.308* (0.002) |
| E*Per capita income | –0.954 (0.267) | 0.340* (0.001) | | 0.407* (0.000) | 1.147* (0.000) | 0.297 (0.092) |
| Diet proxy | –0.358 (0.547) | 0.033 (0.099) | 0.531 (0.360) | 0.375 (0.100) | 0.313* (0.005) | –0.114 (0.442) |
| E*Diet proxy | 7.290* (0.000) | –0.698 (0.202) | | 0.260 (0.592) | –6.457* (0.001) | –0.319 (0.079) |
| Trade openness | 0.298* (0.026) | 0.037 (0.201) | 0.646* (0.000) | –0.035 (0.611) | –0.118* (0.038) | 0.643* (0.000) |
| E*Trade openness | 2.880* (0.000) | –0.111 (0.234) | | –0.192 (0.077) | 0.262 (0.201) | 0.284 (0.127) |

[a] The p-value for each estimated coefficient is shown in parenthesis; an asterisk is used to denote statistical significance at the 5 percent level.

The first column of results outlines the estimated coefficients for per capita import demand of cocoa. A negative and statistically significant relationship is found between per capita imports of cocoa and the price of imported cocoa; this relationship is even stronger in emerging countries. The estimated coefficient for the price of the related import product, sugar, is positive and statistically significant at the 10% level indicating that cocoa and sugar are considered substitute products among the selected importers. Similar to the own-price effect, the relationship between the price of imported sugar and per capita imports of cocoa is stronger in emerging countries. Income and caloric intake do not appear to be statistically important for cocoa importers in developed countries, yet the diet variable is statistically significant for emerging importers. The estimated coefficient for trade openness is positive and statistically significant in developed countries and even more important for importers in emerging countries.

The estimated coefficients in the coffee model indicate that prices are the drivers of per capita import demand in developed countries. The estimated coefficients for the import price of coffee and the import price of the related product (tea) are negative and statistically significant for developed countries; this finding suggests that coffee and tea are complement products in developed countries. Estimated coefficients for the import prices of coffee and tea in emerging countries are not statistically significant. Per capita income is not important for coffee importers in developed countries, yet it is positive and statistically significant for importers in emerging markets. The import demand model for tomatoes shows that prices, income, and trade openness are important factors. Here the related product is cucumbers and our results indicate that imported cucumbers are a substitute product for imported tomatoes in developed countries.

Results from the import demand models for oranges and bananas show similar results. For both oranges and bananas we see that the own price effects are negative and statistically significant while the price effects from the related products are positive and statistically significant. The results show that importers of oranges and bananas in emerging countries are more sensitive to changes in prices relative to developed countries; the own price effect is stronger and the related price effect is dampened in the emerging countries. This indicates that all importers of oranges consider the related product (tangerines and mandarins) to be a substitute; however, this relationship is stronger for importers in developed countries. Similar to import demand for oranges, importers of bananas in emerging countries view the related product (apples) as a weak substitute. Per capita income is an important driver of import demand for bananas in developed countries; it is also a statistically significant variable for orange and banana importers in emerging countries. The relationship between caloric intake and import demand is positive and statistically significant for oranges (at the 10% level) and for bananas (at the 1% level). In emerging countries, the diet variable is statistically significant for bananas but here it becomes inversely related to import demand. Import demand for bananas also shows a negative and statistically significant coefficient for the trade openness variable. Results for the diet and trade openness variables in the import demand model for bananas in emerging countries may not be intuitive. However, it is plausible that import demand for bananas in emerging countries falls with increases in diet quality or trade liberalization and is replaced by greater demand for other imported fruit products (or other food products such as meat). The final column in Table 3 shows results for the model that estimates per capita import demand for palm oil. The estimated coefficient for the import price of palm oil is negative and statistically significant in developed countries and the effect is stronger in emerging countries. Here the price of the related product (soybean oil) is not statistically significant and this may be due, in part, to the low levels of soybean oil trade in markets that are substantial importers of palm oil. Income and trade openness are important factors to importers of palm oil in both developed and emerging countries. Caloric intake is not statistically significant in developed countries but is negative and statistically significant (at the 10% level) in emerging countries. This result suggests that importers in emerging countries consume less palm oil as diet quality increases.

## Conclusion

A review of data for selected horticultural commodities draws attention to the expansion of international trade that has occurred for these crops over the last half century. Most notable in horticultural markets was the rapid rise of trade activity between 1991 and 2005 relative to patterns in various meat, grain, and oilseed sectors, yet few studies have examined the drivers of trade patterns in horticultural markets. Our research begins to fill that gap and provides a careful analysis of the relationships between import demand and prices, income, caloric intake, and trade openness for six horticultural commodities.

Regression results highlight that price is consistently an important determinant of per capita import demand for horticultural commodities. Estimated coefficients for the own price variable were negative and statistically significant at the 1% level in all six models; four of the five models that included data for emerging countries revealed that the own price effect was stronger in emerging countries. Prices of related products and income were often statistically significant determinants of import demand in horticultural sectors. Among developed countries the diet variable was positive and statistically significant at the 5% level in the banana model; it was statistically significant at the 10% level for coffee and oranges. Interestingly, the estimated coefficient for the diet variable in the import demand model for bananas in emerging countries was negative. Trade openness was positive and statistically significant in import demand models for cocoa, tomatoes, and palm oil in developed countries; outside of the cocoa model, trade openness was not a key driver of import demand in emerging countries.

This research examines the drivers of trade in horticultural markets and presents findings that are relevant to food and agricultural industry managers involved in international markets. The results for the trade openness and diet variables highlight some non-trivial differences between the six commodities, and these differences have implications for agribusinesses. Specifically, trade openness was more important for upstream products (cocoa, tomatoes, and palm oil) and diet was more important for downstream products (coffee, oranges, and bananas).[5] Trade openness was not positive and statistically significant for any downstream products and diet was not statistically significant for any upstream products. This set of findings indicates that trade liberalization has been important for food manufacturers and firms that import horticultural commodities to be used as ingredients. It also indicates that diet quality can be a useful measure of the potential import demand for fresh horticultural products. Overall, changes in traded quantities of horticultural commodities have been influenced largely by changes in prices; however, agribusinesses involved in upstream markets are heavily impacted by trade agreements while those involved in downstream markets should pay close attention to shifts in dietary patterns.

Our results suggest that further research in this area should be conducted with two considerations in mind. First, price and income effects are often statistically significant for most commodities in both regions. Many of the own-price and income effects are much stronger for importers in emerging countries, yet cross-price effects in emerging countries do not always reinforce results found in the developed countries. In the case of oranges and bananas, our results indicate that the cross-price effects were inversely related to what was found in developed countries. Horticultural markets include a cluster of closely related products and additional work that estimates price elasticities will help uncover more of these important substitution effects for horticultural commodities. Second, although many horticultural commodities share similar production processes, the economic conditions in these markets are often very different. Our regression results do not tell the same story across the six commodities and provide a strong argument that information would be lost if horticultural commodities are aggregated. However, based on common patterns found here for upstream and downstream products, some level of aggregation may be appropriate for examining trade issues in horticultural markets.

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[5] Upstream products are commonly used as ingredients in further processed foods whereas downstream products require less processing before they are marketed to consumers (for a more detailed explanation see Norwood and Lusk, 2008).

 

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# The Effectiveness of Facilitated Business-to-Business Word-of Mouth Marketing Strategies on Target Participants' Information Sharing Behavior

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## Abstract

This study examines the impact of facilitated business-to-business (B2B) word-of-mouth (WOM) on participants' information transmission decisions. We also examine characteristics of WOM participants and determine the types of participants who spread information. Understanding WOM participants' information sharing decisions is extremely important to agribusinesses using WOM in their marketing mix.

For an expendable crop input, the most important factor in determining whether producers share WOM initiative information with peers is how often they are asked for advice by their peers. In contrast, for an expendable companion animal product the most important factor in determining whether veterinarians share WOM initiative information with peers is whether they had a satisfactory experience in the WOM initiative.

**Keywords**: facilitated B2B WOM, effectiveness of facilitated B2B WOM, indirect impact of facilitated B2B WOM, agribusiness firms' information sharing decisions

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## Introduction

Marketing trends have pushed agribusiness marketers toward more focused communications with customers by providing them with tailored information through tactics such as direct mail, telemarketing, personal selling, and facilitated WOM (Kotler and Armstrong, 2006, page 428). Agribusiness marketers have recognized the effect of facilitated word-of-mouth (WOM) information on product and service demand. Most people think about spontaneous conversation when they think of WOM. For example, Rogers (1962) recorded that Oregon farmers sought peers' opinion about a hybrid seed corn product before placing orders. However, WOM conversations among businesses buyers can go beyond the spontaneous and be facilitated to disseminate product information and generate sales. One type of facilitated business to business (B2B) WOM is audio teleconferences (Falwell, 2002; Xu, 2007). WOM audio teleconferences typically last for about an hour with 18 to 20 decision makers or decision making influencers on a conference phone call. The objective of these initiatives is to provide the participants with detailed information on product performance and value in a manner that is credible because it is coming from their peers (rather than from the manufacturer's employees or advertising). A trained facilitator directs the discussion to ensure that it stays focused on the product under consideration and that key points are highlighted. The facilitator does not play the role of promoting the product either positively or negatively. The perceived benefit of this form of marketing is that the business participants feel that they are receiving unbiased information from their peers, who they consider a credible source.The overall objective is to identify how to make WOM marketing a more effective marketing tool for agribusinesses.  This study focuses on the indirect impact of facilitated B2B WOM on information sharing behavior of WOM participants, i.e. how an agribusiness can get its customers talking to each other about their product in a positive manner.  Our specific objective is to identify the characteristics of customers who are more likely to share information with other customers. First, we distinguish WOM participants who share WOM information with customers from those who do not share at all and second we identify those who share information with many customers. We use two examples, a U.S. crop expendable input where the customers are farmers, and a companion animal product where the decision influencers' are veterinarians. Business marketers can use the results of this study to assist in evaluating their customer databases and segment the customer database to invite those customers, who are more likely to share information, to WOM programs. In this way, agribusiness marketers can get the greatest return on investment of their WOM marketing dollars.

In the following sections, we review facilitated B2B WOM marketing campaigns and WOM opinion leaders' information sharing behavior. We then discuss the conceptual model, the data, and the econometric procedures. Finally, we present results and conclusions.

 

## Background

Studies have validated the importance of WOM information in agribusiness buyers' purchase decisions. An early study by Ryan and Gross (1943) found that corn growers adopted hybrid seed corn based on word-of-mouth persuasion. In a study on farmer acceptance of new farming practices, Wilkening (1956) found that 47% of respondents reported that other farmers are the main source of information in deciding whether to try a new farming technique. Market research by Ciba-Geigy found that the most influential sources that farmers use to make purchase decisions for herbicides were other farmers' "word-of-mouth", followed by dealers, university Extension personnel, salespeople and advertising (Schoeman et al., 1981).

