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IFAMA Business Office • 1511 Texas Ave. S. PMB 203 • College Station, TX 77840-3328, USA
Tel: 1-979-845-2118 • Fax: 1-979-862-1487 • E-mail: ifamr@ifama.org • Web: http://www.ifama.org

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EDITOR'S NOTE

Dear Readers,

Welcome to the first issue of the IFAMR for 2013. I would like to draw your attention to our focus on teaching cases—we have three. First, *ANZCO Foods Limited: Pursuing the Chinese Market* was written by Nicola Shadbolt and her team at Massey University, New Zealand. This case was developed exclusively for the 2012 International Student Case Competition which occurred during the IFAMA conference in Shanghai, China. Those attending the competition saw the richness and high value of this case for use when attempting to develop a market-entry strategy. The case is significant because it was a project initiated by Professor Daniel Conforte who passed away in early 2012, then finished by the Massey team with the help of experienced IFAMR case writers. Secondly, Dr. Greg Baker and his colleagues at GB Pant University in Northern India have written, *Supply Chain Re-engineering in the Fresh Produce Industry: A Case Study of Adani Agrifresh*. This case study helps students explore supply chain management within a developing country. Cold chain management and the role of small holders in modern supply chains remain not only an important research topic but an issue with practical implications for managers. Finally, Dr. Blessing Maumbe and Dr. Cheryl Brown present, *Entrepreneurial and Buyer-Driven Local Wine Supply Chains: Case Study of Acres of Land Winery in Kentucky,* a case study on the development of the wine industry in Kentucky, USA. This is very interesting because it highlights for students the complexities of a firm radically changing its strategic architecture, and then poses the questions of if, and how, a firm might accomplish such a task.

The IFAMR has 48 case studies available for use in the classroom. You can find them by visiting our website under the Publication section for the IFAMR Journal, and selecting the Case Study Articles or by clicking this link. These cases are open access and freely available for your students. Faculty and professional members may request the Teaching Notes by directly emailing the IFAMA or IFAMR Business Office. Included in our case study bank is also a fine article, *Case Writing: An Art and a Science*, written by Kenneth Harling and Emily Misser.

Enjoy the issue.

Peter Goldsmith, Executive Editor, IFAMR

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Socioeconomic and Environmental Impact of Development Interventions: Rice Production at the Gallito Ciego Reservoir in Peru

Holcer Chavez[Φa], Denis Nadolnyak[b], and Miguel Saravia[c]

[a] *MS. Graduate, Department of Agricultural Economics and Rural Sociology, Auburn University, 301-b Comer Hall, Auburn, Alabama, 36849, USA*

[b] *Assistant Professor, Department of Agricultural Economics and Rural Sociology, Auburn University, 209 Comer Hall, Auburn, Alabama, 36849, USA*

[c] *Executive Director, Consortium for Sustainable Development of the Andean Region, (CONDESAN). Andes Basin Leader, Consultative Group on International Agricultural Research (CGIAR) - Challenge Program on Water and Food (CPWF).Calle Mayorazgo 217, San Borja, Lima, Peru*

Abstract

Apart from direct economic impacts, development projects have complex social and environmental impacts among which sustainability plays a major role. The Gallito Ciego reservoir was built to increase and improve agricultural production at the Jequetepeque valley in Peru. Cost-benefit analysis of rice production from 1992 to 2007 is used to measure the immediate economic impact of the project. Also, a matrix of other relevant impact indicators is constructed to expose changes in the project's environment during its life cycle. The main conclusion is that, even though there is a significant positive increase in income from agricultural production, the social and environmental impacts are not necessarily positive.

Keywords: cost-benefit analysis, dams, development, Jequetepeque, rice.

Φ Corresponding author: Tel: + 1 925 3232949
Email: H. Chavez: hzc0017@auburn.edu
D. Nadolnyak: nadolda@auburn.edu
M. Saravia: miguel.saravia@condesan.org

Introduction

Degradation of the environment and natural resources is not only caused by weak economic development, but it can also be generated by excessive economic development. For example, projects like dams and roads require the relocation of population, affecting economic activities and also creating stress to animals and plants around the zone. Furthermore, increasing population pressure and industrialization generates serious problems related to water, soil and other natural resources. These problems cannot be separated from the intervention and have to be taken into account in the development plan as economic development, social wellness, and environmental quality should be the pillars of development projects. A sustainability analysis must be incorporated to ensure social acceptability and maintain the original quality of the previous natural system (Barzev 2002). There must be a balance between these three components.

The Andes Basin Focal Project is an initiative to study the Andes system of river basins. The research done under this project tries to improve the knowledge and methods to grow more food with less water in an environmentally and socially acceptable way. Three big river basins are included in this system: Fuquene in Colombia, Ambato in Ecuador, and Jequetepeque in Peru.

In 1988, the national development institute of Peru (INADE is its acronym in Spanish) built the Gallito Ciego reservoir as part of the "Proyecto Especial Jequetepeque-Zaña (PEJEZA)". Its objective was to allow a better storage and regulation of the Jequetepeque River's water, thus increasing and improving the agricultural area at the Jequetepeque and Zaña valleys.

Agriculture is the main economic activity in the zone, but before the reservoir, it was characterized by high dependence on subsoil water availability and local rainfall patterns. This lack of dependable water sources resulted in unstable yields, which affected farm incomes and investment in the area. The most important crop in the basin is Oryza sativa (rice) representing 70 percent of the total harvested area (MINAG 2007). While rice production benefited from Jequetepeque's soil characteristics, it remained constrained by water availability. It is important to mention that rice production in the Jequetepeque basin represents one third of all Peruvian rice production and is the second one in terms of productivity (MINAG 2009a).

A study to measure the impact of the dam on the agricultural sector of the economy would be very useful for this area. This study focuses on the impact on rice production and on the broader impacts on the society and environment. According to the Peruvian department of agriculture (MINAG for its acronym in Spanish), Peru's annual rice consumption of 54 kg per capita is the highest among all Latin-American countries (MINAG 2009a). Peru is also a net rice importer.

The purpose of this paper is to evaluate the increase in rice production and productivity in response to increased availability of irrigation as a result of dam construction using a cost-benefit analysis, and to evaluate the evolution of the Gallito Ciego reservoir project's environment in terms of changes in five important variables/indicators at the zone. Two scenarios are analyzed: "Without the project" and "With the project".

Literature on Review

At the time this study was conducted, there was a lack of published studies addressing the impacts of the Gallito Ciego project in the Jequetepeque watershed. However, there are some independent unpublished studies and government reports on the watershed evolution after the project's completion the findings from which are used in this study. Here, we also review studies on the impact of other dam construction for comparison purposes.

A study by Martinez (1989) explored the possible negative impacts that the dam would generate in the near future. It is mostly focused on the relocation of families that lived near the dam and how there was going to be a crop switch process which could generate some traditional/cultural losses.

Two working papers by the Danish Institute for International Studies (DIIS) were published for the Jequetepeque watershed zone. For the first one, the objective was to identify key stakeholders in the management of the Jequetepeque watershed and analyze the different interests and issues which contribute to conflict and cooperation among them. The author examined the institutions establishing access to irrigation water and argues that a payment for environmental services must be considered (Raben 2007). For the second paper, a poverty profile for the upper part of the basin was developed. In it, they showed the relationship between water irrigation access and poverty levels (Gomez et al. 2007).

Wittwer explored two relevant projects about dams. In the first one, the author referred to the possible welfare impacts that the construction of the Traveston dam would generate in the Queensland area (Wittwer 2009). It was estimated that project would raise the present modest yield of existing catchment in Southeast Queensland by at least 70 giga-liters. The study also stated that the improvement in cost competitiveness of industries due to water supply would attract additional labor and capital to the region. The welfare impacts calculated using cost-benefit analysis, conditional on future rainfall patterns and water requirements over time, are estimated to be US$ 3.4 billion at a real discount rate of 5 percent. For the second one, the impact of irrigation water buyback in the Murray-Darling basin is addressed (Dixon et al. 2012). The results suggested that rather than a reduction, based on the increase in price of water, there would be an increase in the economic activity in the basin. The buyback policy would not be as hard on the environment as farmers would switch to less water demanding crops.

In 2009, a study assessing the progress of Public Financing Institutions (PFIs) in recent years was published. It focused on the application of environmental impact assessment mitigation and monitoring the large dam projects financed by those institutions. The key finding of this research is that multilateral PFIs have a better record regarding environmental safeguards in the dams they finance than bilateral PFIs (Caspary 2009).

Gunatilake and Gopalakrishnan (1999) stated that the benefits of water resource projects often fall short of original expectations because of sedimentation of the reservoirs. Their study estimated the cost of sedimentation in Mahaweli reservoirs including the impact on hydropower production, irrigation water supply, water purification, and loss of fisheries yields. The present cost of sedimentation is estimated to be US$ 26,406,620. They also argued that the benefits of

prevention of reservoir sedimentation are inadequate to compensate for the costs involved. Using soil erosion control measures at farm level offers a better solution for reservoir sedimentation compared with de-silting.

Duflo and Pande (2007) studied the productivity and distributional effects of large irrigation dams in India. They found that, in districts located downstream from a dam, agricultural production increased and vulnerability to rainfall shocks declined. Food grain production in India nearly quadrupled in the last 60 years and the study attributed nearly 50 percent of this increase to the dam construction.

Study Area

The Jequetepeque basin is located on the north coastal side of Peru, between the parallels 7°6' and 7°30' south latitude; and the meridians 78°30' and 79°40' west longitude (Figure 1). It covers 4,372.5 km^2 located in two states: La Libertad (north area) and Cajamarca (west area).

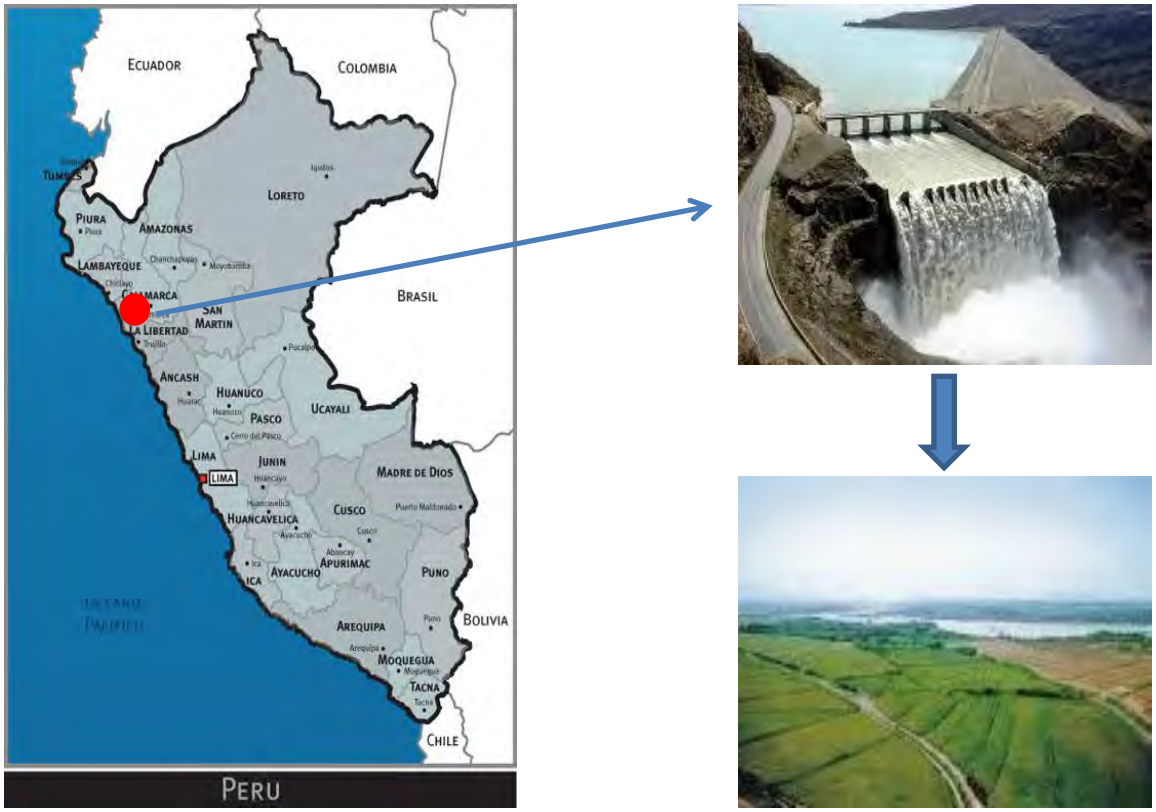

Figure1. Jequetepeque location (CONDESAN 2009)

According to national 1993 census, Jequetepeque basin population was 261,499: Half of them lived in rural areas and the other half in urban areas but 47 percent of the population worked in agriculture. Basically, the basin is divided in three sectors: low lands (valley), mid lands, and upper lands.

The upper part of the basin's annual rainfall is about 1000 mm. This part of the basin has stable precipitation which is relatively heavier between October and May. Meanwhile, the adjacent valley area receives almost no precipitation, except for El Niño summers. This low precipitation in the coastal area is due to the sea water temperature, whereas the weather in the upper part of the basin is influenced by the Amazon basin and the humidity coming from the Pacific.

The average annual discharge from the Jequetepeque River is around 816 millions of cubic meters (MCM) (CONDESAN 2009). As this discharge has relatively low volatility (between 777 and 825 MMC in the last 30 years), the hydrological regime of the Jequetepeque River can be considered stable (CONDESAN 2009).

The Gallito Ciego reservoir is located in the Yonan district, Contumaza province in the state of Cajamarca. Its average altitude is 350 meters above sea level. It is located in the low path of the Jequetepeque River, between the mid lands and the valley, forming a "cup" 12 km in length and 1.5 km in width. It is the second largest dam in Peru with a usable volume estimated at 400.4 MCM. The operation of Gallito Ciego has allowed the increase of water availability reducing by 75 percent the run-off of water into the ocean.

Within the valley sector, land use is divided in urban areas and poultry farms, farmland (agriculture), forest plantation, and land with no use. Rice is the primary seasonal (perennial) crop of the valley representing 70 percent of all the harvested land. Table 1 shows the use of the land.

Table1. Actual use of the land (valley)

Land use	**Area (ha.)**	**%**
Urban areas & poultry farms	1,353.59	1.91
Vegetables	50.82	0.07
Perennial crops	35,714.36	50.49
All year round crops	1,986.84	2.81
Forest plantations	552.75	0.78
Unused lands	31,081.13	43.94
Total	70,739.51	100.00

Source: CONDESAN (2009).

Except for rice, all other agricultural products are imported from other parts of the country or overseas. Jequetepeque's rice production also supplies Lima and some national markets in the north – Cajamarca, Trujillo, Chimbote and Chiclayo.

Annual irrigation water requirements at the low lands (in millions of cubic meters) are shown in Table 2.

Table2. Annual water irrigation requirement in millions of cubic meters (MCM)

Description	Supply	Demand	Surplus
Main season	640.68	602.59	38.1
Complementary season	78.73	7.89	70.83
Total	719.41	610.48	108.93

Source: Compiled by author from CONDESAN (2009)

Agricultural production at the area has substantially benefited from the dam construction. The irrigation supplied by the dam project has increased production by 50 percent.[1] The area within the reach of the irrigation project at the low lands covers 42,836 hectares, from which only around 36,000 (ha) are currently being used (CONDESAN 2009).

Methodology and Data Description

Measuring the aggregate impact of a project is a challenging task. The most straightforward approach is to measure the impact on each specific affected sector separately (i.e., economic (e.g., income), social (e.g., income distribution), and environment), and then add them together to obtain the total effect. This study focuses on the income impact from increased rice production. For this, two scenarios were compared: with and without the project.

Net present value (NPV) of net cash flow (NCF) is an effective tool to conduct cost-benefit analysis of a project whose returns and outlays are spread over time. The NCF is the difference between the gross income and the cost of production. The NPV is calculated as a sum of the annual discounted NCF. The purpose of discounting is to incorporate the time value of money into the analysis using a discount rate appropriate for the riskiness of a project, opportunity cost of funds, and time preference. Technically, the present value (PV) of future cash flow (I) is discounted by dividing it by the discount rate (r) to the power of the number of time periods (t) from present. That is:

$$(1)\quad \mathrm{PV}[I] = I/(1+r)^{t}$$

The NPV analysis was used for the first part of the study, which focuses on rice producers' monetary welfare through comparison between the scenario with and the scenario without the project. Rice was selected because it is the most important crop in the area and also because the main goal of the irrigation project was to increase the rice planting area and productivity in the zone. Income and production cost (income statement) dataset for this crop from 1992 to 2007 was assembled using cost data collected from the Gallito Ciego Reservoir Camp (PEJEZA 2009) and income data collected from the MINAG (2009b) website and the MINAG Trujillo (MINAG 2009c) regional website[2]. The income statements were built using annual average production cost for a typical producer in the area (mid-high technology producer) and aggregate level

[1] According to PEJEZA website. www.pejeza.gob.pe

[2] Even though the project started on 1988, data prior to 1992 were not considered reliable as the Peruvian currency suffered severe devaluation caused by inflation problems. A change in currency denomination occurred in 1991, passing from "Inti" to "Nuevo Sol".

income data[3]. The production costs are standardized and include the following items: seed, fertilizer, agrochemicals, transportation, mechanization, labor, draft animal power, threshing processes, financing, indirect costs, and water usage. The income data include: prices, yields, and area harvested (it is assumed that all production was sold). As the objective is to calculate the cost-benefit for rice producers, capital costs of the dam were not included in the NPV because the dam construction was fully financed by the government[4]. Ideally, net benefits from the dam construction should be computed as the difference between the NPVs of gross benefits and the capital investment (construction costs) and subsequent maintenance costs. However, in this situation, it is hard to assign a monetary value to all the benefits and the costs of the project and those include social and environmental impacts, some of which may be long lived. The social impacts include the well-known impacts of higher income on health, education, and labor productivity. Higher farm incomes may also contribute to infrastructure development which has a multiplier effect on the local economy. The environmental impacts are multi-dimensional and include the impacts on soil quality and runoff which, in turn, affects eco-systems and so on. Thus, we do not attempt to perform a standard cost-benefit analysis due to the multi-dimensionality of the project impact. The analysis was made in U.S. dollars using the exchange rate for each year provided by the Central Bank of Peru.

For the "with project" scenario, the actual income statements are used. The production costs included a water expenditure item, which refers to water access/usage provided by the dam (a charge per cubic meter of water used). This value was established at the beginning of the project by the government and includes the investment, operation, and maintenance cost of the dam.

For the "without project" scenario, the NPV is calculated under several assumptions:

- As it used to be before the project, only half of the hectares are used in production
- An average yield obtained over the last five years before the project is used also assuming an annual increase in productivity of 1 percent. The rice price per kilogram each year is the actual market price reported for the given year.
- No other major changes have occurred in the area so that the costs incurred are the same used for the real scenario but only without the entire water cost component.

For the NPV calculation under both scenarios, a discount rate of 4 percent was used. As the discount rate is reflecting the opportunity cost of capital and the riskiness of a project, and the actual interest paid on financing it, this value was chosen to correspond to the interest rate of the Central Reserve Bank of Peru to reflect the time value of savings deposited by the producers at the bank and also the allegedly low rate of time preference by rural investors (Belli et al. 1998; Raboin and Posner 2012).[5] Also, an income tax of 30 percent was applied as it is required for every business in Peru. For both situations, a cost-effectiveness analysis was performed.

[3]Aggregate level income data: in farm paid prices, area harvested, and yields per year for each rice producing province at the Jequetepeque area.

[4] The total cost of the dam was 164 millions of U.S. dollars.

[5] An alternative of imputing a high discount rate (10-30 percent) used in microfinance literature is based on microfinance interest rates (individual farmer lending). Considering the nature, financing, and beneficiaries of the project in question, those high rates are not used in the discounting calculations.

In addition, the Impact Monitoring and Assessment (IMA) tool proposed by the Centre for Development and Environment (CDE) and the German Technical Cooperation (GTZ) (Herweg and Steiner 2002) was used. The IMA is as an instrument of quality control throughout the project's life cycle in order to better adapt project activities to a changing context. In here, a radar (also called "spider" or "amoeba") graph allows the visualization and comparison of relevant indicators in different timeframes. In addition to the "with project" and "without project" scenarios, an *expected* output scenario predicted at the beginning of the project is included to measure the accuracy of the real outcome. A relevant characteristic of this tool is that it has to include indicators reflecting the three components for a project to be sustainable: Economic, Ecological, and Social (Dumanski, Steiner, and Herweg 2000; Herweg and Steiner 2002).

The indicators chosen are as follows: rice yield, water availability (expected dam life), water irrigation efficiency in rice production, population annual growth rate in la Libertad state, and quantity of soils with salinity issues.

With available information from the project background and simple agronomic knowledge, the scales of indicators were built and are shown on Table 3.The scale range is from 5 (very good) to 1 (very poor). In here, the expected output is scaled to back to reflect the specifics of the Andean region – the value of 4 is considered a good value as development projects look for the best balanced feasible outcome. For example, even though expected water irrigation efficiency in rice production of 75 percent (DEJEZA 1977) would be considered average (or 3) in similar projects, that was the feasible expected value at the end of this project and it will be considered a 4 (good).

Continuing with the assembly of Table 3, according to the FAO (2007) data, the average yield for rice in coastal zones is between 8,000 and 9,000 kg/ha. The latter value is used for the expected value for rice yield under the "with project" scenario. After accounting for predicted sedimentation, the usable expected capacity of the dam was set at 400 MCM (PEJEZA 1999). According to Sanchez (1999), the annual population growth rate expected at the valley after the project was 3.25 percent. According to the executive management of the project (DEJEZA for its acronym in Spanish) the expected value of rice irrigation efficiency after the project was 75 percent (DEJEZA 1997). Finally, because of the intensive usage of water and rice cultivation practices, the amount of soil with salinity problems was expected to increase. The expected value assigned by "Apoyo a la Política de Desarrollo de Selva Alta" (APODESA 1994) was a 3 percent increase in salinity – from 28.5 percent before the project (ONERN 1988) to 31.5 percent.

The data for the two scenarios rely on the measurements from previous studies. Most of them come from the public sector research. The base year is 1987 and become the "without project" scenario. For the "with project" scenario, the end of the first stage of the project (2006) or the nearest record available for each specific variable was used. The values are shown in the results' section.

Table 3. Scales of indicators

Indicators	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Water availability (MCM)	<150	150-249	250-349	350-450	>450
Rice yield (kg/ha)	<6,500	6,500-7,499	7,500-8,499	8,500-9,500	>9,500
Water irrigation efficiency (%)	<50	50-59	60-69	70-80	>80
Population Growth rate (%)	<2.0	2.0-2.4	2.5-2.9	3.0-3.5	>3.5
Soils with salinity (%)	>38	36-38	33-35	30-32	<30

Source: compiled by author – DEJEZA, FAO, PEJEZA, Sanchez, APODESA, ONERN.

Results

The NPVs for the two scenarios are very different. The "without project" (baseline) scenario would generate negative returns (losses) of US$ 4,201,119. Under the alternative ("with project") scenario, the NPV was positive (US$ 69,500,051), which indicates that the rice producers benefited substantially from the project. Because of the negative value under the "no dam" scenario, cash flows per year are analyzed.

Table 4 shows the cash flows from rice production for each year. It can be seen that in the "without project" scenario some of the cash flows are positive and others negative. The year 2007 was an outlier for several reasons that are explained in the next paragraph. If the outlier year is taken out, the NPV of the cash flow becomes positive (US$ 4,224,409).

Table 4. Cash flows and cost-effectiveness of rice production under the two scenarios

Year	Without project	With project	Incremental flow	Cost effectiveness
1992	-738,065	-12,147,997	-11,409,933	-41.59%
1993	301,989	2,212,992	1,911,003	24.56%
1994	-7,443,835	-8,738,182	-1,294.35	24.13%
1995	-2,949,932	-2,656,615	293,317	-6.64%
1996	3,579,323	19,225,928	15,646,604	83.03%
1997	2,332,790	11,081,596	8,748,806	41.35%
1998	7,666,447	14,543,989	6,877,542	83.53%
1999	-1,235,183	5,021,336	6,256,519	19.64%
2000	391,468	9,762,284	9,370,816	50.76%
2001	731,822	15,062,435	14,330,613	70.72%
2002	-2,126,824	3,659,952	5,786,776	15.83%
2003	-1,955,486	5,481,835	7,437,322	24.20%
2004	8,176,257	38,475,429	30,299,172	187.03%
2005	1,602,554	11,624,926	10,022,372	52.25%
2006	-143,596	8,436,723	8,580,319	31.79%
2007	-15,173,901	-18,957,686	-3,783,785	-20.57%

Incremental cash flows per year are all positive except for 1992, 1994, and 2007. Through a personal conversation with the CEO of the MINAG office in Trujillo, Segundo Vergara, the losses in 1992 are explained by a shortage of water supply from the Jequetepeque River. For that year, the annual water mass from this river was only 338 MCM generating suboptimal outputs. In 1994, the price of rice went down from 0.45 to 0.32 soles (0.23 to 0.15 US$) per kilogram affecting the revenues. The big loss in 2007 is explained by a considerable increase in gasoline prices. This increased production expenses from US$ 37 million in 2006 to US$ 92 million in 2007, whereas production did not increase proportionally (276 and 236 million of ton respectively). Also in Table 4, a cost-effectiveness measure was obtained as a ratio of the profits and total costs. It was on average 40 percent.