Starting in the late 1960's, business marketers provided B2B WOM teleconferences to improve awareness and facilitate purchase decisions. Schoeman (1981) studied a marketing initiative aimed at a newly introduced corn and soybean herbicide where TeleSession Corporation used long-distance telephone lines to link 8-10 prospective users with two or three current users for an hour-long moderated discussion. These telephone conferences were held among groups of physicians sharing their experiences with new drugs (Silverman, 2001). Telephone conferences have also been held with corn or soybean growers (Schoeman, 1981; Falwell, 2002), veterinarians (Falwell, 2002), and IT engineers (Nicks, 2006).

More recently, several studies have confirmed the importance of WOM information from other farmers on the adoption of specific farm inputs. Falwell (2002) examined farmers' adoption of a newly introduced insecticide product and found that 40% of respondents frequently looked to other farmers (page 47) and 60% felt that information from other farmers were reliable (page 41). The farmer-to-farmer transfer of information has also greatly affected farmers' adoption of integrated pest management (IPM) in Honduran subsistence maize agriculture (Wyckhuys and O'Neil, 2007). Through surveying 120 farmers in four communities in Honduras, Wyckhuys and O'Neil (2007) found that farmers principally learn about IPM through peer-to-peer interaction and larger farm units with higher levels of social participation, social connections and higher social economic status serve more frequently as an information source.

The effectiveness of WOM on information sharing has been connected to opinion leaders being more credible information sources (Rogers 1962). Rogers describes opinion leaders as having "technical competence, social accessibility, and conformity to the system's norms" and thus opinion leaders' WOM has a strong impact on followers' buying decisions (Rogers, 1995, page 26). Several types of opinion leadership were identified including early adopters, innovators, market mavens and experts.

 

Limited research exists related to information sharing as a result of facilitated B2B WOM marketing of agricultural input products. Falwell (2002) examined the impact of facilitated B2B WOM on participants' information sharing decisions about an insecticide product and an animal health product. He found that WOM teleconferences resulted in a high rate of information sharing: 41% of the participants in the insecticide program (Falwell 2002, page 38) and 69% in the animal health product program shared information with peers (Falwell 2002, page 54).

Martilla (1971) found that age matters when it comes to identifying opinion leaders. He found that business opinion leaders are 40-55 years old, explaining that those who are too young may lack credibility and too old may be not current in the field. File et al. (1994) found that size of the buyers' operations and buyers' satisfaction with the service significantly affected their information sharing decisions. One other type of opinion leadership is the "market maven" who has "information about many kinds of products, places to shop, and other facets of markets, and initiates discussions with consumers and responds to requests from consumers for market information" (Feick and Price, 1987, page 85). Market mavens are found to be heavy media users; they read the most magazines, watched the most television and also used the internet.

## Research Methodology

Firms use marketing programs to influence customers' purchase decisions. When using WOM marketing campaigns firms want to target WOM participants based on their information sharing behavior which may be affected by various factors. As shown in Figure 1, the target participants' information sharing behavior is expected to be influenced by the features of the B2B WOM experience, and the participants' operation size, propensity of adoption, demographic information, previous experiences, information sources and information uses.

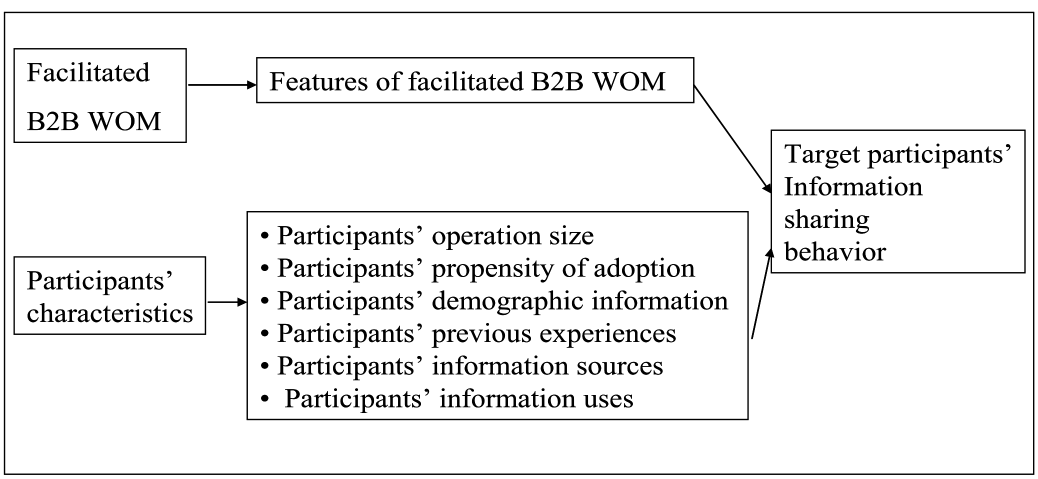


**Figure 1**: A Conceptual Model Describing Factors Affecting WOM Target Participants' Information Sharing Behavior

 

The objective of this data analysis is to identify characteristics of customers who first are more likely to share information with other customers, and second, who will talk to many customers.

*Variable Selection*

WOM participants' information sharing behavior is expected to be influenced by firm size. Based on the findings of File et al. (1994) smaller operations are expected to be more likely to share WOM information with peers (Size). Innovators and early adopters are more likely to share WOM information with others (Rogers, 1962). Thus WOM participants' propensity to adopt new technology is expected to be positively related to their information sharing behavior (New technology). Previous studies have also suggested that target WOM participants' demographic information, (Age, Gender and Education) are factors that impact information sharing behaviors (Martilla, 1971; Feick and Price 1987, Chan and Misra, 1990). Though as noted by Chan and Misra, the direction and intensity of the relationship between demographics and information sharing behaviors tend to be product specific, we do expect the willing information givers to form a particular demographic segment in this study. We included a variable to take into account the impact of learning-by-doing, i.e. previous experience with the product, on information transmission (Previous experience). Given that a higher level of involvement with a product stimulates information sharing (Chan and Misra, 1990), we expect a positive relationship between previous experience and the likelihood of information transmission.

In addition, participants who are frequently sought for advice by their peers may have more opportunity to share WOM information (Information source). Target participants who rate other farmers as an important information source may also be more likely to communicate WOM information (Other farmer). Target participants' use of email for business purpose represents the involvement of information technology in their operations. Those who use email as an information source may be more likely to share WOM information with peers (Email).
Information from facilitated B2B WOM interacts with the above factors to determine WOM participants' information sharing behavior. A factor describing WOM participants' evaluation of the WOM experience i.e., their willingness to participate in another teleconference is selected to explain their information sharing decisions (Participate again). Satisfied participants are expected to be more willing to transmit information.
Data

Two facilitated WOM campaigns, one involving a U.S. crop expendable input with farmers as primary decision makers and another involving a companion animal product with veterinarians as decision influencers, were evaluated. The crop expendable input WOM program took place throughout late 2004 and early 2005 with a total of 855 farmers from Indiana, Iowa, Nebraska and Illinois participating in the program (Table 1). A stratified random sample based on distribution by state, of 122 WOM participants were invited for the telephone interview, of which 87 completed the interview resulting in 85 useable responses. The companion animal product WOM program took place throughout May 2005 and June 2005 with a total of 518 veterinarians in 40 states in the U.S. participating in the program. A total of 80 WOM participants were contacted by telephone for the interview, of which 68 completed the interview. One of the criteria for completing the interview was that they remembered having participated in the WOM program. Data were collected via personal interviews conducted over the telephone by a professional market research firm. Note that the telephone surveys were conducted some time after the initiatives in order to measure the longer term behavior change as a result of the WOM initiative. For the U.S. crop expendable input, there were approximately 21 months between the WOM teleconference and the survey of farmer information sharing behavior. For the companion animal product, there were approximately 17 months between the WOM teleconference and the survey of veterinarian information sharing behavior.

**Table 1:** A Summary of WOM Initiative Information and Telephone Survey Information

| | **Products** | |
|---|---|---|
| | U.S. Crop Expendable Input | Companion Animal Product |
| Time of WOM | Nov. 2004 - Jan. 2005 | May 2005 - June 2005 |
| Time of telephone survey | Sept. - Oct. 2006 | Nov. 2006 |
| Geographic locations | IN, IA, NE, IL | 40 states[a] |
| Occupation of respondents | Growers | Veterinarians |
| Numbers of participants in the WOM program | 855 | 518 |
| Number of respondents in the telephone survey | 122 | 80 |
| Number of respondents recalled participating in the teleconference | 87[b] (71%) | 68 (85%) |

1 The 40 states include: AL AR AZ CA CO CT FL GA LA ID IL IN KS KY LA MA MD MI MN MO MS MT NC NE NH NJ NY OH OK OR PA SC TN TX UT VA VT WA WI WV.

2 These 87 observations were used in the ordered logit regression. Two observations were automatically dropped because of missing values for the "Previous Experience" variable and the "Participate Again" variable. Thus the total number of observations in the regression is 85.

 

*Estimation Model*

In order to explain participant information sharing behavior, we used logit analysis which predicts the probability that a participant shares information given a set of characteristics. First we estimated whether or not the participant shared information using the binary logit regression. The binary logit regression of the U.S. crop expendable input estimation and the companion animal product estimation includes a Yes/No dependent variable which is coded as 1 if the respondent shared WOM information with peers and 0 otherwise. Second, we estimated the intensity of information sharing using the ordered logit regression. In the ordered logit regression of the U.S. crop expendable input estimation, the dependent variable is categorical which is coded as 1 if the respondent did not share information with other farmers; 2 if they shared with 1 to 4 other farmers; and 3 if they shared with 5 or more farmers. In the ordered logit regression of the companion animal product estimation, the dependent variable is set equal to 1 if the respondent did not share WOM information; 2 if they shared with 1 or 2 veterinarians; and 3 if they shared with more than 2 veterinarians (Table 2).

**Table 2:** Definitions for Discrete Variables and Preliminary Statistics for the Dependent Variables.

| U.S. Crop Expendable Input | | | | Companion Animal Product | | | |
|---|---|---|---|---|---|---|---|
| Definition | Category | n | % | Definition | Category | n | % |
| Did not share information | 1 | 40 | 46% | Did not share information | 1 | 23 | 33% |
| Shared with 1-4 other farmers | 2 | 32 | 38% | Shared with 1-2 veterinarians | 2 | 14 | 21% |
| Shared with 5 or more other farmers | 3 | 13 | 16% | Shared with more than 2 veterinarians | 3 | 31 | 46% |
| *Total Respondents* | | *85* | | | | *68* | |

This study employs six groups of explanatory variables: 1) evaluations of the WOM experience; 2) demographics; 3) previous experience with the product; 4) participants' tendency to adopt new technologies; 5) participants' information sources and information uses; and 6) leadership positions. Table 3 presents the definitions and summary statistics for all explanatory variables.