Table 5 shows the most important indicators in the area served by the dam under the two scenarios, also listing the expected values. A measure of water availability (dam life) is important because it reflects the years the farmers will benefit from the project. A bathymetry study at the dam in 1999 showed that the volume of total estimated sedimentation was around 65 MCM, with the annual average of 3.4 MCM. This reduced the useful life of the dam to 33 years instead of the expected 50 (Cobeñas 2007). The rice yield indicator allows quantification of the real gains in agricultural output. According to MINAG (2007), the rice yield for the zone before the project was 5,975 Kg/ha but almost doubled to 10,108 Kg/ha in 2005. Irrigation efficiency in rice production in the area was measured using three efficiency components: delivery, distribution, and application. Delivery rates are correlated with water recuperation rates and altitude. Distribution refers to the deficiencies of a particular irrigation canals and its extension.

Table 5. Project Values

Variable	Without Project	Expected	With Project
Water availability	0	**400**	335
Rice yield	5,945	**9,000**	10,108
Irrigation efficiency	40%	**75%**	73%
Population Growth rate	2.10%	**3.25%**	1.70%
Soil Salinity	28.5%	**31.5%**	34%

Source. compiled by author – Cobeñas, MINAG, DEJEZA, CES, Sanchez, INEI, ONERN, PEJEZA.

Application relies on climate data, information on the crops in each sector (using FAO's CROPWAT program), and the requirements for their vegetative stage (CES 1997). A study about economic and technical feasibility by DEJEZA (1977) showed that the total irrigation efficiency before the project through rural irrigation canals was around only 40 percent. There were no very recent studies about the water efficiency so research findings from CES (1997) were the best proxy. According to those results, water use efficiency increased to 73 percent. Big projects like dams may have mixed impacts on population. Dams can increase population density around the area because of the perceived economic growth but can also decrease it because of the relocation of people who lived in the path of the dam. The study made by Sanchez (1999) under the supervision of INADE established that the population growth rate in the valley during 1981-1993 was 2.1 percent which is the rate also given by the Peruvian National Institute of statistics (INEI) for the whole state of La Libertad. The INEI also stated that the actual growth rate for the

state from 1993-2007 was 1.7 percent (INEI 2007). Salinity problems are very common in in rice production as it is very water intensive. This is a big issue as high salinity can decrease productivity and soil quality. The national office for natural resources evaluation (ONERN) determined that the area covered by soils with salinity problems at the beginning of the project was around 28.5 percent. The value at the end of the first stage of the project taken from the document provided by PEJEZA (2005) is 34 percent. A radar graph described in the previous section and constructed using these values is shown in Figure 2 for better exposition. The farthest away from the center represents a better outcome.

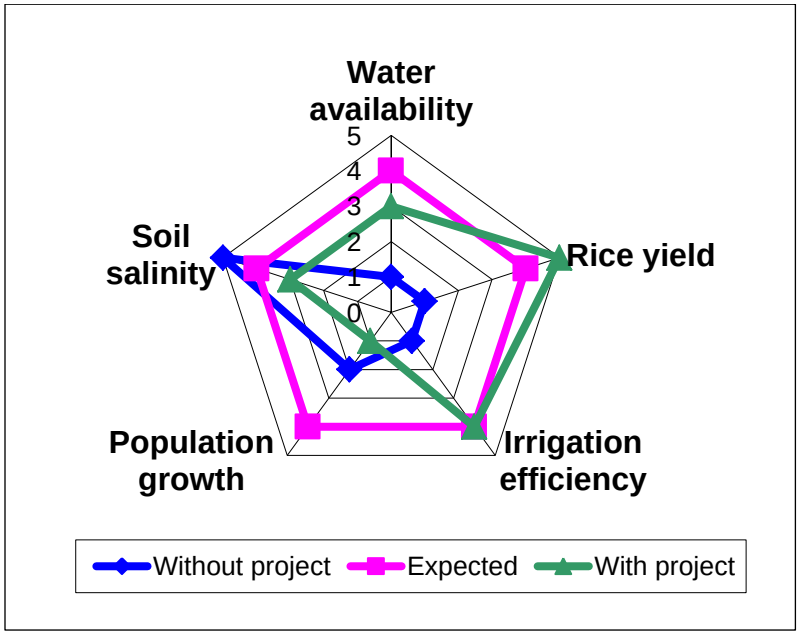

Figure 2. Radar Graph

The comparison of the historical data, predicted outcomes, and real outcomes at the end of the first stage of the project shows that the number of years of water availability from the dam was smaller than estimated due to extra sedimentation. At the same time, the estimation of the gains in irrigation efficiency at the beginning of the project was accurate. With respect to agricultural outputs, the estimates matched the actual rice yields. The population growth rate was overestimated, whereas the increase in salinity was underestimated. According to the numbers, the no dam scenario looks significantly worse than the alternative.

Discussion

Despite the coverage areas being different, this study's NPV of US$ 69,500,051 obtained can be related to US$ 3.4 billion estimated by Wittwer (2009) because they are both positive. Nevertheless, project's coverage was different and, in the case of Queensland, all the possible impacts were estimated, including electricity generation and job generation (income distribution). This study, on the other hand, only included the agricultural sector focusing on a single crop—rice—because the main objective of Gallito Ciego was to increase the agricultural production in the zone. We have confidence in our results because of the small area covered by

the project. Another difference is that the project in Queensland was determined to generate higher rates of migration to the development zone because it has a smaller population density and because the area is significantly bigger than the one in northern Peru.

According to PEJEZA, the powerful effects of the 1997 El Niño were mostly responsible for Gallito Ciego increased volume of sedimentation. Putting some numbers on it, the annual average amount of solids moved by the Jequetepeque River during the period of 1943–1998 was 2.9 MMC instead of the 1.7 MMC estimated before implementation of the project. For the period of 1968–1998, this amount is determined in 3.4 MMC which is the reason why the useful life of the dam is reduced to 33 years instead of the original 50 years. If the global warming trend continues, leading to increased frequency of El Nino and La Nina cycles, heavier precipitation should be expected in the region, which would increase sedimentation and lower the estimated future benefits of the project, unless further investments are made to remove sediments from the dam.

Regarding the annual population growth rate for the state of La Libertad, the expected value of 3.25 percent was very upward biased (compared to the real outcome of 1.7 percent). The average population growth rate for that period in Peru was 1.6 percent, being 2 percent for the state of Lima (the capital state) and 3.5 percent the state of Madre de Dios (the highest value and definitely an outlier). The values for the most important provinces in the valley belonging to the state of La Libertad, Chepen and Pacasmayo, were only 1.3 percent and 1.5 percent respectively. The average value for the state of La Libertad was improved by the province of Viru (located in the south of the state) whose growth rate was 5.1 percent. Viru is included in other bigger irrigation project called "Chavimochic".A possible explanation for not reaching the expected population growth rate can be that the time period considered is too short. However, this does not explain the reduction in the rate reinforcing the idea that a big development project might increase the population growth ratio at the location but other factors like culture, government policies, and the economic performance of the whole country should be taken into account.

In general, dams tend to have a negative impact on the broader environment even when they produce specific benefits, such as improved agricultural production. Increasing water availability for artificially low prices can exacerbate the environmental problems by increasing production in ways that accelerate soil erosion, which would eventually lead to long-term losses in productivity. This study showed a 6 percent increase in the quantity of soils with salinity problems at the area. In 1999, Sanchez showed that 30 percent of the area at the Jequetepeque basin had high intensity and 36 percent of it had moderate intensity erosion. Hansen and Hellerstein (2007), using the replacement cost method, showed that among 2,111 watersheds in the U.S., a one-ton reduction in soil erosion provides benefits ranging from zero to US$ 1.38. They also did a comparison between lower and higher soil erosion levels (1997 and 1982 respectively) and showed that the lower level erosion conserved US$ 154 million in reservoir benefits. Gunatilake and Gopalakrishnan (1999) used a cost-benefit analysis to estimate the cost of reservoir sedimentation in Mahaweli reservoirs. They estimated the sedimentation cost present value to be of US$ 26,406,620. A model like the one used by Dixon et al. (2012) might be applicable to mitigate the negative externalities on soils as it shows that an increase in irrigation water prices leads to farmers switching to less water demanding crops without compromising agricultural outputs.

Conclusions and Recommendations

This paper examines the impact of the construction of Gallito Ciego reservoir using two tools: a cost benefit analysis for the rice producing agricultural sector and a spider graph showing the changes in the project's environment after the implementation. It was found that the NPV of the benefits to the rice producers after construction of the dam was US$ 69,500,051 compared to a hypothetical scenario of no project (no dam construction) with the NPV of US$ -4,201,119. The cost-effectiveness ratio of the project was around 40 percent. At the same time, the dam project led to a 6 percent increase in soil salinity in the area, which is almost double of the expected increase, and the population growth rate in the zone covered by the project (1.7 percent) was lower than expected.

The estimation of the NPV of the dam irrigation project for rice production in the Jequetepeque watershed suggests an aggregate positive impact. However, the study shows that estimations of the environmental and social impacts were too optimistic relative to the actual cost. This reinforces the idea that, in developing countries, environmental and social components are not getting the attention they deserve, leading to greater risks of falling into poverty traps through overexploitation, soil depletion, or social conflicts.

A replacement cost study might be explored in the future to measure the environmental impact of the dam, particularly the impact on soil quality. This technique uses the cost of returning the environmental component to its original condition as a way to express the environmental damage in monetary units.

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Seed Market Segmentation: How Do Argentine Farmers Buy Their Expendable Inputs?

Roberto Feeney[ⓘa] and Valeria Berardi[b]

[a] *Associate Professor, Center for Food and Agribusiness, Austral University, 1950 Paraguay Street, City of Rosario, Province of Santa Fe, Argentina*

[b] *Professor, Center for Food and Agribusiness, Austral University, 1950 Paraguay Street, City of Rosario, Province of Santa Fe, Argentina*

Abstract

In this paper we analyze the buying behavior of farmers for expendable inputs. In particular, we will study the case of the seed industry in Argentina. We segment them using cluster analysis, identifying four distinctive segments of farmers for seed purchasing: Performance, Price, Balance, and Convenience. This work intends to help agribusiness managers understand customers in the seed market in Argentina. Additionally, a multinomial logit model is used to predict segment membership for seed purchases based on farmers' observable and attitudinal variables.

Keywords: expendable inputs, seed industry, Cluster analysis, Multinomial logit.

ⓘCorresponding author: Tel: + 54.341.522.3000
Email: R. Feeney: rfeeney@austral.edu.ar
V. Berardi: valeriaberardi@hotmail.com

Introduction

Agricultural input markets for products such as seeds, crop protection, and fertilizer are important markets in Argentina. Although it varies greatly from year to year, expendable input purchases by Argentine producers can amount for several billion dollars a year. Among them, the seed market is significant due to its size as well as its importance as a key input for farmers. The total formal seed market for major crops in Argentina was about one billion dollars in the year 2010. Additionally, there is an informal market, in which seed companies do not make profits (Appendix 1. Vilella et al. 2009; FIS 2000; CREA 2010).

The existence of an informal seed market in Argentina is due to the fact that there are some crops, such as soybeans and wheat, which are self-pollinated. For these crops farmers do not always pay for the seed they use, as they can save some from their last harvest. Only a fraction of the seeds sold in the market provides revenues to the seed companies: the seed sold in the legal market plus a system of payment called "extended royalties". This would be the formal market; the rest of the seeds are sold in the informal market. For soybean the formal market was only 35 percent of the total market while for wheat it was around 50 percent in 2010, as we can observe in Annex I (USDA-FAS 2010; Goldsmith et al. 2003).

However, Argentine farmers are not a homogeneous group, nor buy seeds in the same way: They differ in terms of key dimensions such as farm size, educational background, age, location, land tenure, attitudes, risk management practices, technology adoption, and so forth. Grouping farmers by more homogeneous classes, in terms of segmenting farmers and defining their profiles are important issues for agricultural input companies in order to define their marketing strategies. In this paper we try to define how Argentine farmers buy their seeds for crops, segmenting these farmers in different classes with different purchasing profiles.

Marketing segmentation helps firms define particular marketing mix strategies that enable them to target customers with specific profiles and needs in each segment. This results from the fact that rarely customers in a particular market have exactly the same needs and expectations. By segmenting their customers companies can get closer to each customer by developing an appropriate marketing mix (Kotler1997).

Conceptually market segmentation can be defined as the process of subdividing the market into distinctive subsets of relevant customers that behave in the same way or have similar needs. Segmentation divides the heterogeneous market into relatively homogeneous groups in order to design a suitable marketing mix. The final goal of market segmentation is to find customers with different purchasing power and buying behavior, addressing the different needs of customers, and increasing the profit potential for the firm (Foedermayr and Diamantopulos 2008).

There are different stages in the market segmentation process, among which market definition, variable selection, and method decision are the most relevant from a normative perspective: How market segmentation ought to be conducted? The market definition is the first and one of the most crucial steps for its success. It should be defined integrating several dimensions, such as customer needs, competition, products and technologies (Danneels 1996).

Segmentation variables are the sets of characteristics that are used to assign customers to segments and indicate why segments differ. These variables can be classified into general or product specific, and also as observable or inferred. The general variables are independent of the product, while the product relates specifically to products and customers. Observable variables can be measured directly, as with demographic, economic or geographic variables. Inferred variables, on the contrary, are not directly observed, as the case of psychographics, perceptions, values and attitudes (Steenkamp and TerHofstede 2002).

Previous work has been done to segment farmers buying agricultural inputs, especially for the US (Hooper 1994; Bernhardt et al. 1996; Gloy and Akridge 1999; Foley 2003; Alexander et al. 2005; Reimer et al. 2009).

Gloy and Akridge (1999) identified four market segments for commercial farmers (producers with sales above 100,000U$ a year) in the US: Balance, Convenience, Performance and Price. Balance farmers weighed the various purchasing factors evenly when selecting an input supplier. They found that the Balance farmers were the largest segment and the most sophisticated users of technologies such as computers and Internet. When making purchasing decisions of agricultural inputs, they were the most reliant on off-farm sources of information such as local dealers and local sales representatives. Balance-oriented farmers showed the least agreement with the statement that generic products represent a good trade-off between price and quality, and were also heavy users of custom application services.

On the other hand, the Convenience segment was the smallest, and placed a great deal of importance on convenience and location factors when selecting an inputs supplier. They tended to be the older farmers and were the most likely to not own computers. However, when they used computers for purposes such as financial record keeping and communicating, they did so at a low rate. They preferred to buy products from one supplier and were willing to pay more to buy from the locally owned providers. This segment tends to be the least reliant on off farm sources, except for local dealers on which they relied heavily. Regarding brands, Convenience members showed the least disagreement with the statement that there were no differences across brands.

Price buyers were the second largest segment and placed a great deal of weight on price factors when selecting an input supplier. They tended to be the largest farmers and most of them owned their computers. Regarding their off farm sources of information, the local dealer scored relatively low for these producers. They also tended to agree the most strongly that they planned to increase their usage of generic products in the future. Price buyers also were the most likely to agree that they always purchased the lowest priced expendable and capital goods. These farmers were the least likely to purchase from one input supplier.

Finally, the Performance-oriented farmers were those who focused on the performance of the products that they bought. In this segment were the most educated producers, in terms of years of college. These producers disagreed the most strongly that there were no differences across brands, as they believed that brands were not the same across products. They were unlikely to purchase only on the basis of price, and required technical competence from the sales representative.

Alexander et al. (2005) studied the purchasing behavior of US crop and livestock farmers with annual sales greater than 100,000 dollars. They used cluster analysis to identify five distinctive market segments for expendable inputs: These segments are Balance, Performance, Price, Convenience and Service. While Balance and Performance farmers can be categorized as business buyers, producers in the Price segment can be defined as economic buyers. Convenience and Service producers, on the other hand, can be considered as relational buyers. A business buyer is the person who purchases a good based less on cost and more on the productivity of the input. An economic buyer, in contrast, is the one that buys primary on price intending to reduce the input cost. A relational buyer would be someone that buys from the person he knows and trusts, and usually values services highly.

The Balance segment was the largest segment in Alexander et al. (2005), followed by Price, Service, Performance, and Convenience as the smallest. Convenience purchasers tended to be the oldest farmers, focused mainly on convenience/location purchasing factors. This segment contained the smallest operations in terms of gross sales, and had the least ambitious growth plans. On the other hand, the Service segment placed the most weight on service/information and personal factors when selecting an input supplier. The members of this segment operated the largest farms, in terms of gross sales, and had the lowest percentage of college graduates.

While the Price segment was the one with the least product loyalty, the Service segment was the most loyal. Regarding information sources, the Performance segment was the most information intensive, in terms of usage of computers and Internet, and producers in the Convenience segment were the least likely to own or use a computer. Balance and Performance buyers were the heaviest users of consultants and custom services, while Price purchasers had the lowest overall use of customer services and relatively low usage of consultants. Members of the Convenience segment were the least likely to use consultants.

These authors concluded that the Convenience segment was rapidly declining in the US. They also identified a second group of relational buyers, the Service segment, which was growing in size. The difference they found between Convenience and Service producers is that while for Convenience buyers their relationship with the salesperson had an intrinsic value, for the Service segment the relationship with the salesperson was valued due to the technical information and expertise offered.

A multinomial regression was also introduced by Alexander et al. (2005) to predict segment membership, concluding that the two variables providing the most predictive power were whether a producer had a college degree, and the number of consultants hired by the farmer: If a farmer would have a college degree he is 4 percent more likely to belong to the Price Segment, and 7 percent less likely to belong to the Service segment. And for each consultant hired the farmer is 3.5 percent more likely to be in the Balance segment, two percent less likely to be in the Price segment and 3 percent less likely to be in the Convenience segment.

The segmentation approach used in the present work is similar to Alexander et al. (2005). It is normatively oriented, intending to explain how segmentation should be conducted rather than how segmentation is actually performed in practice. It also employs a descriptive rather than predictive perspective, as it is aimed to establish relationships between purchasing variables and

different types of producers without distinguishing independent and dependent variables. As well as Alexander et al. (2005), the analytical tools used in this work are cluster analysis to identify purchasing behavior, and a multinomial regression to predict segment membership.
Accordingly, the problem we want to study is how Argentine farmers buy their seed inputs, and how to segment these producers in order to understand better their purchasing behavior for seeds. We will restrict the study to Argentine farmers in the geographic area of the 'Humid Pampa' (which is equivalent to the US Corn Belt) that produce more than 750 tons of soybeans a year.
In this way, the main goal of this paper is to identify distinctive market segments for Argentine farmers purchasing seeds. The idea is to segment farmers into buying characteristics according to their purchasing behavior, and to be able to predict farmers' segment membership. This will help us to answer questions regarding the factors that allow farmers to be segmented, which may signal the need for alternative marketing strategies.

Data

The data we used to segment the farmers' input markets is based on the survey "The Need of Argentine Farmers", done in the second half of the year 2009 by the Center for Food and Agribusiness of the Austral University in Argentina, with the partnership of Purdue University in the US. This survey was done between August 17th and September 17th 2009 by a team of qualified interviewers, through personal interviews to farm operators responsible for the farmers they manage. The questionnaire had 37 questions, and took around 60 minutes to answer. Only one question was open-ended, 29 were closed questions, and seven were semi-structured questions.

The population under study was farmers in the main agricultural area of Argentina ("Humid Pampa") which produce 750 or more annual tons in soybeans, in order to target producers with a minimum scale to be considered professional farmers. Surveyed producers were heads of farms (owned or leased properties) in which 70% of their income came from soybeans and the rest from other crops.

This area covers the provinces of Santa Fe, Córdoba and Buenos Aires. It includes the counties in which the sowing area represents more than 10% of the total production area. The total population includes 7,400 producers, who produce 70% of the total soybean in the main crop area of Argentina.

The sample formed by 502 farmers responsible of farms with owned or rented land was drawn from a database containing information on location and enterprise. The sample size was obtained by proportionally stratifying method to the amount of farms per province with a degree of statistical confidence of 95%.

Methodology

The two methodological tools we used in this work are cluster analysis and a multinomial logit model. Following Gloy and Akridge (1999) and Alexander et al. (2005), we used cluster analysis to segment the seed input markets. The goal of cluster analysis is to divide a data set into different groups or clusters, based on buyer characteristics and buyer behaviors, so that the

characteristics and behaviors of the individuals in a group/cluster are as similar as possible to each other and as dissimilar as possible to the observations in other groups/clusters.

According to Aldenderferet and Blashfield (1984) there are five basic steps that characterize all cluster analysis studies:

1. Selection of a sample to be clustered;
2. Definition of a set of variables on which to measure the entities in the sample;
3. Computation of the similarities among the entities;
4. Use of a cluster analysis method to create groups of similar entities;
5. Validation of the resulting cluster solution.

In a cluster-based segmentation we first have to select the sampled data, which in our case are the 502 Argentine farmers in the Humid Pampa region producing more than 750 tons of soybeans a year, as we explained in the previous section. Then, identify the key variables that ought to characterize the purchasing behavior of Argentine farmers for seeds. As in Alexander et al. (2005), the key question used in the segmentation analysis asked farmers to weigh the influence of six factors when purchasing their agricultural inputs. The influence of these factors had to sum up 100%.

The question was stated as follows: "*When you choose a supplier for the following categories of input products (seeds, crop protection, fertilizers, machinery, and financial services), how is your decision influenced by the following factors? Assign a percentage value to each value to each factor based on its importance in the decision.*"

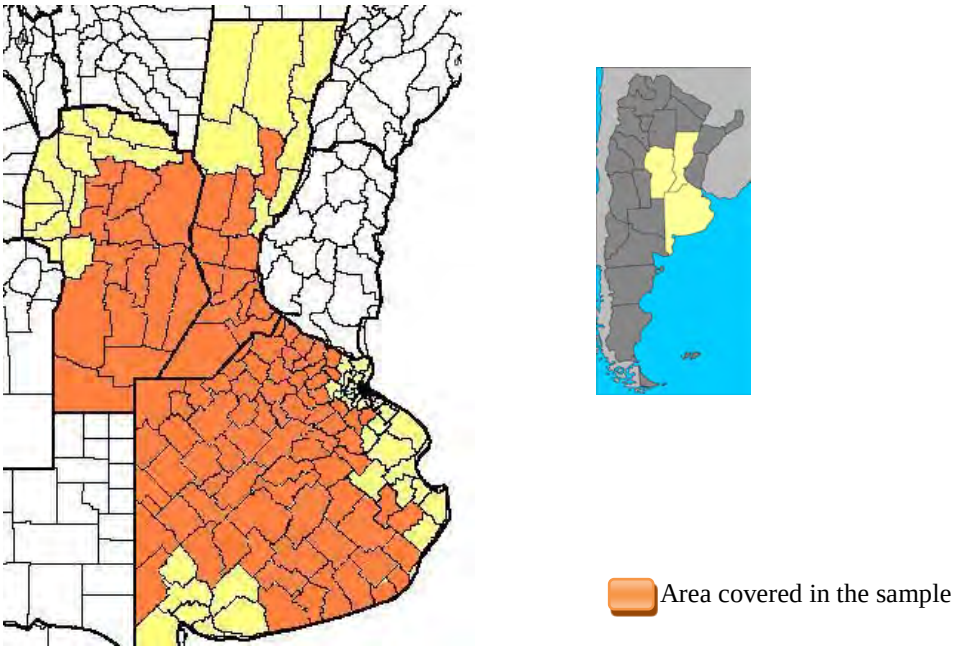

Figure 1. Area Covered in the Sample

The factors included were convenience/location, customer services/information (e.g., responsiveness, follow-up, advice), personal factors (e.g., trust, working relationships), price, product performance (e.g., yield, durability, rate of gain) and support services (e.g., delivery, repair, application).

Next, the data on these variables was processed in order to place respondents with similar answers in the same segment/group or cluster. The idea is that through cluster analysis we can group observations in such a way that there will be a higher level of natural association between group members than those that are not.

What follows is to define the cluster analysis method to be used. The two main cluster analysis methods to create groups of similar entities are the hierarchical and non-hierarchical (or partitioning) clustering methods.

Hierarchical clustering involves creating clusters that are hierarchically nested within clusters at earlier iterations, in that each cluster can be included as a member of a larger, more comprehensive cluster at a higher level of similarity. The most familiar expression of the results of hierarchical clustering methods is the tree diagram or 'dendrogram', which shows graphically the hierarchical structure entailed by the similarity matrix and clustered by the linkage rule. Among agglomerative hierarchical methods, we have the Ward Method. This procedure is designed to optimize the minimum variance within clusters, and it works by joining those groups or clusters that result in the minimum increase in the variance. (Aldenderfer and Blashfield 1984)

Non-hierarchical clustering, on the other hand, are methods that divide a data set into a number of clusters by trying to minimize some defined error function. Partitioning clustering methods do not depend on previously found clusters. These methods work directly upon the raw data, therefore offer the opportunity of handling distinctly larger data sets than hierarchical methods. As they make more than one pass through the data and can compensate for a poor initial partition of the data, thereby avoiding one of the major drawbacks of hierarchical agglomerative methods. Partitioning clustering methods, however, suffer from some drawbacks, as they posit explicit assumptions about the shape of the clusters; calls for an initial guess at the number of clusters that will eventually be found; and are influenced by the choice of initial seeds, the presence of outliers, and by the order in which the seeds are observed and analyzed. (Aldenderfer and Blashfield 1984)

As previous authors have done (Gloy and Akridge, 1999; Alexander et al., 2005), we will first used a Ward hierarchical clustering method to identify the number of clusters and to get the starting points (seed values) for a second non-hierarchical algorithm procedure, which is the k-means technique. This second algorithm rearranges the results optimally given the previous results about the cluster means.