 

**Table 3:** Definitions for Discrete and Continuous Variables and Preliminary Statistics for the Independent Variables

| | | U.S. Crop Expendable | | | Companion Animal Product | | |
|---|---|---|---|---|---|---|---|
| Continuous Variables | Definition | Category | N | % | category | n | % |
| Size | total corn acres in 2004 (unit: thousand acres) | 85 | 0.62 | | -- | -- | -- |
| Previous use | 2004%= (treated acres)/(total corn acres) | 85 | 0.22 | | 2005 bottles | 68 | 1.46 |
| Discrete Variables | Definition | Category | N | % | category | n | % |
| Age | 0-54 and younger; | 0 | 44 | 52% | 0 | 35 | 51% |
| | 55 and older | 1 | 41 | 48% | 1 | 33 | 49% |
| | | **Total** | **85** | | **Total** | **68** | |
| Education | high school or less; | 0 | 35 | 41% | -- | -- | -- |
| | more than high school | 1 | 50 | 59% | -- | -- | -- |
| | | **Total** | **85** | | | | |
| Gender | Female | -- | -- | -- | 0 | 30 | 44% |
| | Male | -- | -- | -- | 1 | 38 | 56% |
| | | | | | **Total** | **68** | |
| Size | number of clients: | | | | | | |
| | 3,000 or less; | -- | -- | -- | 0 | 33 | 49% |
| | more than 3,000 | -- | -- | -- | 1 | 35 | 51% |
| | | -- | -- | -- | **Total** | **68** | |
| Participate again | Favorable; | 1 | 50 | 59% | 1 | 34 | 50% |
| | neutral to unfavorable | 0 | 35 | 41% | 0 | 34 | 50% |
| | | **Total** | **85** | | **Total** | **68** | |
| Other farmers | important sources; | 1 | 58 | 68% | -- | -- | -- |
| | unimportant sources | 0 | 27 | 32% | | | |
| | | **Total** | **85** | | | | |
| Information source | frequently serve as information source; | 1 | 21 | 25% | 1 | 8 | 12% |
| | Never/sometimes serve as information source | 0 | 64 | 75% | 0 | 60 | 88% |
| | | **Total** | **85** | | **Total** | **68** | |
| New technology | first/one of first to adopt; | 1 | 50 | 60% | 1 | 46 | 68% |
| | wait for a few others, many others or one of the last to adopt | 0 | 35 | 40% | 0 | 22 | 32% |
| | | **Total** | **85** | | **Total** | **68** | |
| Leadership | have leadership positions | 1 | 30 | 35% | 1 | 11 | 16% |
| | do not have leadership positions | 0 | 55 | 65% | 0 | 57 | 84% |
| | | **Total** | **85** | | **Total** | **68** | |
| Email | used email; | 1 | 32 | 38% | 1 | 46 | 68% |
| | did not use email | 0 | 53 | 62% | 0 | 22 | 32% |
| | | **Total** | **85** | | **Total** | **68** | |

 

*The Binary Logit Regression Analysis*

The latent variable model for the binary logit regression for the U.S. crop expendable input estimation is:

$$n_i = x'_i\beta + \varepsilon_i = \beta_1(Age_i) + \beta_2(Education_i) + \beta_3(Size_i) + \beta_4(Peviouse_i) + \beta_5(PARTICIPATE\ AGAIN_i) + \beta_6(OTHER\ FARMER_i) + \beta_7(INFORMATION\ SOURCE_i) + \beta_8(NEW\ TECHNOLOGY_i) + \beta_9(LEADERSHIP_i) + \beta_{10}(EMAIL_i) + \varepsilon_i \quad [1]$$

For the companion animal product estimation is:

$$n_i = x'_i\phi + \varepsilon_i = \phi_1(AGE_i) + \phi_2(GENDER_i) + \phi_3(SIZE_i) + \phi_4(PREVIOUS\ USE_i) + \phi_5(PARTICIPATE\ AGAIN_i) + \phi_6(INFORMATION\ SOURCE_i) + \phi_7(NEW\ TECHNOLOGY_i) + \phi_8(LEADERSHIP_i) + \phi_9(EMAIL_i) + \varepsilon_i \quad [2]$$

The dependent variable  is equal to 1 if the participant shared information with peers and 0 otherwise.

*The Ordered Logit Regression Analysis*

The latent variable model for the ordered logit regression shares the same feature as the binary latent variable model except the definition for the dependent variables is different. The dependent variable has an ordinal feature with unequal distance between categories. The number of peers a respondent shared information with equals $n_i$ where:

$\alpha_i$ are threshold values;

$$\begin{aligned} N_i &= 1 && if\ n_i \le \alpha_1 \\ N_i &= 2 && if\ \alpha_1 < n_i \le \alpha_2 \\ N_i &= 3 && if\ n_i > \alpha_2 \end{aligned} \quad [3]$$

Based on the log (odds) function (Greene 2000), the probability that a participant shares information or not is computed and presented in Table 4. The probability that a participant chooses a specific category, i.e. shares with many peers is presented in Table 5. The marginal effects are presented in Table 6.

 

### *Estimation Results*

Performance of the overall model, i.e. the overall model goodness-of-fit, was tested by conducting a likelihood ratio chi-square test (Greene, 2000). The likelihood ratio Chi-square value for the two regressions is low (LR chi-square=12.43 for the U.S. crop expendable estimation, Probability >chi2=0.2575; LR chi-square=8.05 for the companion animal product estimation, Probability >chi2=0.5288), suggesting that the fitted model is not significantly better than the restricted model (the one with all estimated coefficients set to zero). This lack of significance of our overall model goodness-of-fit suggests that the selected factors cannot fully explain the change of information sharing behaviors of the WOM participants. That said, we believe that the lack of significance of our overall model it is likely due to our small samples, 85 observations for the crop expendable input and 68 observations for the companion animal product.

**Table 4:** Estimated Coefficients for Binary Logit Analysis on Decision to Share Information after Participating in a Facilitated B2B WOM

| Variables | U.S. Crop Expendable Input | Companion Animal Product |
|---|---|---|
| Age | 0.384 | 0.3849 |
| | [0.79] | [0.65] |
| Education | -0.179 | -- |
| | [-0.36] | |
| Gender | | 0.2061 |
| | | [0.37] |
| Size | 0.0004 | -0.1218 |
| | [0.75] | [ -0.21] |
| Previous use | 0.7534 | -0.0747 |
| | [0.84] | [-1.1] |
| Participate again | 0.1273 | 1.1364* |
| | [0.25] | [1.88] |
| Other farmer | 0.5584 | -- |
| | [1.06] | |
| Information source | 1.4798 ** | 1.7287 |
| | [2.29] | [1.32] |
| New technology | 0.2113 | -0.149 |
| | [0.41] | [-0.24] |
| Leadership | -0.0044 | -0.9116 |
| | [-0.01] | [-1.07] |
| Email | -0.0379 | -0.1451 |
| | [-0.07] | [-0.22] |
| N | 85 | 68 |
| LR chi-square | 12.43 | 8.05 |
| Prob > chi2 | 0.2575 | 0.5288 |

Z-values are reported in brackets
* - represents a statistical significance at α=0.1
** - represents a statistical significance at α=0.05

 

In the U.S. crop expendable input estimation, the only significant predictor of information sharing was participants who were frequently asked for advice by their peers which is one measure of opinion leadership (Information source, α=0.05). When the effects from other factors are held unchanged, participants who were frequently sought for advice by peers are 4.39 times more likely to share information[1] than participants who were less likely to be asked for information. Effects from all other factors are insignificant in determining participants' information sharing behavior about this product.

In the companion animal estimation, the quality of the WOM experience as measured by the participants' willingness to participate again significantly affects a participant's information sharing behavior (Participate again). Those who were willing to participate in another WOM initiative were more likely to share WOM information with other veterinarians (α=0.1). A satisfied WOM participant is 3.12 times more likely to communicate WOM information than a participant who is less satisfied[2]

The binary logit analysis suggests that dominant factors that affect participants' information sharing/not sharing behavior differs between the two WOM initiatives. The information sharing behavior of farmers who are the primary decision maker is mainly influenced by how often their peers ask them for advice which is one measure of opinion leadership. Farmers who are frequently asked for advice are likely to be confident about their value as an information source, which would increase their comfort with sharing information. In contrast, the information sharing behavior of veterinarians is influenced by the WOM experience. When participants had a good experience with the WOM initiative, they were more likely to share this information with others.

Results of the ordered logit regression are presented in Tables 5 and 6. The model goodness-of-fit statistics, the coefficient estimates and the Z test statistics are computed. The likelihood ratio Chi-square value for the U.S. crop expendable input estimation is high (LR chi-square=16.95; Probability >chi2=0.0754), suggesting that a statistically significant overall model goodness-of-fit is obtained. The LR chi-square value for the companion animal product estimation is low indicating that the fitted model is not significantly better than the restricted model which is most likely due to the small sample size.

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[1] Log(odds)=1.4789; odds=EXP(1.4789)=4.39.
[2] Log (odds) = 1.1364; odds=EXP(1.1364)=3.12.