To validate the number cluster we used three criteria: the pseudo F statistical value, the cubic clustering criterion (CCC) and the R^2 test. The Pseudo F-value is used to compare variability obtained with K and K+1 groups or clusters, evaluating the relative reduction of variability as we add new clusters. The higher the F value, the higher the variability reduction that is obtained as we add one additional cluster. The cubic clustering criterion (CCC), establishes a comparative

measure of the deviation of the segments regarding the expected distribution if the observations would have been obtained from a uniform distribution. A value above two would suggest that the structure of the clusters would be good; a value of zero to two would suggest not a very clear structure of a cluster. The negative values of the CCC criteria would be attributed to the presence of out-layers. Finally we have the R^2 test, as the proportion of variance explained by the observations belonging to the conglomerate, the higher its value the better the conglomerate.

Finally, we validated the segmentation through tests of significance differences between the groups' responses to non-clustering variables (Gloy and Akridge 1999). After clusters were identified, chi-square tests of no association were run on the non-clustering categorical variables to examine differences in segment characteristics and attitudes. Statistical significance of mean responses between the clusters for each continuous variable was calculated using an F-test.

Similar to Alexander et al. (2005) we used a 'multinomial logit model' to predict segment membership for seed purchases by Argentine farmers based on observable factors and business management attitudes. Each producer can only belong to one segment, and each buying behavior segment is distinct and unordered. The multinomial logit is a probability model that explains the odds ratio of belonging to a certain cluster if an observable behavior or characteristic of a farmer is present (Gujarati, 2003).

The cluster results were developed by using various routines in SAS 9.0 (SAS Institute, Inc. 1989). For example, the hierarchical clustering (Ward´s algorithm) was implemented with the CLUSTER procedure, and the k-means clustering algorithm was implemented with the FASTCLUS procedure. The chi-square test was calculated with the option "chisq" in the FREQ procedure and the F-test was implemented with the ANOVA procedure. To the multinomial logit analysis we used the MLOGIT procedure in Stata 10.0. (SPSS 10.0 Syntax Reference Guide, SPSS Inc. 1999).

In the next sections we will present the result of our cluster analysis. In the first section we present the segmentation of farmers in different clusters, as we shall see in Table 1. In the next part, we introduce the description of farmers in each of these segments by non-clustering variables, as described in Tables 2 to 6. Finally, in the last section, we present the logit multinomial regression used to predict segment membership, presented in Table 7.

Results

Based on the two steps clustering procedures, and using the validation criteria, we identified four natural clusters according to their seed buying behavior. Table 1 presents the means percentage and the names of each cluster based on the most influential factor in the supplier choice.

Characteristics of Segments

The Performance segment is the largest cluster, with 37 percent of the respondents. Members of this cluster search for high quality products and services. On average, the members of this segment placed 77 percent weight on product that perform well and only 11 percent on price.

Performance members weighted the other factors (convenience/location, service/information, personal factors, and support services) between 2 to 4 percent each. Table 1 shows that producers in this segment placed much more weight on performance than farmers in other segments; and less for price, personal factors, convenience/location and services and information. Thus, Performance farmers are not interested in working relationships when choosing suppliers; and related services and information were relatively unimportant for them. They were mainly focused on purchasing products that perform well, not caring too much about price nor services, information, convenience and location factors.

The Price and Balance segments were, respectively, 28 and 29 percent of the marketplace. Members of the Price segment placed emphasis on competitive price (48 percent) which would mean that these farmers are cost-oriented: they buy their seed at a lowest price. In spite of this, performance is the second most important factor with a weight of 34 percent, and these two factors account for 82 percent of the total weight of purchasing factors. Other factors (convenience/location, service/information, personal factors, and support services) were ranked low by these farmers, similar to the case of Performance producers. Price oriented farmers were those who were interested in buying their inputs at the lowest price for products that performed reasonably well.

In the Balance cluster, farmers valued all factors fairly equal but gave special importance to performance and price: 22% and 23%, respectively. Services and information, as well as personal factors were also important factors to this segment with 18% each. Farmers in the Balance segment ranked higher than producers in other segments 'service and information', 'personal factors', as well as 'support services'. Farmers in this segment were looking for input suppliers who would be able to supply a large array services and information, at a reasonable price, and with products that perform well.

Table 1. Seed Industry Segmentation: Mean Percent Importance of Each Purchasing Factor

Factors/Segments	**Performance**	**Price**	**Balance**	**Convenience**
Convenience/Location	2	4	8	60
Service/Information	4	5	18	8
Personal factors	2	5	18	5
Price	11	48	23	13
Performance	77	34	22	6
Support Services	4	5	10	7
Frequency	188	147	142	25
Percentage of the Sample	37	29	28	5

The smallest cluster is Convenience, with only 5 percent of the sample. Members of this segment placed a large emphasis, roughly 60 percent of their weight, on 'convenience and location', provided by a seed supplier. The rest of the factors had a lower weight: 13 percent for price,

eight percent for service and information, seven percent for support services, five percent for personal factors and only six percent to performance. These farmers were the only ones focused mainly on convenience and location, without much regard for 'performance' nor 'service/ information', 'personal factors' or 'support services'. Prices paid for their inputs were also relatively unimportant.

This gives us a general profile of farmers in each cluster. To help suppliers assess which segment represents the best target market, the segments were examined with respect to many of the factors that characterize the decision makers and their farm business and the product /service/information mix that they are likely to desire. In the next section we will analyze the demographics and general business characteristics, and the commercial attitudes of farmers in these groups.

Demographics and General Business Characteristics

The demographic and general characteristics considered were education, age, farm size, total sales and future growth. These characteristics are generally observable and assist marketers in building a demographic profile of the segments. The results show that the differences in education, age, farm size and future growth among the four segments were not statistically significant (Annex II). Minhas and Jacobs (1996) found that market segmentations based on customer characteristics are poor predictors of future buying behavior in the financial services market, so the behavior segmentation proved to have much better predictive power.

The producers sampled were relatively young with an average age of 46.5 years (with standard deviation of 11.6 years), and almost half of them had a college degree (46 percent). More than half of the producers had a farm size less than 600 hectares and the expected percent growth in size was 32.5 percent (with standard deviation of 112.7%).

Balance farmers were relatively large, and 46 percent of them earned more than half a million dollars. On the other hand, Convenience farmers were relatively small in terms of farm size. This segment contained 60 percent of their operations between 200 thousand and half a million dollars but only 4 percent had income less than 200 thousand dollars (Annex II).

Table 2. Commercial Attitudes

	Segments				*Prob. of no association*
	Performance	*Price*	*Balance*	*Convenience*	
Brands are more or less similar for seeds	2.05	2.38	2.32	2.72	0.155
Brand loyalty for seeds	3.72	3.46	3.49	3.36	0.182
I purchase seeds at the lowest price	1.62	2.07	1.79	2.08	0.017**
Loyalty with the local dealer	3.76	3.45	3.55	3.68	0.057*

Notes. Single, double and triple asterisk(*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. (Likert scale from 1 to 5; 1=I Strongly Disagree, 5= I Strongly Agree)

Commercial Attitudes of Farmers in Each Segment

Farmers can choose their seed inputs with different quality, prices, and brands; they also can buy them from different suppliers. In order to assess how farmers perceive brands, prices and suppliers, respondents were asked to signify their level of agreement regarding different statements measured on a five point Likert type scale, in which a 5 would mean "I strongly agree" and a 1 "I strongly disagree". An answer of 3 would convey some neutral standing regarding the statement. The average responses for farmers in different segments are presented in Table 2, along with the probability of no differences in response across the segments.

The perception of farmers regarding seed brands was similar across segments: All segments agreed with the statement that brands were not similar (average of 2.37); and they all strongly agreed with the statement that farmers were loyal to seed brands (average of 3.51). Thus, while segments do not show statistical differences regarding the perception of brands, they all considered themselves loyal to them.

Producers in all segments disagreed with the statement that said that they usually purchased seeds at the lowest price; however, farmers showed statistical differences across segments regarding this issue. Farmers in the Performance segment disagreed the most, followed by the Balance purchasers, while members of the Convenience and Price segments only weakly disagreed.

In contrast, all clusters strongly agreed that they were loyal with local dealers; but some did so more firmly than others. Performance was the most loyal segment, while the Price segment showed to be the least loyal among all clusters. These differences across segments were statistical significant, as we can see in the last column of Table 2.

The management implication regarding the commercial attitudes of farmers is that the Performance buyers were the most attractive group for seed input firms, in terms of price sensibility and loyalty to local dealers. Those in the Price segment were the least attractive regarding price sensibility and loyalty with local dealers, while Convenience farmers were not attractive from the pricing perspective. Regarding branding strategies, there was no difference among segments. However, branding is an important issue that seed firms must consider when selling their products in Argentine.

Information Sources

According to how customers value their information sources, input firms can design different commercial strategies. These sources can be more personally oriented, such as the manufacturer salesperson or other farmers; or communication media oriented, for instance the agricultural section of newspapers. In this section respondents were asked to evaluate how often they obtained useful information from the following sources on a five point Likert type scale, in which a 1 would mean "I never use it" and a 5 "I always use it". The average responses for farmers in different segments are presented in Table 3, along with the probability of no differences in response across the segments.

Table 3. Useful Information Sources

	Segments				*Prob. of no association*
	Performance	*Price*	*Balance*	*Convenience*	
Manufacturers salesperson	3.41	2.99	3.01	3.00	0.026**
Information local dealers	3.61	3.26	3.59	3.72	0.080*
Other producers	3.22	2.68	2.78	3.00	<0.001***
Meeting with suppliers	3.13	3.08	3.11	3.32	0.021**
Emails	3.43	2.96	2.89	3.40	<0.001***
Ag websites	3.11	2.91	2.82	3.60	0.032**
Ag section newspapers	3.22	2.98	3.27	3.40	0.075**

Notes. Single, double and triple asterisk(*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. (Likert scale from 1 to 5; 1=I Strongly Disagree, 5= I Strongly Agree).

The results show strong significant differences between the segments in all items. What can be observed in Table 3 is that Performance buyers were the ones that tended to use more frequently sources such as 'manufacturers salespersons', 'other producers' and 'emails'. Farmers in the Convenience segment used more frequently information obtained from 'local dealers', 'meetings with suppliers', 'agricultural websites', and the 'agricultural section of newspapers'. On the other hand, Price and Balance oriented farmers tended to use less frequently these information sources that Performance and Convenience buyers.

The implications from this section are that Performance and Convenience buyers were the most intensive information users. They not only used personal information sources frequently to buy their inputs but also media sources such as agricultural web pages and the agricultural section of newspapers. Input firms would have to have strategies to address customers in these segments on the web, and also ways of delivering information from the personal channels for these buyers as well. However, it would be more difficult to tailor an information strategy for farmers in the Balance and Price segment, as they tended to use less frequently media and personal sources to make their purchases.

Table 4. Table Usage by Consultant

	Segments				*Prob. of no association*
	Performance	*Price*	*Balance*	*Convenience*	
Independent Crop Consultant	62	70	61	44	0.062*
Pest Control Consultant	34	31	28	20	0.481
Environmental Consultant	5	2	2	4	0.297
Management Consultant	14	19	22	20	0.354
Accountancy/tax Consultant	90	88	87	88	0.834
Financial Consultant	12	9	16	12	0.293

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment.

Consultant Usage by Farmers

Independent consultants provide useful information and advice to farmers. Farmers rely on consultants in specific areas in which they need their expertise. Respondents were asked if they currently use any of the following types of independent, paid consultants on their farms. The answers are shown on Table 4, in term of the percentage of farmers that use consultants in different fields per segment.

The most used consultants were 'the independent crop' and 'accountancy/tax'. However, only the use of independent crop consultant significantly differed among the four segments. The Price buyers were the ones who were more likely to used independent consultants (70 percent), while the Convenience purchasers were the least likely (44 percent).

These results suggest that 'independent crop consultants' might influence farmers' seed purchases in the case they consult them frequently, which is especially the case for Price buyers.

Salespeople Characteristics and Activities Most Valued by Farmers

Salespeople are a key asset for input suppliers, by which they traditionally reach farmers and sell their products. In this section we address the issue of what are the characteristics and activities that salespeople perform that are most valued by farmers.

Regarding salespeople characteristics, respondents were told to think about the best agricultural salespeople they knew and asked to answer how important were some characteristics such as: 'technical competence', 'honesty', 'knows your operations', 'represents your interests', and 'is a friend'. The results are shown in Table 5, in terms of the percentage of producers selecting each characteristic as one of the most important characteristic of a sales representative by segment.

Table 5. Salesperson most important characteristics by Segment

	Segments				*Prob. of no association*
	Performance	*Price*	*Balance*	*Convenience*	
Has a very high level of technical competence	49	44	32	52	0.014**
Is honest	29	29	35	32	0.645
Knows my operations well	11	10	18	14	0.154
Represents my interests	7	14	12	12	0.220
Is a friend	4	4	3	0	0.763

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment.

Technical competence', 'honesty', and 'knows my operations well' were ranked as the most important characteristics by all farmers; while 'represents my interests' and 'is a friend' were not highly valued. The results in Table 5 indicate significant differences among purchasing segments only for the 'technical competence' characteristic. The Convenience buyers valued the most

'technical competence', followed by farmers in the Performance segments. On the other hand, the Balance segment valued this characteristic the least.

This would mean that input firms should train well their salespeople in the characteristics that farmers value most. In the case they sell products to the Performance buyers, they should take special care to train their salespeople in technical skills. On the other hand, selling to Balance-oriented farmers would require recruiting and training salespeople not only with technical skills but also concerned with being honest.

Regarding salespeople activities, respondents were ask rank the activities that salespeople perform, such as 'calls by phone', 'provides good follow up services' or 'brings innovative ideas'. Results are show in Table 6, on a five point Likert type scale, in which a 5 would mean "Very important" and a 1 "Not important".

All activities, except 'Call me frequently by phone' are highly valuated. The most valued activity is 'brings me the best prices', in which Price purchasers value it the most. Also the Price segment perceives as important 'provides good follow up services' above other segments. The item 'Provides relevant/timely information' is also valued highly, but there are no significant differences among segments.

The business implications regarding salespeople characteristics and activities is that purchasing segments had significant different preferences. Suppliers have an opportunity to train their sales force to address these differences, focusing on the ones more relevant for each type of buyer. For instance, Convenience and Performance buyers would value the most technical competences, while the Balance segment value 'honesty' and 'knowing well their operations'. Regarding salespeople activities, price purchasers would value 'brings me the best price' and 'provides good follow up services', and so on.

Table 6. Salesperson Activities Most Valued

	Segments				*Prob. of no association*
	Performance	*Price*	*Balance*	*Convenience*	
Call me frequently by phone	2.63	3.07	3.11	2.76	0.096*
Provides good follow up service	3.97	4.14	3.98	3.84	0.058*
Is a consultant for my business	3.40	3.41	3.30	3.44	0.156
Brings me innovative ideas	3.69	3.86	3.94	3.56	0.113
Provides relevant/timely information	4.12	4.15	4.11	3.84	0.362
Brings me the best prices	4.32	4.58	4.18	4.12	0.015*
Provides access to suppliers resources	3.77	3.65	3.53	3.56	0.640
He help me feel sure/confident about my purchasing decision	3.39	3.77	3.63	3.48	0.101

Notes. Single, double and triple asterisk(*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. (Likert scale from 1 to 5; 1=I Strongly Disagree, 5= I Strongly Agree).

Predicting Segment Membership

Once market segments have been identified, and agribusiness managers develop marketing programs tailored to each segment, managers and salespeople face the challenge of identifying whom to target with each program in the future. In working with producers, salespeople can easily observe farm characteristics and collect additional information about the farm through simple questions. Using information that can be observed by salespeople, we employed a multinomial logit analysis to predict segment membership for the 502 respondents.

This is potentially useful for marketing managers because, observing characteristics and key behaviors of a client such as demography, sales, location, information sources and business management attitudes, they would be able to predict to which cluster that farmer belongs, and in this way, know what that person values most in his purchases.

Table 7 reports the marginal effects, which indicate the impact that each observable characteristic has on the probability that a customer will be a member of a specific buying behavior segment. A positive value of the marginal effect at observable characteristic would make a farmer belong to a certain cluster, while a negative value would make him member to another cluster. The marginal effect of the dummy variables is calculated as the discrete change in the expected value of the dependent variable as the dummy variable changes from 0 to 1.

The model χ^2statistic (80.38 with 33 degrees of freedom) is significant at a level of 1% level of probability. Likewise, the predicted share for each cluster is consistent with the actual share in each one of the segments. In all the groups, except for the Price segment which has only two significant variables, there are at least three to five significant observable characteristics that supply significant statistical predictive power for each one of the cluster membership.

Table 7 shows that observable demographics variables are not relevant in order to predict segment membership, except for sales. Farms with higher total sales are 5 percent more likely to be in the Balance segment and 5.5 percent less likely to be in the Performance segment. These results are consistent with those of Annex II, in which it is shown that differences based on demographic characteristics are not statistically significant with the exception of sales volume.
The information sources such as manufacturer salesperson, local dealer, email and agricultural websites provided substantial information about their input buying behavior, but there may be more difficult for a supplier to observe. However, a salesperson could easily ask a producer if he/she uses more frequently that source of information.

If the producer uses more frequently information obtained from manufacturer salespersons, then he/she is 5 percent more likely to be in the Performance segment, and if the producer tends to use more frequently information from Agricultural websites, then he/she is 2 percent more likely to be in the Convenience segment. These results are consistent with those presented in Table 3 regarding useful information sources.

Table 7. Results of a Multinomial Logit Model Predicting Segment Membership: Marginal Effects (with standard errors in parentheses)

Variable	**Producer Segment**			
	Performance	*Price*	*Balanced*	*Convenience*
Age	-0.0179	0.0213	0.0016	-0.0050
	(0.021)	(0.019)	(0.019)	(0.006)
Sales	-0.0558	-0.0022	0.0517	0.0063
	(0.032)*	(0.030)	(0.030)*	(0.01)
Education	-0.0208	-0.0334	0.0467	0.0076
	(0.051)	(0.048)	(0.047)	(0.015)
Location	-0.0073	-0.0331	0.012	0.0283
	(0.03)	(0.029)	(0.028)	(0.009)***
Manufacturer salesperson	0.048	-0.0215	-0.0207	-0.0059
	(0.019)**	(0.017)	(0.018)	(0.006)
Local Dealer	0.0062	-0.0343	-0.0246	0.0035
	(0.02)	(0.018)*	(0.019)	(0.006)
Emails	0.0701	.0.0234	-0.0402	-0.0065
	(0.023)***	(0.021)	(0.021)*	(0.007)
Ag websites	-0.0271	0.0061	-0.0022	0.0187
	(0.022)	(0.021)	(0.021)	(0.007)**
Brand similarity	-0.0491	0.0242	0.0157	0.0092
	(0.018)***	(0.016)	(0.017)	(0.005)*
Brand loyalty	0.0385	-0.0228	-0.0134	-0.0023
	(0.018)**	(0.016)	(0.016)	(0.005)
Salesperson offers best prices	-0.0177	0.0749	-0.0487	-0.0085
	(0.026)	(0.027)***	(0.023)**	(0.007)
Predicted share	37.79%	29.65%	29.19%	3.36%
Real Share	37.45%	29.28%	28.28%	4.98%

$\chi 2=80.38$*** (33 d.f.); Prob> $\chi 2<0.001$

Note. Single, double, and triple asterisks (*) denote statistical significance at the 0.10, 0.05, and 0.01 level respectively.

It also can be observed that if the producer obtains more frequently useful information from email, then he/she is 7 percent more likely to be in the Performance segment and 4 percent less likely to be a member of the Balance segment. This is coherent with the results presented in Table 3, in which Performance buyers tend to value email information more than other segments. Regarding brands, if a producer considers that brands are similar, then he/she is 5 percent less likely to be in the Performance segment and 1 percent more likely to be in the Convenience segment. Also, if a producer is loyal with brands, then he/she is 4 percent more likely to be in the Performance segment. The management implication is that the marketing manager of an input

firm should promote the product´s brand especially to producers in the performance segment through local dealers, emails, and manufacturers' salesperson.

If the producer values highly to be offered by the salespersons the best prices, he/she is 7.5 percent more likely to be a member of the Price segment and 4.9 percent less likely to be a member of the Balance segment. This is consistent with the purchasing priorities of the Price segment, presented in Table 6. Thus, pricing strategies should be implemented for these segments by marketing managers in order to improve their performance.

Overall, the logit model has strong predictive power, which is shown by the significant relationships we explained above. Using this model to predict segment membership benefits the company if the customer classification is correct. The customer will be offered a tailored marketing mix matching his or her needs and wants, and the marketing literature has demonstrated that the tailored marketing approach builds customer loyalty and increases customer retention (Kotler 1997).

Conclusions

The main goal of this paper was to identify distinctive market segments for Argentine farmers purchasing seeds, by segmenting them according to their purchasing behavior. The overall goal was to provide some insights regarding Argentine producers' purchasing behavior for their seed inputs based on the information we collected from farmers.

Argentine farmers were partitioned into four clusters according to their seed buying behavior: Performance, Price, Balance, and Convenience segments. Farmers in the Performance and Balance segments would be business purchasers, as they purchase goods based less on cost and more on the productivity of the input. Farmers in the Price segment are cost-oriented or economic buyers as they buy primarily based on price intending to reduce the input cost. The Convenience farmers, on the other hand, are those who prioritize location and convenience for their purchases, without much regard for performance, nor services and information.

The second goal was to characterize farmers in each segment. The data indicated in Tables 2 to 6 fitted well with the different segments we have defined in this work. Regarding the Performance buyers, the largest segment, it has been established that farmers in this segment value the information coming from the manufacturer salespeople, other producers and emails. They are the most loyal buyers to local dealers and do not buy seed at the lowest price. These producers value the 'technical competence' from input salespeople.

The Price-oriented farmers belonging to this segment value getting from the salesperson the best prices and good follow up services. They are the second largest group and tend to be the highest users of crop consultant services. The Balance buyers, on the other hand, are the third largest group and have relatively low price sensitivity. They value, to some extent, the frequent calls from salespeople.

As in Alexander et al. (2005) the Convenience buyer is the smallest segment. Farmers in this segment demand a high level of technical competence from salespeople, and use relatively few

independent crop consultants. They are the second most loyal group to local dealers. They value information from local dealers and meetings with suppliers. They also consider valuable the information from agricultural websites, newspaper´s agricultural section, and emails.

In this way we were able to define a profile for each segment, which we summarize in the Table 8. There are several management implications from these results. Firstly, the largest and most attractive group is the Performance segment: they require high quality products, have high brand loyalty and low price sensitivity. However, they do not give too much value to services or the convenience/location factors.

Table 8. Summary of Important Tendencies by Seed Segments

Description/Traits	Performance	Price	Balance	Convenience
Demographics	The largest segment	Second largest group	Third largest segment	The smallest segment
	Importance of high quality products	Price-oriented buyers	Values all factors relatively equal	Values location/ Convenience
			Largest segment in sales volume	Smallest segment in sales volume
Pricing	Not very price sensitive, lower than other segments		The second lowest in price sensitivity	
Relation with the local dealer	The most loyal to local provider			Second most loyal to local provider
Personal Related Information Sources	The manufacturer salesperson and other producers are good information sources			Two main information sources are the local dealer and meeting with suppliers
Media Related Information Sources	They consider emails valuable			They consider Ag websites and newspapers Ag sections valuable
Consultants		The highest usage of crop consultants		
Salesperson Characteristics	The second highest requirement of technical competence			The highest requirement of technical competence
Salesperson activities		High importance of 'brings me the best prices' and 'provides good follow up services'	They place some value on salesperson's frequent calls	

On the other hand, the Convenience producers are the smallest segment, with lower brand loyalty and higher price sensitivity, what turns them into a less interesting group to serve. This would mean that the Convenience segment is a niche market with small economic significance for marketers. The Balance group would be the second most attractive segment, as they are fairly large and have low price sensitivity.

These results also highlight the importance of brands in these markets, for producers in all segments: Input firms selling seeds in Argentina need to invest in brands in order to do well. Also, producers in all these segments tend to be loyal to local dealers, which turns them into important partners in this business.

Regarding the information sources, firms have to use an array of personal and media related sources to reach producers in Argentina, especially those in Performance and Convenience segments. The local dealers' information appears as a relevant source for all segments, while the manufacturer salespeople's information is relevant for Performance producers. Convenience farmers would be the ones who value most Ag websites, Ag sections of newspapers and meeting with suppliers.