 

**Table 5:** Estimated Coefficients for Ordered Logit Analysis of the Decision to Share Information after Participating in a Facilitated B2B WOM on Information Sharing Decisions – Shared with More

| | US Crop Expendable Input | Companion Animal Product |
|---|---|---|
| *Variables* | 1-Did not share information;<br>2-Shared with 1-4 other farmers;<br>3 -Shared with 5 or more other farmers | 1-Did not share information;<br>2-Shared with 1-2 veterinarians;<br>3-Shared with more than 2 veterinarians |
| Age | 0.0356<br>[0.08] | 0.6607<br>[1.26] |
| Education | -0.2988<br>[-0.66] | -- |
| Gender | -- | -0.2074<br>[-0.42] |
| Size | 0.7602*<br>[1.79] | -0.3542<br>[-0.69] |
| Previous use | 0.9914<br>[1.27] | -0.0751<br>[-1.11] |
| Participate again | 0.2286<br>[0.50] | 0.9153*<br>[1.81] |
| Other farmers | 0.6743<br>[1.36] | -- |
| Information source | 1.1296**<br>[2.22] | 1.3042<br>[1.33] |
| New technology | 0.128<br>[0.26] | -0.129<br>[-0.24] |
| Leadership | -0.1036<br>[-0.24] | 0.0807<br>[0.10] |
| Email | -0.1226<br>[-0.24] | -0.3794<br>[-0.68] |
| CUT1 | 1.1463 | 1.1463 |
| CUT2 | 3.3497 | 3.3497 |
| N | 85 | 68 |
| LR chi-square | 16.95 | 10.2 |
| Prob > chi2 | 0.0754 | 0.3345 |

Z-values are reported in brackets
* - represents a statistical significance at α=0.1
** - represents a statistical significance at α=0.05

 

Table 6: Estimated Marginal Effects

| Products | U.S. Crop Expendable | | | Companion Animal Product | | |
|---|---|---|---|---|---|---|
| Outcomes | Did not share information | Shared with 1-4 other farmers | Shared with 5 or more other farmers | Did not share information | Shared with 1-2 vets | Shared with more than 2 vets |
| Age | -0.0088 [0.1101] | 0.005 [0.0621] | 0.0038 [0.048] | -0.1406 [0.1105] | -0.022 [0.0244] | 0.1626 [0.1273] |
| Gender | -- | -- | -- | 0.0443 [0.1043] | 0.0072 [0.0186] | -0.0515 [0.122] |
| Education | 0.0733 [0.1106] | -0.0405 [0.0606] | -0.0328 [0.0514] | -- | -- | -- |
| Size | -0.1874* [0.1041] | 0.1057* [0.0641] | 0.0817* [0.0488] | 0.0758 [0.1088] | 0.0119 [0.0197] | -0.0877 [0.1259] |
| Previous use | -0.2445 [0.1923] | 0.1379 [0.1147] | 0.1066 [0.0858] | 0.0161 [0.0146] | 0.0025 [0.003] | -0.0186 [0.0167] |
| Participate again | -0.0565 [0.1121] | 0.0323 [0.0654] | 0.0242 [0.0474] | -0.1946* [0.1054] | -0.0288 [0.0274] | 0.2234* [0.1193] |
| Other farmers | -0.1665 [0.121] | 0.1 [0.0799] | 0.0665 [0.0465] | -- | -- | -- |
| Information source | -0.2577** [0.1038] | 0.1056** [0.048] | 0.1521* [0.0826] | -0.2205* [0.1215] | -0.087 [0.0862] | 0.3075 [0.1995] |
| New technology | -0.0316 [0.1211] | 0.018 [0.0696] | 0.0136 [0.0517] | 0.0275 [0.113] | 0.0046 [0.0207] | -0.0321 [0.1333] |
| Leadership | 0.0256 [0.1192] | -0.0146 [0.0686] | -0.011 [0.0507] | -0.0172 [0.1642] | -0.0029 [0.0306] | 0.0201 [0.1947] |
| Email | 0.0303 [0.1265] | -0.0172 [0.0727] | -0.013 [0.054] | 0.0793 [0.1134] | 0.0151 [0.0279] | -0.0943 [0.1393] |

* - represents a statistical significance at α=0.1
** - represents a statistical significance at α=0.05

In the U.S. crop expendable input estimation, two variables are found to have a positive and statistically significant impact on the number of peers a participant shares information with: Information source (α=0.05) and Size (α=0.1). A participant who was frequently sought for advice by peers is likely to share with many peers about what they learnt from facilitated WOM. The odds of him/her sharing information with 5 or more peers versus the combined no share or share with 1 to 4 peers categories are 3.09 times greater[3] if the participant is frequently asked for information by peers. The marginal effects indicate that the probability he/she shares with 1-4 other farmers increases by 10.56% and shares with 5 or more other farmers increases by 15.21% if a participant perceived himself/herself as a frequent information source for other growers compared to those who was never or only sometimes asked for advice by others (α<0.1) (marginal effects see Table 6).

[3] Log(odds)=1.1296; odds=EXP(1.1296)=3.09.

 

In addition, size matters. Participants from larger farms as measured by the total corn acres planted in the year before WOM are more likely to share information with many peers. Specifically, if the total corn acres were to increase by 1000 acres, the predicted probability of sharing with 1-4 other farmers increases by 10.57% and sharing with 5 or more other farmers increases by 8.17% (α=0.1; marginal effect see Table 6).

In the companion animal estimation, a participant's willingness to participate in the WOM initiative again (Participate again) is the only factor that significantly impacts the number of peers he/she shares information with (α=0.1) (Table 5). The probability of sharing with more than 2 veterinarians increases by 22.34% if a participant is willing to participate in another WOM initiative (α<0.1) The marginal effects suggest that when a participant was frequently asked for advice by peers (Information source) he/she was also more likely to communicate WOM information with many peers (Table 6). The predicted probability of sharing with more than two veterinarians increases by 30.75% if the participant was often sought for advice by peers (α=0.1).

The ordered logit analysis suggests that size is an important factor that determines a farmer participant's likelihood of information sharing about the crop expendable input. Decision makers from larger farms are found to be more likely to share information, and to share information with more peers than participants from smaller farms. In addition, farmers who are an information source for their peers were also more likely to share information. Veterinarians' breadth of information sharing is highly affected by their evaluation for the WOM experience where satisfied WOM participants share information with many peers.

## Discussion and Conclusions

This study focuses on the indirect impact of facilitated B2B WOM and specifically the questions of "who shares vs. not share" and "who shares WOM information with many peers". By studying two WOM initiatives, this study provides business marketers with important information to help them understand the effectiveness of facilitated B2B WOM and to better utilize it as a marketing tactic.
Corn growers' information sharing decisions depend to a large extent on whether peers look to them for advice about products or services, which is one measure of opinion leadership. Those who believe they are often looked to for advice are found to be more likely to share what they learnt from WOM initiatives which is consistent with the conclusions of Rogers (1962). In contrast to File et al. (1994), size of the operation has a positive impact on WOM participants' information sharing behaviors. As suggested by Wyckhuys and O'Neil (2007), larger farms may have higher levels of social participation, social connections and higher social economic status and they may have higher potential to serve as information sources. It is noteworthy that the ordered logit regression was statistically

 

significant, while the binary logit was not, most likely due to the small sample size of 85 observations. With a larger sample size we would expect more robust regression results.

The companion animal product results tell a different story. A participant's willingness to participate in another WOM initiative determines whether he/she shares WOM information or not, and if he/she shares, the number of peers he/she shares information with. Once they decide to share, they are more likely to share with more than two other veterinarians. This finding is consistent with the recommendations of WOM marketing experts. As Sernovitz (2006) notes, "Real people will talk about you when they like you," and "Happy people grow your business." In addition, evidence from the marginal effects analysis suggests that veterinarians who are generally looked for information by peers also exhibit a higher potential to disseminate WOM information which again is consistent with the conclusions of Rogers (1962). Neither the binary logit or ordered logit regressions were statistically significant, again likely due to the small sample of only 68 observations.

The behavior of sharing WOM information or not and the breadth of information sharing are different for growers and veterinarians. In order to improve the efficiency of WOM initiatives, agribusiness marketers should consider the impact of the significant factors when identifying whom to invite. When promoting a crop expendable input, agribusiness marketers will want to invite farmers who are already considered opinion leaders, and especially those farmers with larger operations. When promoting the companion animal product, manufacturing marketers may want to pay more attention to the quality of the WOM initiatives in order to ensure a satisfactory experience for the participants which in turn would lead to more information sharing.

We hypothesize that one reason the WOM initiative experience may matter to veterinarians but not to farmers is that veterinarians play the role of decision influencer rather than decision maker. The veterinarian must feel confident that the information received in the WOM initiative is valuable and unbiased before he or she is likely to share this information with others. For the veterinarians, their reputation and business success depends on being a source of reliable information. In contrast, the farmer is in a position to directly use the information gained in the WOM initiative and may be more confident in interpreting and using the information regardless of the quality of the experience. Thus for farmers, whether or not they pass any of the information along depends on their confidence in being a valuable source of information to other farmers which is derived from being asked for advice by other farmers. This distinction between decision makers and decision influencers has not been explored in academic research and we believe it merits further attention.

 

Finally, the impact of facilitated B2B WOM on information sharing behavior may change based on the product and the lifecycle stages. In this study, the companion animal product had been launched a very short time prior to the WOM initiative. The crop expendable input had been launched about a year before the initiative. The difference in lifecycle stage and product type may explain the difference in participants' information sharing behaviors. Future studies could compare the impact of WOM initiatives on products in different lifecycle stages and even in different industries. While this study did open up this area by considering two different products, future work could be much more systematic here.

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# Opportunities for Producing Table Grapes in Egypt for the Export Market: A Decision Case Study

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## Abstract

The Barakat Fruit Farm desires to increase their share of the exportable grape market in Egypt. Unfortunately, the grape cultivars currently cultivated by the farm bear fruit after the early market window to the European Union when prices are high. An analysis of the company, competition, consumer, market channel, and conditions, provides insight into possible solutions to the challenges faced by the farm management. Designed for undergraduate classroom use, this case encourages students to think outside of traditional production techniques to arrive at solutions that are viable from both crop culture and financial standpoints.

**Keywords:** Decision case, horticulture, agriculture economics, grape production

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**IAMA Agribusiness Case 12.2**

## The Company

### *Owner*

Reda Barakat grew up in Cairo, studied agricultural sciences, and worked as a faculty member in the Faculty of Agriculture at Cairo University. Dr. Barakat wanted to use his experience and theoretical knowledge of real-life production agriculture; therefore, he decided to own and manage a fruit farm focusing on the export market. In 1994, he purchased about 1,500 feddan[1] of land in Nobarya along the Cairo-Alex Desert road (Figure 1) to fulfill his vision of establishing his fruit farm. Before cultivation of crops, the desert land needed substantial reclamation and building of infrastructure.


**Figure 1:** Location of Barakat Fruit Farm

As can be seen in Table 1, Reda Barakat started his business by cultivating the same successful crops as the neighboring fruit farms. He also analyzed the major Egyptian fruit export trends during the 1984 to 1994 period. Major export crops showed a steady increase during this period in production, area harvested and export value (Table 2). Therefore, he decided to start cultivating peaches, grapes, and apricots as potential export crops on about 500 feddan. Other areas of the farm (260 feddans) are used to cultivate a variety of vegetable and cereal crops.