Considering the firms' sales force, the results show that farmers in Argentina value their 'technical competence' more than any other characteristic. In no case 'friendship' is considered valuable for any of the segments. Regarding salesperson's activities, 'providing good follow up services' and 'offering good prices' appear to be the most valued activities, especially for Price-oriented buyers. All this would be important for firms to consider when training their sales force.
Another goal was to be able to predict segment membership of farmers, which we did with a logit regression model. Farmers' observable characteristics such as age and education resulted to be poor predictors of future buying behavior by farmers, with the exception of sales volume. On the other hand, variables which were obtained through asking farmers (such as the usage of email as a useful source of information about farm inputs, brand similarities, or the salespeople's activities as offering the best prices) performed much better in order to predict segment membership.

In this way, for example, if a famer has relatively low sales volume, uses more information obtained from manufacturer salesperson or emails, and is more brand-loyal, he/she would be more likely to belong to the Performance segment. This can be a useful tool for marketing managers in order to forecast to which buying cluster a farmer would belong, and in this way, use the appropriate marketing tools.

These results are different from those obtained by Alexander et al. (2005) for US farmers buying expendable inputs. Firstly, Argentine producers are, on average, younger than US farmers, a larger percentage have college studies and higher future growth expectations. Also, Argentine farmers tend to be more brand-loyal and have less price sensitivity than American producers. Regarding salespeople characteristics most valued, Argentine farmers value more 'technical competences' while American producers value 'honesty'.

Secondly, the US study finds five segments for expendable inputs while in this work we obtained four; and the importance of each segment is different. While for US farmers buying expendable inputs the Balance segment is the largest buyer, for Argentine producers buying seeds the

Performance group is the largest. The Performance farmer in Argentina would appear to be less price-sensitive and more loyal to brands than a US farmer in the same segment.

This work also differs from Alexander et al. (2005) in terms of the logit model results to predict farmers' membership to purchasing segments. While in Alexander's work the two variables providing the most predictive power are the producer college degree and the number of consultants hired by the producer, in this paper we have four significant variables with the most predictive power: sales volume, usage of emails as a relevant information source, brand similarity, and the salesperson who brings the best price.

Finally, this work provides two main contributions: the identification and characterization of four different segments for the seed markets in Argentina; and secondly, the existence of a segment membership forecast tool to predict in which segment an Argentine farmer would fit. Also from this paper we could raise the question of how input firms in Argentine segment their markets, and how this affects their marketing practices.

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Appendix 1. Seed Market in Argentina, Year 2009-2010

	Corn	**Soybean**	**Wheat**	**Sunflower**	**Grain Sorghum**	**Other Seeds***	**TOTAL**
Planted land millons of ha	3.30	18.30	3.55	1.54	1.00		
Bags/hectares	1	2	2	1 bag 2.8 ha	1 bag 2 ha		
Price/Bag U$ dollars	100	25	12.5	95U$	70U$		
Percentage Legal Seeds**	100%	20%	37%	100%	100%	100%	
Extended Royalties***		15%	15%				
Total Market	**330 MM U$**	**194 MM U$**	**43 MM U$**	**52 MM U$**	**35 MM U$**	**300 MM U$**	**954 MM U$**

*Includes pastures and seed exports. No official figures for pastures. Based on industry estimates 100 million dollars.
Seed Exports: Based on ASA figures, 200 million dollars.
**For soybeans and wheat, there are self-fertilized plants, not all farmers buy the seeds, only a percentage of them do.
***Pays 2 U$ per bag for soybeans and 1 U$ in wheat and covers 15% of the market in both cases.

Appendix 2. Observable Characteristics. Demographics and Farm Features

Demographics and General Business Characteristics of Seed Segments

Demographics traits	**Segments**				*Prob. of no association*
	Performance	*Price*	*Balance*	*Convenience*	
% College Graduate or more	50	46	39	56	0.155
Age <35	19	12	11	20	0.292
Age 35-44	34	35	31	32	0.292
Age 45-54	25	21	31	32	0.292
Age 55-64	15	22	20	8	0.292
Age >64	7	10	6	8	0.292
Age (Average years)	46	48	47	45	0.210

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment, except average age in years.

Farm Size, Sales, and Future Growth of Seed Segments

	Segments				*Prob. of no association*
	Performance	*Price*	*Balance*	*Convenience*	
Size 250-600 hectares	53	53	54	56	0.468
Size 600-1840 hectares	29	35	32	40	0.468
Size 1841 hectares or more	18	12	14	4	0.468
Total Sales < U$S 200.000	20	23	14	4	0.074*
Total Sales U$S 200.000-U$S 500.000	39	33	39	60	0.074*
Total Sales > U$S 500.000	41	44	46	36	0.074*
Future growth (% average)	31	41	23	52	0.554

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment, except average age in years.

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Economic Feasibility of Sustainable High Oilseed-Based Biofuel Production: The Case for Biodiesel in North Carolina

Anthony Yeboah[a], Cephas Naanwaab[ⓟb], Osei Yeboah[c], John Owens[d], and Jarvetta Bynum[e]

[a] *Professor,* [b] *Post Doc. Research Associate, Department of Agribusiness,* [c] *Associate Professor, Agricultural Economics,* [d] *Instructor, Department of Agribusiness,* [e] *Research Associate, Department of Agribusiness, Applied Economics and Agriscience Education, North Carolina, A&T State University, 1601 East Market Street, Greensboro, North Carolina, 27411, USA*

Abstract

We assess the economic feasibility of a 10 million gallon per year biodiesel plant that uses canola seeds as feedstock. A Monte Carlo Cash Flow model is programmed using @Risk simulation software. The model is programmed with three output variables: stream of revenues, profits/loss, and the resulting net present value (NPV) over ten year forecast period. The study finds that the likelihood of the NPV greater than zero is 63% on average. This indicates that the plant may be economically feasible, subject to model assumptions. Sensitivity and scenario analyses show that the NPVs were most affected by fluctuations in biodiesel price, canola seed price, and the price of seed meal. Indeed, over the long-term, feedstock price and biodiesel subsidies remain the major determining factors of profitability in biodiesel production. Historically, feedstock prices have been characterized by high volatility. The profitability of the biodiesel plant hinges to a large extent on the assumption that feedstock prices remain low and regular gasoline prices, especially petroleum diesel, remain stable over the forecast horizon. Moreover, the analysis assumes that the current biodiesel subsidy at $1.00/gallon remains in effect over the period of the study. Thus, removal of the subsidy would also render biodiesel production unprofitable given current feedstock prices.

Keywords: biodiesel, economic feasibility, Monte Carlo Simulations, risk analysis, Sensitivity Analysis.

ⓟCorresponding author: Tel: + 1.336.285.4730
Email: C. Naanwaab: cbnaanwa@ncat.edu

A. Yeboah: yeboaha@ag.ncat.edu
O. Yeboah: oyeboah@ncat.edu
J. Owens: owensj@ncat.edu
J. Bynum: jsbynum@ncat.edu

Introduction

Environmental concerns and geopolitical considerations are beginning to shape energy policies in the United States and other developed countries. The dependence on petroleum fuels not only pollute our environment but also raises questions concerning national security since much of the U.S. oil consumption is imported from politically unstable countries. Biodiesel and ethanol have become two competing candidates to substitute for petroleum fuels. However, the cost-competiveness of these renewable energy types, particularly biodiesel, has been called into question (Fore et al. 2011; Hill et al. 2006). Besides cost considerations, the food versus fuel debate has also picked up steam especially in the wake of the global food crises of 2008-2009 (Abott et al. 2008; Mitchell 2008). Pimentel and Patzek (2005) have questioned the moral and ethical basis of diverting corn from human consumption to fuel production, which has the tendency to cause food price inflation. Pimental et al. (2009) noted that ethanol production from corn in the U.S. increases the price of beef, chicken, pork, eggs, bread, cereals, and milk by about 10% to 30%.

Much of the renewable fuel produced in the U.S. is ethanol, although biodiesel production has been increasing rapidly in recent years (Pradhan et al. 2008). Until the 2008 economic downturn, biodiesel production was growing at a faster pace than ethanol production. Beginning in 2011, biodiesel production started to recover from the economic recession, surpassing its peak level in 2008. Both ethanol and biodiesel have experienced significant increases in the number of plants in operation or under construction in response to the passage of the Renewable Fuel Standard (RFS) and Energy Independence and Security Act (EISA) of 2007. Corn-based ethanol production is becoming less profitable due to rising corn prices (Outlaw et al. 2007). At the current rate, ethanol production from corn is expected to increase from the current 14 billion gallons in 2011 to more than 15 billion gallons by 2015. In 2011, the U.S. produced 12,358 million bushels of corn, of which 5,050 million bushels went into ethanol production, representing 41% of the 2011 corn crop (USDA-NASS, 2012). This level of ethanol production could fuel more corn price increases, making ethanol production from corn less competitive.

While ethanol remains the leading biofuel produced in the U.S., there is potential for biodiesel production to catch-up or outpace ethanol production, especially as corn prices continue their upward trajectory. Ethanol production increased from 3.4 billion gallons in 2004 to 13.9 billion gallons in 2011—representing an increase of about 300% (Figure 2). In the same period, biodiesel production increased from 28 million gallons to 967 million gallons, a whopping increase of 3,300% (Figure 3). Given that soybean production, the largest biodiesel source, is not huge enough to fulfill the biodiesel mandate, other oilseeds such as canola can play an immense contribution to this effect. Canola biodiesel production, while a novel concept in North Carolina, is nonetheless one with a huge potential to be successful. Experimental trials on canola production conducted since 2000 have demonstrated that it can be profitably grown in North Carolina. The environmental conditions in North Carolina and the Southeastern U.S. in general are well-suited for the production of canola.

Among first generation biofuels, biodiesel production from oilseeds such as soybean, canola (a hybrid of rapeseed), sunflower and other vegetable oils is gaining popularity. Second generation biofuels, mainly cellulosic sources such as corn stover, rice and wheat straw, wood biomass, and

energy grasses (e.g.switchgrass and miscanthus), are equally gaining traction, albeit with a higher per unit production cost than ethanol production using corn.

Biodiesel production in the State of North Carolina relies on eight small-scale plants that use mainly waste vegetable oils (WVOs) and animal fats as feedstock (Table 1). The plant with the largest production capacity in the state is Patriot Biodiesel LLC, located in Greensboro, North Carolina. With a capacity of 6.5 MMGY (million gallons per year), this plant uses multi-feedstock, but waste vegetable oils from restaurants form the major feedstock. Several plants, capacity ranging from 5 to 15 MMGY, are either under construction or being planned in the state. Soybeans, one of the major oil-seeds for biodiesel production, are grown in the state, although it is not nearly enough to feed the planned increases in biodiesel production. As a result, canola (**Can**adian **o**il **l**ow **a**cid), so named because of its low erucic acid content, has become a candidate: oil-seed crop for biodiesel production in North Carolina. Canola is an improved cultivar from cross-breeding of four main *Brassica* oil-seed species, namely, rapeseed (*Brassica napus*), field mustard (*B. rapa*), Indian mustard (*B. juncea*), and Ethiopian mustard (*B. carinata*).

Nationally, there are five biodiesel plants that use canola oil as feedstock—these include: Archer Daniels Midland Co. of North Dakota (with operating capacity of 85 MMGY), Double Diamond Energy Inc. of Texas (operating capacity 30 MMGY), Inland Empire Oilseeds of Washington (operating capacity 8 MMGY), and Sun Power Biodiesel LLC of Wyoming (capacity 5 MMGY). Many other plants use some combination of multi-feedstock that includes canola, soy oil, and other vegetable oils. Agrigold Renewables in Texas uses sunflower oil and yellow grease to operate its 2 MMGY plant. According to data on plant capacity and utilization provided by the National Biodiesel Board (NBB 2011), soybean oil is the predominant feedstock choice for most of the biodiesel plants in the U.S. accounting for about 40% of biodiesel feedstock. Canola accounts for about 5% and recycled and waste vegetable oils make up less than 1 percent of feedstock. Canola and sunflowers have an oil content of 40%, while soybeans have 20%, thus capital and operational costs for the former oilseeds are lower (they require less extruder and press capacity) than the latter (Bender 1999). However, soybean byproduct—meal cake—has a higher monetary value than canola and sunflower meals.