[1]Feddan is a local measure of land equal to 4,200 square meters or 1.038 acres

 

**Table 1:** Cultivated Areas and Crop Production of the Barakat Fruit Farm

| Crop | Variety | Cultivated Area (Feddan)* | Farm Production (Tons)2006 | Notes |
|---|---|---|---|---|
| Apricots | Florida Brins | 60 | 2,442 | For export & local market |
| Grapes | Superior<br>Flame Seedless<br>Thompson Seedless | 120 | 1,105 | For export & local market |
| Peaches | Dessert | 60 | 286 | For export & local market |
| Banana | Maghraby | 40 | 18 | Local market |
| Wheat | Giza 168 | 100 | - | Local market |
| Vegetables | Various | 70 | - | Local market |
| Forage | Alfalfa | 50 | - | Feedstock for farm animals |

* 1,000 feddan are in reclamation

*Labor*

Skilled managers and laborers are essential if the farm is to operate effectively. Dr. Barakat uses two different kinds of labor to run the farm, contracted and seasonal laborers. The contracted laborers include 1 general farm manager, 3 executive agricultural engineers, and 26 technical assistants. The average salary of the general manager is about 1500 L.E.[2] per month, while each executive engineer earns about 600 L.E. per month. The technical assistants earn about 400 L.E. per month. The general manager is responsible for selecting crops and cultivars to be produced, designing irrigation systems, planning the IPM pest and disease controls, and assigning tasks to the executive engineers and technical assistants. He is also responsible for purchasing inputs and implementing marketing strategies. The executive managers are responsible for the farm operations including the laborers' productivity and overseeing their management; maintaining and altering the irrigation systems; and defining the volume and application time of pesticides. The technical assistants are primarily responsible for farm infrastructure security and fruit orchard conservation, which includes the application of irrigation water, fertilizer, and pesticides. The technical assistants are also responsible for harvesting the mature produce.

The number of seasonal laborers varies from 40 to 60, based on the amount of work needing to be done. These trained laborers are paid about 25 L.E. per day and are recalled, as needed, through a labor contractor. During harvest season, 15 to 20 seasonal laborers are hired per feddan as the fruit ripens. After harvesting, 10 to 15 seasonal laborers are hired to maintain the fruit orchard by cleaning and burning about one feddan of refuse a day.

[2] 1 L.E. = 0.174 USD in November 2006 when information was collected for case.

 

**Table 2:** Production (tons), harvest area (Ha), and export value (USD $ 1,000s) of major exportable fruit in Egypt

| | Bananas | | | Grapes | | | Apricots | | | Peaches | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Production | Harvest Area | Value | Production | Harvest Area | Value | Production | Harvest Area | Value | Production | Harvest Area | Value |
| 1985 | 203,000 | 9,660 | 9 | 395,000 | 36,130 | 136 | 23,000 | 2,100 | 54 | 13,000 | 1,260 | 1 |
| 1986 | 237,000 | 12,180 | 7 | 452,000 | 45,790 | 236 | 21,000 | 2,940 | 197 | 31,000 | 4,200 | 34 |
| 1987 | 278,000 | 14,280 | 18 | 510,000 | 46,630 | 51 | 29,000 | 2,940 | 37 | 32,000 | 4,620 | 42 |
| 1988 | 355,000 | 15,543 | 25 | 557,000 | 46,630 | 34 | 33,000 | 2,520 | 30 | 33,000 | 9,660 | 245 |
| 1989 | 388,000 | 15,963 | 141 | 621,000 | 45,789 | 12 | 42,000 | 2,520 | 88 | 33,000 | 9,660 | 299 |
| 1990 | 415,495 | 14,627 | 238 | 584,694 | 37,952 | 66 | 38,000 | 2,662 | 16 | 37,442 | 9,516 | 155 |
| 1991 | 392,887 | 14,147 | 370 | 526,716 | 37,274 | 312 | 24,795 | 2,670 | 0 | 52,381 | 12,566 | 263 |
| 1992 | 396,497 | 14,218 | 21 | 658,061 | 57,921 | 828 | 44,833 | 2,923 | 137 | 105,000 | 16,800 | 765 |
| 1993 | 405,237 | 13,779 | 10 | 726,082 | 58,392 | 1,227 | 45,000 | 3,000 | 140 | 159,000 | 21,000 | 1032 |
| 1994 | 459,012 | 13,973 | 9 | 707,049 | 49,329 | 610 | 43,000 | 3,000 | 99 | 213,000 | 25,500 | 881 |
| 1995 | 498,679 | 14,473 | 10 | 739,478 | 49,183 | 466 | 53,948 | 2,956 | 70 | 267,000 | 29,000 | 367 |
| 1996 | 570,457 | 15,350 | 5 | 943,702 | 49,961 | 912 | 50,611 | 3,067 | 0 | 321,000 | 32,500 | 221 |
| 1997 | 635,000 | 16,814 | 3 | 867,905 | 50,590 | 498 | 40,652 | 3,080 | 8 | 376,969 | 35,635 | 163 |
| 1998 | 655,570 | 16,998 | 7 | 957,734 | 52,174 | 507 | 45,110 | 3,199 | 3 | 429,853 | 34,658 | 138 |
| 1999 | 728,999 | 22,524 | 0 | 1,009,560 | 59,342 | 451 | 43,042 | 3,350 | 3 | 301,191 | 36,121 | 60 |
| 2000 | 760,505 | 22,053 | 0 | 1,075,100 | 59,765 | 1,875 | 62,613 | 4,960 | 0.36 | 240,193 | 32,725 | 35 |
| 2001 | 849,293 | 20,707 | 2 | 1,078,910 | 62,355 | 1,294 | 71,191 | 5,138 | 4 | 247,300 | 32,981 | 26 |
| 2002 | 877,588 | 21,129 | 5 | 1,073,815 | 56,259 | 1,817 | 103,070 | 6,218 | 137 | 339,266 | 31,368 | 62 |
| 2003 | 870,886 | 21,307 | 27 | 1,196,852 | 57,214 | 2,930 | 70,424 | 6,747 | 65 | 302,667 | 31,359 | 218 |
| 2004 | 875,123 | 21,270 | 202 | 1,275,288 | 58,193 | 11,440 | 72,523 | 7,484 | 140 | 360,937 | 31,761 | 385 |

FAOSTAT - FAO Statistics Division 2007 | 17 January 2007.

 

*Products*

Egyptian grape exports have steadily increased in the last few years due to a) improvements in production and market quality (boxes and packaging materials), b) the availability of sea transport, which has reduced transport costs, and c) the European demand deficit. Because of this, the grape production of Barakat Fruit Farm is directed toward the export markets, and the majority of other fruit production is allocated to the local market. The grape cultivation area in Barakat Fruit Farm represents about 24% of the total cultivated area (120 feddan out of 500 feddan). Three late-season grape cultivars, Superior, Flame Seedless, and Thompson Seedless, are cultivated on 40 feddan each. These cultivars vary in production quantity and quality (Table 3).

**Table 3:** Economic Indicators for Table Grapes Produced on Barakat Fruit Farm

| Variety | Cultivated Area (Feddan) | Production (Ton/Feddan) | Export | Local Market |
|---|---|---|---|---|
| Superior | 40 | 9 to 11 | 54% | 46% |
| Flame Seedless | 40 | 8 to 10 | 60% | 40% |
| Thompson Seedless | 40 | 8 to 9 | 44% | 56% |

**Source:** Barakat Fruit Farm, 2006.

*Estimation Model*

Production parameters for attaining quality grapes in Egypt are readily available (Azancot, 2000; Berger, 1998; Tayel et al., 2008). Many small producers of Egyptian grapes utilize less than optimal production practices due to limited access to information. Management at the Barakat Fruit Farm does not have this limitation and opted to maximize harvest quantity and quality by adapting a drip irrigation system to supply water and chemical fertilizer to the vineyard. Barakat Fruit Farm management and laborers are skilled in grape cultivation thereby ensure consistency of product and the ability to change cultural practices as needed to increase crop production or quality. Importantly, the trained laborers live close to the farm, providing an added level of security in the event of unforeseen production issues.

*Local Competition*

Egyptian producers of table grapes in Minia, Gharbia, Behera, Dakahlia, Giza, Menoufia, and Beni Suef governorates are the main competitors for Nobarya producers (Figure 2). These competitors include large-scale farmers, small-scale farmers and farmer associations, who commonly cultivate early maturing grape cultivars. Southern Egypt grape producers may have some climatic advantages over northern Egyptian grape producers, but are at a disadvantage with transportation and cold chain facilities.

 

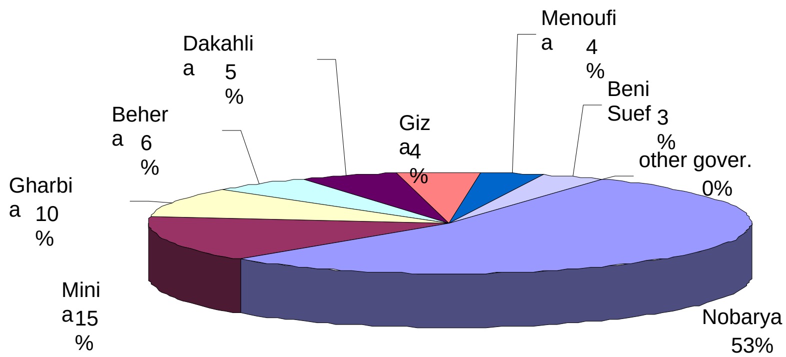


**Figure 2:** Table grape production by region in Egypt.
**Source:** Swanson et al. 2004 - MUCIA DATABASE, 2006.

With the exception of the Nobarya area, where late season grapes are cultivated, only a small amount of the grape production from the regional Egyptian competitors mentioned above, as little as 1.4 % (El-Sawalhy et al., 2008), goes to the export market. The second-class and third-class grapes from all regions are shipped to the local market, which negatively affects local area grape prices. For example, the Egyptian table grape production in the 2005 season was about 1,275 million tons. About three percent of this amount was exported abroad, while the rest (97%) was consumed domestically.

*International Competition*

A window of opportunity for fresh table grapes in the foreign market, especially in the European Union (EU), exists. For a two-month period, the supply of table grapes is reduced in Europe accompanied by an increase in product price, due to scarcity (Figure 3). Egyptian producers and exporters are using this opportunity to their advantage as the grape harvest begins in May and continues until the end of September (for white varieties) or into November (for red varieties). The peak occurs when many competitors halt supply and before other competitors initiate supply. During this time high prices occur.

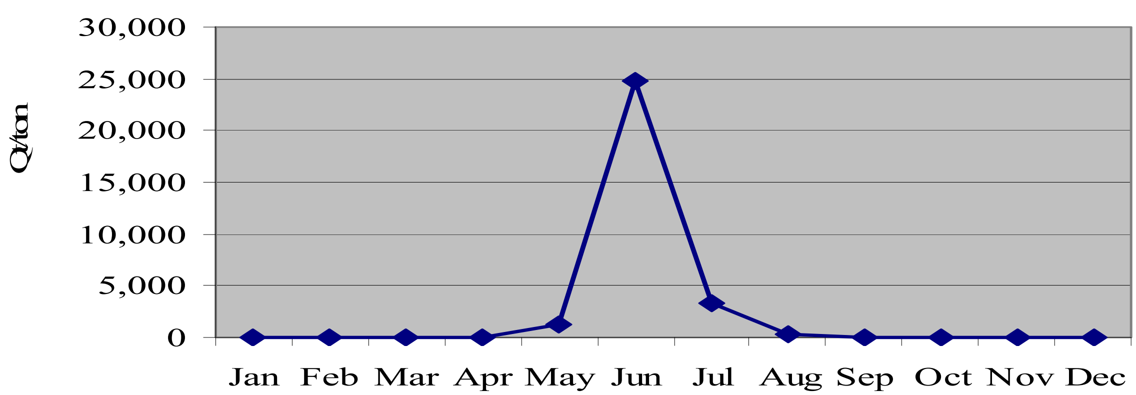


**Figure 3:** Egyptian monthly exports of table grapes to European Union.
**Source:** Swanson et al. 2004 - MUCIA DATABASE, 2006.

 

**Table 4:** Tons of Egyptian grapes exported monthly to the European Union, Gulf States, and Asia during 2005

| | | MONTH | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Country** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| EU | England | | | | | 675 | 12,557 | 1,602 | 315 | 24 | | | | 15,173 |
| | Netherlands | | | | | 175 | 6,615 | 1,193 | 63 | 15 | | | | 8,060 |
| | Italy | | | | | 80 | 1,886 | 152 | | | | | | 2,118 |
| | Germany | | | | | 74 | 1,300 | 189 | | | | | | 1,562 |
| | Belgium | | | | | 183 | 1,338 | 34 | | | | | | 1,555 |
| | Norway | | | | | 15 | 328 | 59 | | | | | | 403 |
| | France | | | | | 35 | 282 | 2 | | 7 | | | | 327 |
| | Sweden | | | | | | 165 | | | | | | | 165 |
| | Finland | | | | | 14 | 103 | 14 | | | | | | 132 |
| | Ireland | | | | | | 68 | 50 | | | | | | 118 |
| | Austria | | | | | 1 | 72 | | | | | | | 72 |
| | Spain | | | | | | 19 | | 8 | | | | | 27 |
| | Czech | | | | | | 19 | | | | | | | 19 |
| | Greece | | | | | | 1 | 2 | | | | | | 3 |
| | Other | | | | | | 1 | | | | | | | 1 |
| | Sub-Total | | | | | 1,252 | 24,753 | 3,298 | 385 | 46 | | | | 29,735 |
| Gulf | Emirates | | | | | 35 | 418 | 272 | 123 | 67 | 2 | | | 917 |
| | Other | | | | | 63 | 670 | 608 | 156 | 14 | 3 | 5 | | 1,520 |
| | Sub-Total | | | | | 97 | 1,089 | 880 | 279 | 81 | 5 | 5 | | 2,437 |
| Asia | Russia | | | | | | 533 | 188 | | | | | | 720 |
| | Other | | | | | 23 | 522 | 210 | 232 | 178 | 87 | 2 | | 1,255 |
| | Sub-Total | | | | | 23 | 1,055 | 398 | 232 | 178 | 87 | 2 | | 1,976 |
| | Total | | | | | 1,373 | 26,896 | 4,576 | 897 | 305 | 92 | 8 | | 34,148 |

**Source:** Central Agency for Public Mobilization and Statistics (2007).

The Egyptian grape market share in the world market is greatly influenced by the time of export, export prices of competitors, and the quality of product being exported (El-Sawalhy et al., 2008). A marketing study tour in the EU examined the export of Egyptian table grapes and found that few competitors appeared between May 15 and July 1. However, several Mediterranean countries also began exporting table grapes to the EU market, including Israel, Jordan, southern Spain and Greece. There are also non-Mediterranean suppliers, primarily Brazil and Mexico, who partially supply table grapes during this time. In addition, grapes imported to the EU from Argentina, Chile, South Africa, India, and Pakistan are gaining an increased market share during this period (Saied, 2001). Even with competition, however, Egyptian grapes represented 3.6%, 3.5 %, and 2.4% of imported grapes during 2004 in the United Kingdom, Italy, and Netherlands markets, respectively (Eurostat, 2007). The opportunity exists for Egypt to increase its market share of table grapes in the EU during this window. El-Sawalhy et al. (2008) reported that Egyptian grape exports may be increased in certain EU markets, but that price is the key factor to effectively competing in the world market.

## Consumer

The consumer, specific target markets, types of clients, their purchasing power and their needs will be discussed in this section of the case. The EU market is considered the largest market for importing table grapes from Egypt, especially UK, Netherlands, Italy, Germany, and Belgium (Figure 4).

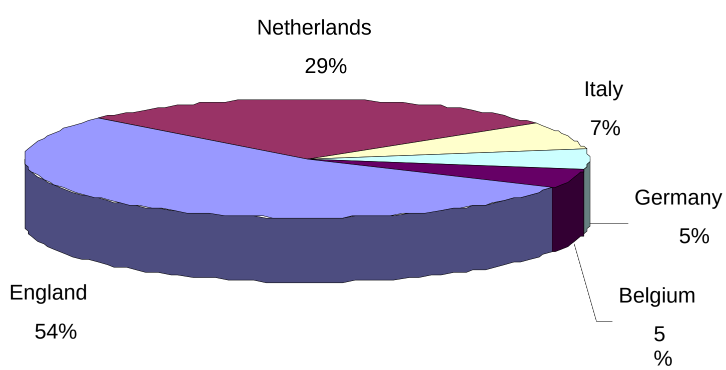


**Figure 4:** The Main EU Markets for Egyptian Table Grapes, 2005
**Source:** Swanson et al. 2004 - MUCIA DATABASE, 2006.

This may be attributed to the more than 379 million people with good incomes (GDP per capita = 23,200 €) and the trend toward a healthy lifestyle that is increasing the demand for fresh fruits and vegetables. The EU also has a limited capacity to produce fresh fruits and vegetables, which creates seasonal shortages (Eurostat, 2007). The EU market is relatively close to Egypt, which results in low transportation costs. Therefore, the EU is a promising market for Egyptian grapes. Finally, there are also the emerging markets of Eastern Europe countries like Poland and Hungary that observe quality standards like EurepGAP but are less stringent than Western Europe in this aspect. After careful consideration of all crops produced on the Barakat Fruit Farm, the management decided that grapes were the most likely crop that could be produced for export.

## Market Channels

Egyptian market chains for horticultural crops have strengths and weaknesses (Alaa, 2004). Market channels, specifically the distribution system to local and export markets, the market organization (wholesale markets and middlemen), and the market share for Egyptian table grapes can be divided into the domestic market (97%) and the overseas markets (3%). The domestic market can be subdivided into retail, institutional, and processing, while the overseas fresh markets can be again subdivided into conventional and organic. Various factors influence the competitive advantages available to Egyptian products traveling through the market channel and must be assessed when estimating potential profitability of a product (Alaa, 2004).

When estimating the potential profitability of table grapes, the margins charged by different intermediaries in the export industries are influenced by many different factors. These include the type of grape produced (cultivar, season, and quality), the current and expected future harvest situation, the level of demand, and the price trend. All of these factors make it extremely difficult to provide information on typical margins in the trade. For the purposes of this case, the following numbers presented in Table 5 are very rough guidelines on the mark-up added to the buying price by each type of middlemen and exporter. For many horticultural products, middlemen and exporters pool product from several farms until a suitable volume is available for exportation (Alaa, 2002). Barakat Fruit Farm, like most small farms, does not have the international connections or the product volume to market their products directly to international clients and must rely on middlemen and exporters for the distribution of product. Interviews of exporters and farmers also revealed that a margin of about 25% to 40% is added to the prices that exporters take from farmers. Farmer estimates of price increases in grapes agree with those on other horticultural crops (IFAD 2008). The level of these increases for any given crop is based on cultivar, season, and quality.

Table 5 illustrates the per ton value of Egyptian grapes exported during 2005 to the European Union, Gulf States, and Asia. The values presented exclude packaging at the farm level and assume a 5%, 10%, and 20% loss rate at the wholesale, retail, and export levels, respectively. Packing, grading, and shipping costs are included at the retail and export level.

 

**Table 5:** Per Ton Value of Egyptian Grapes Exported during 2005

| Costs and Prices | Egyptian Pounds L.E. | U.S. $ |
|---|---|---|
| Production Costs | 501 | 86 |
| Farm Price | 1,200 | 207 |
| Net Margin for Farmer | 699 | 121 |
| | | |
| Farm Price + Transportation/Loading (Wholesale Cost) | 1,270 | 219 |
| Wholesale Revenue (Wholesale Price) | 1,500 | 259 |
| Net Margin/Wholesale | 230 | 40 |
| | | |
| Wholesale Price + Loading (Retail Cost) | 1,625 | 280 |
| Retail Revenue (Retail Price) | 2,000 | 345 |
| Net Margin/Retail | 375 | 65 |
| | | |
| Wholesale Price + Loading/Shipping (Export Cost) | 5,889 | 1,015 |
| Export Revenue (Export Price) | 9,280 | 1,600 |
| Net Margin/ Export | 3,391 | 585 |

**Source:** CARE, ACID/VOCA, MALR, and ITC. 2004.

## Conditions

The Teaching Notes for this case examine the challenges facing the farm manager. The farm produces cultivars of grapes that mature at the end of June. This is an issue as the farm's exportable grape product misses the most of the EU's early market, i.e., the mid-May to the end-of-June window. Grape exportation from Egypt to the EU plummets from late June to mid-July. The Barakat Fruit Farm management believes there are several options that can be pursued to increase the percentage of exportable grapes produced on the farm for this early market window. The owner of the Barakat Fruit Farm is considering three possible solutions to the company's current situation:

1. Replace the existing late season cultivars in the grape vineyard with early season cultivars,
2. Adjust applied agricultural practices and farm structure to produce high quality grapes for the early market using the existing vineyards, or
3. Cover the existing grape vineyard with plastic sheets (thiran) to hasten crop maturation.

 

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# Implementation of a Traceability System From Constraints to Opportunities for the Industry: A Case Study of Quebec, Canada

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## Abstract

Increasing frequency of epidemiological crisis and their disastrous consequences are motivating nations, around the world, to introduce traceability systems. Traceability systems enable identification, prevention of propagation, and control of diseases and health problems in the shortest possible delay. However, while this effort is praise worthy and indeed necessary, the implementation of a traceability system is complicated primarily because it involves additional constraints and costs to the industry. This article describes the introduction and success of a compulsory traceability system in the Quebec province of Canada by presenting the approach and the strategies that were adopted to minimize constraints and generate opportunities for the industry.

**Keywords:** traceability, strategy, strategic alliance between industry and government, epidemiological crisis, information technology.

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## Introduction

The laws and regulations governing traceability are not well adapted to the industry. With respect to sanitary control and food security, they are generally embedded in the Government's overall strategy. Accordingly, the implementation is often managed by government veterinarians and human health specialists. Hence, the needs and constraints of the industry, while accounted for, are often treated a posterior in spite of the precedence of public protection objectives. This creates a situation where the introduction of a traceability system leads to large resistance on the part of the industry that takes the tangible and short-term constraints and costs more into consideration than the opportunities that can be generated.

The sustained follow-up and management of farm information relating the links of the agri-food chain offers, in reality, a lot of opportunity to the industry; whether this is to maintain access to international markets, to identify the origin of convenience goods for marketing, to improve livestock or field management practices, or else. However, the main problem is that most of the advantages stay intangible and somewhat hypothetical in the short-run, and become concrete only in the event of an epidemiological or food safety crisis or in the long-run when various opportunities will arise.

The implementation of a traceability system is challenging to the industry in terms of optimally reducing of the associated costs and constraints, and perceiving the potential benefits from the opportunities thereof. It is, therefore, essential that the decision-makers responsible for the setup of such a system be aware of this challenge. They should also pay attention to and account for the priorities of the industry.

This article presents the case of Quebec's traceability system where the cooperation between the industry and the Government has been the key factor used to facilitate the implementation process.

## The Implementation of a Traceability System in Quebec

### *1- Agricultural Production in Quebec*

In terms of value of agricultural production, Quebec is the third largest producer among Canadian provinces. The agricultural sector, in this province, mainly consists of small and medium sized family farms, and animal production. In 2008, the value of farm production was estimated to be $7.5 billion Canadian. The share of animal production is around 70% of the total gross farm market receipts from the agricultural sector. Although, historically focussed on the domestic market, Quebec's agriculture has experienced growth over the last twenty years, on the occasion of NAFTA and WTO agreements, through its export-oriented sectors of production (such as pork and horticulture). As a result, at the turn of the year 2000, Quebec's agri-food balance of trade turned into a surplus, for the first time in its history.

*2- The Creation of a Partnership*

In light of the high frequency of epidemiological crisis around the world (such as Bovine Spongiform Encephalopathy (BSE), foot and mouth disease and avian flu), and their significant economic consequences (including destruction of products, loss of access to international markets and reputation among other), the Government of Quebec and UPA (the union representing the agricultural producers of the province) agreed by the end of the 1990s, to introduce a system of permanent identification and traceability of agricultural products from the point of production (the farm) to the point of consumption (the table).

To this effect, MAPAQ (Quebec' Ministry of Agriculture, Fisheries, and Food) and UPA jointly created the autonomous non-profit organisation, Agri-Traceability Quebec (ATQ), to start its mandatory program in 2001.  ATQ is managed by a board of directors consisting of Government representatives, MAPAQ and FADQ (Quebec's organization that manage agriculture insurance programs) and UPA (representing the agricultural producers). Its chair position is held by a producer. The objective of the partnership was to efficiently integrate both the requirements of the laws and regulations, and the needs of the agricultural producers (such as the simplification of the system for stakeholders, minimisation of expenses, and optimisation of benefits). Hence, this inter-disciplinary pool of experts, working towards the same purpose, was formed to allow the simultaneous achievement of the two objectives. This is, in fact, clearly stated in the ATQ mission statement as follows: «…to contribute to the improvement of food safety and the competitive capacity of agricultural producers of Quebec…»

From funding perspective, the Government of Quebec, that is also responsible for the laws and regulations on traceability, has granted ATQ a total of $21.5 million over a period of four years. This budget is for the development and the implementation of a traceability system in the province. In turn, the agricultural producers are responsible for the purchase and the placement of identifiers.

> *«In the absence of the partnership between the Government and the industry, it would have been practically impossible to implement traceability in Quebec. Traceability is a tool primarily used by government authorities due to their responsibility human and animal health protection. Had the Government tried to do it on its own, it would have faced resistance from producers and other stakeholders in the industry. Hence, the partnership helped unite the interests of all groups concerned… By working together throughout the development of the traceability system, each interest group had to understand the realities and*

 

*constraints of the others. This way, they were able to find viable mechanisms for the implementation of the traceability system. They were also able to look into the possible alternatives for cost sharing during the introduction of the system…»*

Personal communications: Mrs Linda Marchand, General Manager of ATQ

*3 - Priority of the Livestock Sector and the Farm to the Table Information Management*

ATQ was given the responsibility to put in place systems of traceability for all of the agricultural producers in Quebec. However, given the magnitude of the task and of the analysis of risks, it has been agreed to start the implementation with the ruminants sector, and to mainly concentrate on the transfer of information from the farm to the slaughterhouse. This was conceived with the belief that the collection of information at the farm of origin is often at the core of any system of traceability.

ATQ operates, at present, compulsory systems of traceability in the sectors of production of cattle (milk, calves and steers), sheep, and cervidae. The development of a system in the pork and poultry production sectors has also started. ATQ mandates will also expand to include fresh produce, goats and equine sectors by 2010. It also received, recently, the mandate to implement traceability in the hog sector across Canada. Additionally, a pilot project to incorporate and complete the chain of information from farm to the table is underway.

*4 - Choices Made and the Establishment of the System*

In order to be in a position to develop a reliable, tight but simple system, it has been agreed to base the system on the following four major characteristics:

- Centralization of the information in one database, and this, for all types of production. Since agricultural producers have, in most cases, more than one type of production in their enterprise, it becomes simpler and more efficient to centralize the set of information in the same database. Additionally, this helps ensure better reliability of the collected data.

- Identification of the animals from the first days after birth. It is easier to identify the animals at birth and thereby ensure the tightness of the system.

- Recording of the births and movements of the animals in the database. This aspect is imperative to ensure the reliability of the information related to the movement of animals. However, it raises an important challenge in terms of simplicity of data recording. This issue is discussed farther in the present study.

 

- Identification of all of the sites where each animal spends time. A site is defined as any location where an animal is susceptible of spending time (barn, truck, fair, gathering park, animal market, auction, pasture, slaughterhouse etc). The aim is to ensure tracking of all of the places where the animals stayed. This, again, is another important challenge from the point of view of data recording. The way the traceability system functions in Quebec is illustrated in Figure 1.

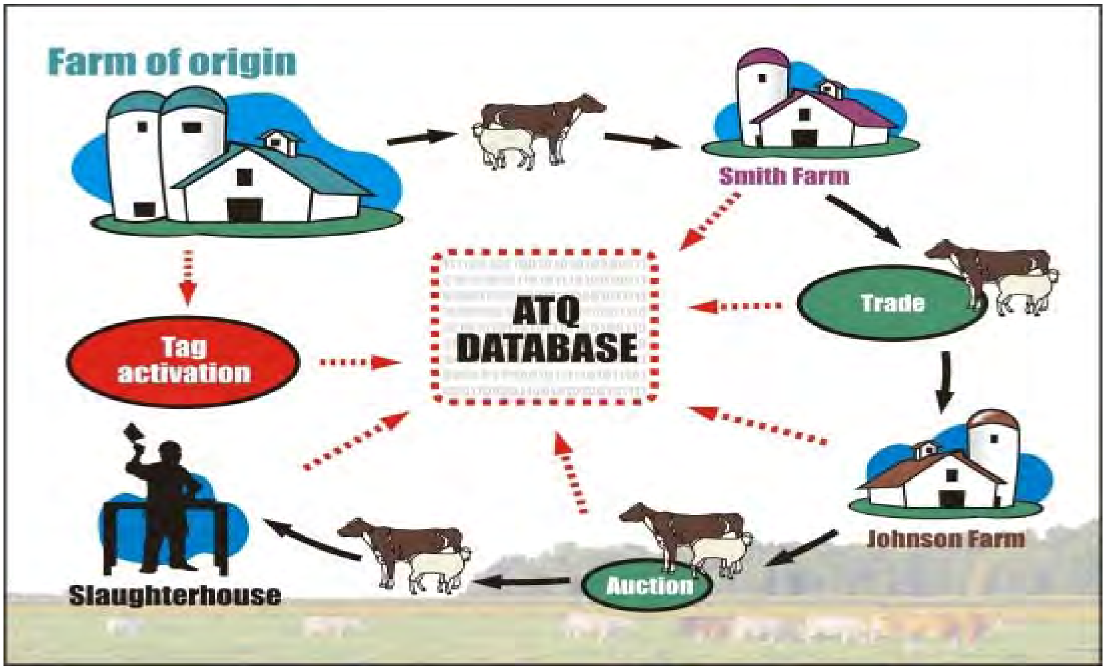


**Figure 1.**The Traceability System of Quebec
**Source**: ATQ Website: www.agri-tracabilite.qc.ca/en/traceability-quebec.html

### *5 - The Challenge of Simplification and Reliability of the Collected Information*

The chain of movements of the animals presents a major challenge with respect to the simplicity of data collection and the reliability of the information. Such an operation risks exasperating producers and stakeholders through repetitive obligations to provide new data. The automation of data recording has, thus, been selected. To this end, ATQ has undertaken many installation pilot projects at farms to test new information technologies aimed at simplifying the process of data entry and transfer. With respect to this, many strategic alliances have been formed with suppliers in order to have them participate in the search for solutions to the problems that arose during the pilot projects.

 

### *6 - Pilot Projects and Innovation*

In order to simplify the collection of data, ensure the reliability of the information, and automate data recording, ATQ undertook pilot projects jointly with the producers and the different stakeholders, and those at the different site during the movements of the animals between the farm and the slaughterhouse (for instance, transporters, animal market responsible, etc).
The questions to which ATQ desired to respond using the pilot projects were the following:

- What are the data that should be collected?
- What type of identifiers should be chosen?
- How should the different chain of activities be linked?
- What kinds of partnership should be established?
- How should maximum automation of information transfer be introduced?

The results of the pilot projects have led to the following decisions to be made:

- Double identifiers on ruminants; a visual panel with a number and barcode, and an electronic ring;
- Emphasis on technological innovation (IP technology, Bluetooth, etc.) in order to be able to develop tools for entry and electronic transfer of information (software, electronic scanners/readers, etc) for the different links in the chain of movements from the farm to the slaughterhouse.
- Possibility to producers to either manually or electronically enter, and transfer the information to ATQ
- Harmonisation of the identification numbers, and the fulfillment of the information exchange agreements with other partners of the industry who register animals (such as expert centers and association of races) so that the producer does not have to register the same animal at more than one location.

> *«In order to facilitate the electronic meshing, ATQ, first, chose a pilot project approach. This allowed understanding the particularities, and detecting the needs of the sector in which it planed to implement traceability. Then, it proceeded to technological intelligence to find the appropriate software, disk drive, and information transfer tools among those which already exist on the market…The selected technologies were tested on site with the stakeholders. It is well known that the choice of technology is quite challenging. The technologies that were initially proposed were unique and could be installed everywhere. However, it was, soon, discovered that each site had very specific needs and that they could not be adapted to every situation. Hence, it was necessary to find technological solutions that satisfy the immediate needs of every user, that are easy, user friendly and long lasting… Suppliers were*

*involved in the pilot projects so that they master the nature of the needs and adapt the tools they propose to these needs.»*

Personal communications: Mrs. Linda Marchand, General Manager of ATQ

*7 - The Sharing of Know-How*

After a tremendous amount of experience, ATQ decided to create a new division Agri-Traceability International (ATI) in order to share its acquired know-how.

*«… ATI is the division of ATQ that plays the role of offering expertise to Quebec concerning matters related to traceability outside the province, such as Canada or elsewhere in the world. When I speak of expertise, I am not referring to the provision of a copy of the database, but rather strategic consultancy for the development, introduction, and implementation of a traceability system. This, for instance, means assistance in the search for solutions, evaluation of needs, and support in communication strategies, among other…»*

Personal communications: Mrs Linda Marchand, General Manager of ATQ

*8 - The Creation of Value Added*

The perception of traceability is slowly transformed from one of constraints to one of opportunities gradually as the system became simpler and the benefits more tangible. In addition to the importance of such a system in terms of epidemiological control and public reputation, the principal direct benefits that the producer under this system obtains are the following:

- Maintain the boarders opened for the ruminants sector. After the Mad Cow Disease (BSE) crisis hit Canada in 2003, the continued records of information in the ATQ system (such as age of the animal and movements among other) has facilitated the reopening of markets for animals less than thirty months.

- Use of the information in the database to obtain export certificates from the Canadian Food Inspection Agency (CFIA). Following the information exchange agreement concluded with ATQ, the veterinarians of CFIA now use the information from the database in order to issue their certificates.

- Link the automation of the recorded information to computer tools of herd management and control. Collaborations are made between ATQ and herd management program developers in order to integrate the information in their computer tools.

 

> *«The most important advantage that the traceability system gave was the rapid reopening of boarders after the BSE in Mai 2003. This is because the information contained in the system was well recorded for slaughterhouses and live animal exporters. ATQ had the facilities to confirm the real birth dates of the animals before they got exported either towards the U.S.A. or Japan.*
>
> *Another advantage to the breeders is that the information contained in the system facilitates their day to day work… It is centralised at one location, and due to the protocol approved by the producer, other organisations also share this information… Furthermore, slaughterhouses outside Quebec that are provided with cattle from Quebec can guarantee to their Japanese buyers the age and the source of the animals using the ATQ database provided that the producer issues a written agreement.»*

Personal communications: Mrs Linda Marchand, General Manager of ATQ

*9 - The Importance of the Service to the Clientele*

Given the resistant state of the agricultural clientele to the introduction of the traceability system on the farms, the client approach takes on a crucial importance. ATQ has expended constant efforts to improve the services offered and the communication activities with its clients. These include:

- IP telephone system allowing, among other, audio expedition of messages to the target clientele;
- Information website that is constantly improved and equipped with transactional component allowing information exchange and online consultation of files;
- Multiple means of communication to reach the clientele through specialised journals, announcements, e-mails, telephone services, dissemination of the results from pilot projects, guides on traceability, among other; and
- Continued training of officers who give services to the clients so that they adequately respond to the needs of the clientele.

*10 - The Emphasis on the Quality of the Service and the Reliability of the System*

The reliability, tightness and the overall quality of a system of traceability are the most important variables that help confirm the performance of an enterprise such as ATQ, and indicate to its clientele that all precautions and measures are taken to guarantee the efficiency of the tool in time of crisis. In respect to this, ATQ has set in motion an international standardisation, ISO, measure for all of its business process in spring 2006 and it has obtained ISO-9001 certification in March 2009.

 

## Conclusions

It should be noted that the producers showed great resistance to the adoption of the traceability system at the beginning of the process of its introduction. However, the partnership industry-Government and the approach used to select the most appropriate method of implementation finally allowed to easily tackle this issue, and facilitated the adoption.

> *«First of all, a traceability system is a system based on the collaboration industry Government. This collaboration should not be limited only to producers and Government but also those implicated at the different links, for instance, transportation, auction blocks, slaughterhouses, processing, distribution and retailing…Traceability should also be easily accessible and user friendly, and should offer a value added to users… It is primarily a collaborative effort. All stakeholders should feel implicated and concerned.»*

**Personal communications: Mrs Linda Marchand, General Manager of ATQ**

 

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# Global Supply Chain
# An Executive Interview with Mary Shelman [1]

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## Introduction

Mary Shelman discusses forces driving higher food prices and some of the changes which are impacting the global food supply chain. Shelman coordinates Harvard Business School's premier Agribusiness Seminar attended annually by more than 200 CEOs and top managers from global firms. She also organizes and teaches similar programs in Europe, Latin America and Asia. Her research focuses on the forces shaping global agribusiness. Her experience bridges academia, as an author and teacher of dozens of case studies on strategic change and challenges in global agribusiness firms, with industry experience.

**This podcast can be seen with Realplayer on IAMA's website at:**
http://www.ifama.org/dispatch.asp?page=executive_interviews_2008

[1] Mary Shelman served as Chairman of the Board of RiceTec, Inc., a fully integrated agribusiness venture owned by the Prince of Liechtenstein, and has served on boards of various international companies and industry associations including IAMA. After receiving a BS in Chemical Engineering with High Distinction from the University of Kentucky, she achieved an MBA with Distinction from the Harvard Business School and was awarded a Dean's Doctoral Fellowship for research in economics and marketing. Ms. Shelman can be contacted at: mshelman@hbs.edu

[①] Doug Jose is the host of the Market Journal, a weekly televised program on agriculture produced by the University of Nebraska-Lincoln. This interview was conducted during the 18th Annual World Forum and Symposium in Monterey, California, June 18, 2008. Doug Jose can be contacted at: hjose1@unl.edu

 

***It's a pleasure to have as my guest Mary Shelman who is director of the Harvard Business School Agribusiness Program. Harvard has been involved in agribusiness for some time and you did start with this concept of supply chains. Tell us a little bit about that and how that relates to the total picture of agriculture.***

Shelman: A lot of people are surprised when they hear that Harvard Business School has an agribusiness program. Boston is not exactly a hot bed of agricultural activity. But the very term "agribusiness" was created by two HBS professors back in the 1950s: Ray Goldberg, who is known throughout the world for his tremendous contribution to the field, and John Davis, a former Assistant Secretary of Agriculture. They coined the term *agribusiness* to describe the flow of goods from the farm all the way to the consumer. In 1958, they published a book called *A Concept of* Agribusiness which became the seminal work in the field. Professor Goldberg went on to write hundreds of cases on agribusiness firms and to teach thousands of executives, and he is still writing and teaching. Ray was also one of the founders of IAMA.

Goldberg and Davis used a "commodity system approach" to look at the supply chain and that is something that we still use today. It is a very important way to think about where value is created within the chain, where value is captured across the chain and how the individual players in that chain react to each other. In today's complicated environment, the framework takes into account government policies, resource constraints, consumer demand factors and a lot of different issues. It is still very powerful.

***Let's jump ahead to today and talk about what is happening related to that. One of the things is the increasing demand for food around the world which is in part responsible for the prices that we have today. On the other side is the productivity of agriculture. In the work that you have done, in the case studies you put together, how does that worked out?***

Shelman: It's a very interesting time. My father was a farmer equipment dealer and also a farmer, so I have been involved in agriculture all my life. What we are seeing reminds me of the 1970s when there was a big run up in agricultural prices built on demand coming out of the Soviet Union. Producers, spurred on by aggressive lenders, bought more land and equipment—all high priced. Then the embargo was put in place and commodity prices collapsed. Many farmers went out of business and many rural communities were destroyed. So one of the questions that we ask today is whether the current run up in prices will mirror what happened in the 1970s. Is this a bubble that will come apart, or is there a fundamental change? Looking around the world, I see a number of factors that are driving up prices in the short term: biofuels, weather shocks, high oil prices, speculation. However, in the long term demand itself is permanently moving up, spurred by rising populations and incomes in the Asian countries, as well as in Brazil and other emerging economies. More people will be eating protein-based diets that are less efficient in terms of the resources required to produce a calorie for human consumption. And if you look at the other side of that equation—supply—we are beginning to see a gap. Historically, the majority of investments in ag research were directed towards improvements in productivity. Today, there is a greater emphasis on "luxury" aspects: resource efficiency, environmental factors, efficient water use, functional foods and other value-added attributes. Increases in basic yields are not keeping up with increases in demand. In the long term, the way I see it, prices will never go back to the level of two-dollar [per bushel] corn.

***What about the impact of the technology? So what you are saying is that the technology is there but it is not keeping up. Where are we headed in terms of the impact of the technology?***

Shelman: Technology is such an important part of the equation. Historically, advances in agricultural technology came from the public sector: active plant breeding programs at land grant universities, international research programs such as those under the CGIAR. Today, most investment in research is in the private sector. And for the private sector to invest, mechanisms must exist that allow companies to capture a portion of the value of their technology. For some technologies, this is an easy thing to do. For example, if you look at the hybrid corn system, it's easy to measure the extra value from higher yields and farmers have to buy new seed every year in order to get that advantage. But for other technologies, such as those associated with using less water or less nitrogen fertilizer, or animals with lower emissions or other attributes that are better for the environment, it's harder for the companies to understand how they might capture that value. Normally you would say that would be a public good, and that public research programs should be working on this. But yet, the funds going into that sector are being pulled back, not only here in the U.S. but all over the world.

***Another thing that we've talked a lot about in recent years is international markets. We're in a global market. I think we can accept that there's an increase in demand at the local level, the farmer's market products. Where is that going to wash out?***

Shelman: Global or local is a very interesting issue. For 20 years or more we've talked about free trade, we've talked about opening markets; we've talked about how tariffs should come down. Yet given the recent run-up in prices and concerns about basic food availability, I see the world moving into a period where governments are going to become more focused on food security. We are seeing a growing number of consumers saying we like our food grown close to home. And now, on a broader basis, nations might be saying we like our food grown a little closer to home. So we have new tariff barriers that won't go away when prices moderate. Just as the United States has found that relying on foreign oil is risky, countries don't want to be in the same situation in terms of food security. Many countries are questioning their policies, especially if they rely heavily on imports. I see more barriers come back into being, even though many have fought long and hard to get them to come down.

 