Canola oil has been proven to be an excellent feedstock for biodiesel production (George et al. 2008). EPA (2010) cleared canola oil as an approved biodiesel pathway; in its findings, the EPA states that canola oil biodiesel pathway creates a 50 percent reduction in greenhouse gas emissions compared to conventional diesel fuel baseline. The EPA study conducted a life cycle analysis on biodiesel production from canola oil and found canola oil has high conversion efficiencies compared to biodiesel produced from soy bean oil. They found that a pound of canola produces 0.40 pounds of oil compared to 0.18 pounds from soy beans. Moreover, canola biodiesel has a higher cetane number than soy biodiesel and petroleum-based diesel (56, 47, and 43, respectively). The higher cetane number of canola biodiesel gives better engine efficiency such as easier starting, quieter engine operation and lower engine temperatures (George et al. 2008). Thus canola oil now meets the standard as an advanced biofuel under the Energy Independence and Security Act of 2007 (EPA 2010).

Experimental trials have shown that canola can grow well in North Carolina as a winter annual crop. Its production practices are much similar to winter wheat, and thus, farmers who already

grow winter wheat in the state could grow canola. The soil and fertilizer requirements of canola are similar to those of winter wheat (George et al. 2008). Additionally, canola is a good choice for biodiesel production because it gives a better oil yield per acre, more than twice that of soybean (approximately 110 gallons per acre versus 45 gallons per acre). A proposed canola farmers' cooperative association is under formation by researchers at North Carolina A&T State University. The proposed canola farmers' cooperative will grow canola to feed a 10 MMGY biodiesel plant.

The objective of this study is to assess the economic feasibility of a biodiesel plant in North Carolina that uses canola seeds as primary feedstock. Our analysis is based on a 10 million gallon per year (MMGY) operating capacity. We perform a stochastic Monte Carlo financial simulation using historical data on biodiesel and seed meal prices, as well as costs of feedstock, to determine the economic feasibility of the proposed plant. Our study seeks to contribute to filling the gap in scientific knowledge regarding biofuel feedstock alternatives in North Carolina. Moreover, it is apparent that the U.S. EPA renewable fuel mandate of 36 billion gallons by 2022 cannot be met by ethanol alone, which is why the U.S. EPA has expanded its renewable fuel mandate to include biodiesel. This means that other feedstock options have to be investigated, as we move toward the goal of achieving the renewable fuel mandate. To this end, the findings of the present study can help inform agribusiness managerial decision making towards investing in canola biodiesel production in North Carolina.

Table 1. North Carolina Biodiesel Plants.

Plant Name	**City**	**Feedstock**	**Capacity (MMGY)**
Blue Ridge Biofuels	Asheville	Multi-feedstock	1.2
Carolina Biodiesel LLC	Durham	[a]WVOs	0.5
Evans Environmental Energies	Wilson	Animal fats/soy oil	3
Filter Specialty Inc.	Autryville	Soy oil/yellow grease	1
Foothills Bio-Energies LLC	Lenoir	Multi-feedstock	5
Patriot Biodiesel LLC	Greensboro	Multi-feedstock	6.5
Piedmont Biofuels Industrial LLC	Pittsboro	Multi-feedstock	1.4
Triangle Biofuels Industries Inc.	Wilson	Soy oil/ yellow grease	5

Sources. National Biodiesel Board and Biodiesel Magazine: [a] Waste Vegetables oils

Data and Methods

Biodiesel, an alcohol ester, is a renewable fuel produced from vegetable oils or animal fats (Bender 1999). Biodiesel is made through a chemical process called transesterification (Figure 1), in which methanol/ethanol reacts with triglycerides resulting in methyl/ethyl esters (Barnwal and Sharma 2004). As Figure 1 indicates, the process of producing biodiesel is to transesterify triacylglycerols in vegetable oils or animal fats with an alcohol (commonly methanol), in the presence of an alkali or acid catalyst (Zhang et al. 2003). The commonest alcohol used in biodiesel production is methanol owing to its lower cost. The resulting products are methyl ester

(biodiesel), a co-product (crude glycerin), and some waste. The commonest used catalyst is either sodium hydroxide (NaOH) or potassium hydroxide (KOH).

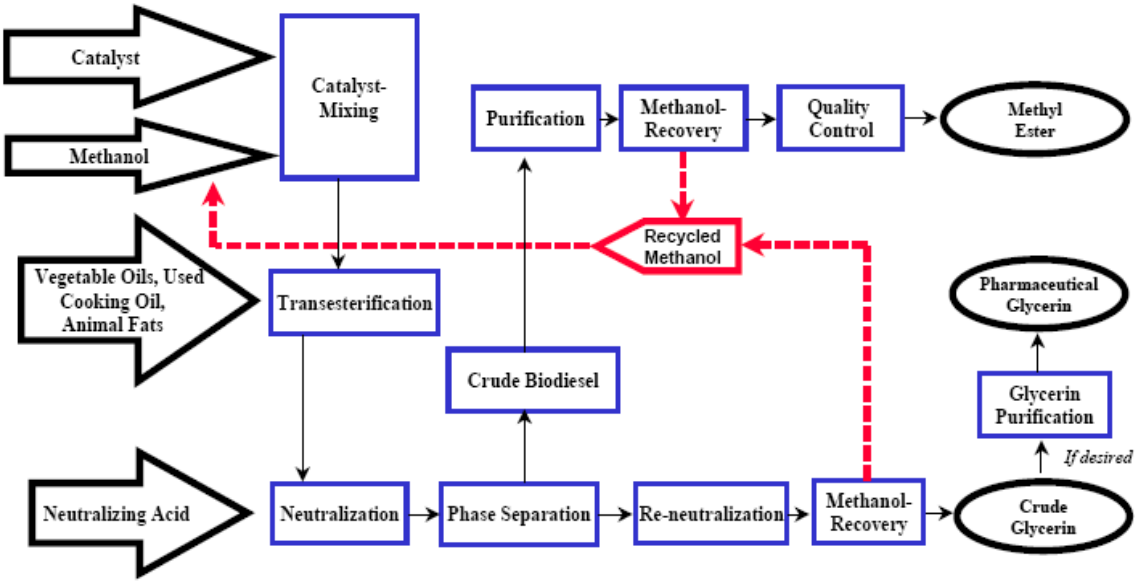

Figure 1. Biodiesel Production Process (Adapted from National Biodiesel Board 2011)

The reaction process may be summarized as follows;

$$(1)\quad \underset{(100\ parts)}{Methanol} + \underset{(1015\ parts)}{Vegetable\ Oil} \xrightarrow{NaOH} \underset{(1000\ parts)}{Methyl\ Ester} + \underset{(100\ parts)}{Glycerin} + Free\ Fatty\ Acid + Waste$$

Biodiesel production in the U.S. received a boost under the Energy Act of 2005 and the Energy Independence and Security Act of 2007. Production of biodiesel increased sharply from less than 2 million gallons in 2000 to about 802 million gallons in 2011 (NBB 2011). Figure 3 shows the trends in biodiesel production in the U.S. from 2001 to 2011, while Figure 4 provides a comparison of monthly biodiesel production and consumption in the U.S. from 2005 to 2011. Biodiesel production suffered a sharp decline in 2008-2010. Although the economic downturn may have contributed to this decline, two major factors explain the near collapse of the biodiesel industry: First, biodiesel feedstock prices increased by more than 200% during that period, thus, rendering biodiesel production unprofitable relative to petroleum diesel. Secondly, exports of U.S. biodiesel to the European Union increased during this period in response to high prices there. However, the EU, sensing a threat to their biodiesel industry from the imports, imposed higher tariffs on U.S. biodiesel which curtailed the growing imports. This, coupled with a recovering economy and a new biofuel mandate (RFS2) led to the rebound in biodiesel production starting in 2011. In Figure 4, the production and consumption of biodiesel curves are in virtual lockstep, indicating a high demand for biodiesel. At present, U.S. international trade in biodiesel, or biofuels in general, is minimal. In 2001, U.S. imported 78 thousand barrels of biodiesel and exported 39 thousand, implying net imports of 38.9 thousand barrels (Table 2).

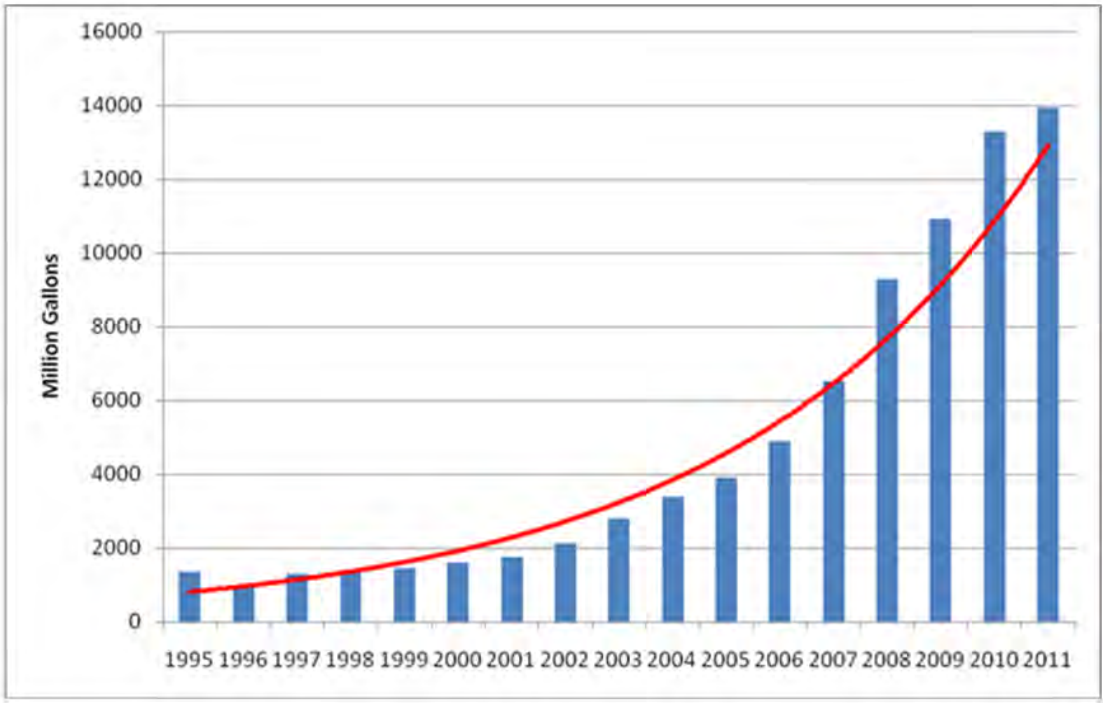

Figure 2. U.S. Ethanol production
Source. U.S. Energy Information Administration, Monthly Energy Review

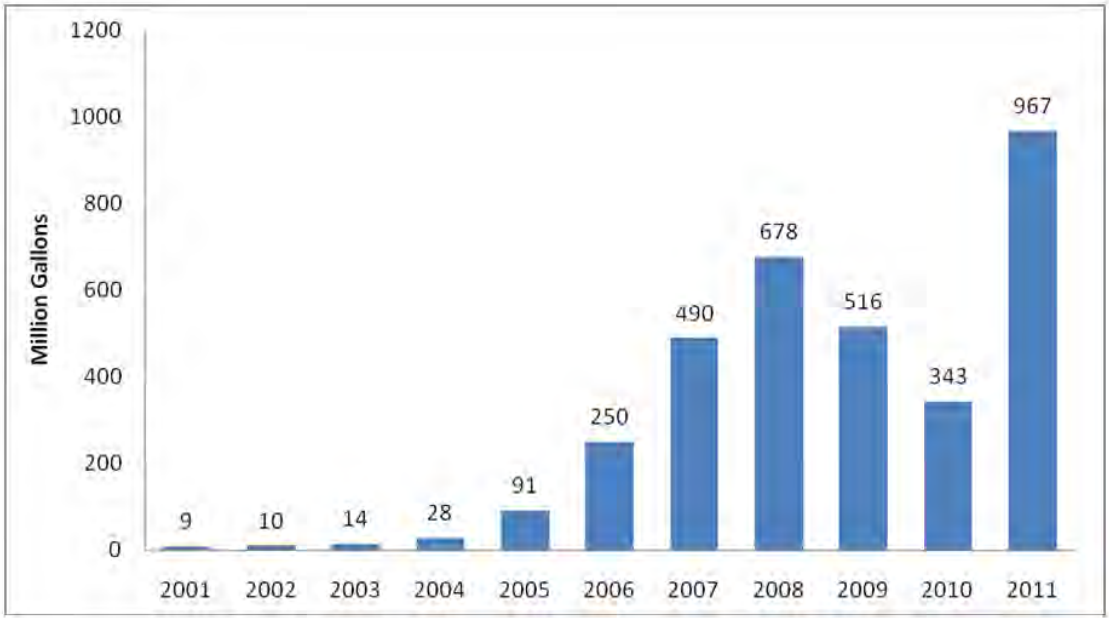

Figure 3. Annual Biodiesel Production, million gallons
Source. U.S. Energy Information Administration, Monthly Energy Review

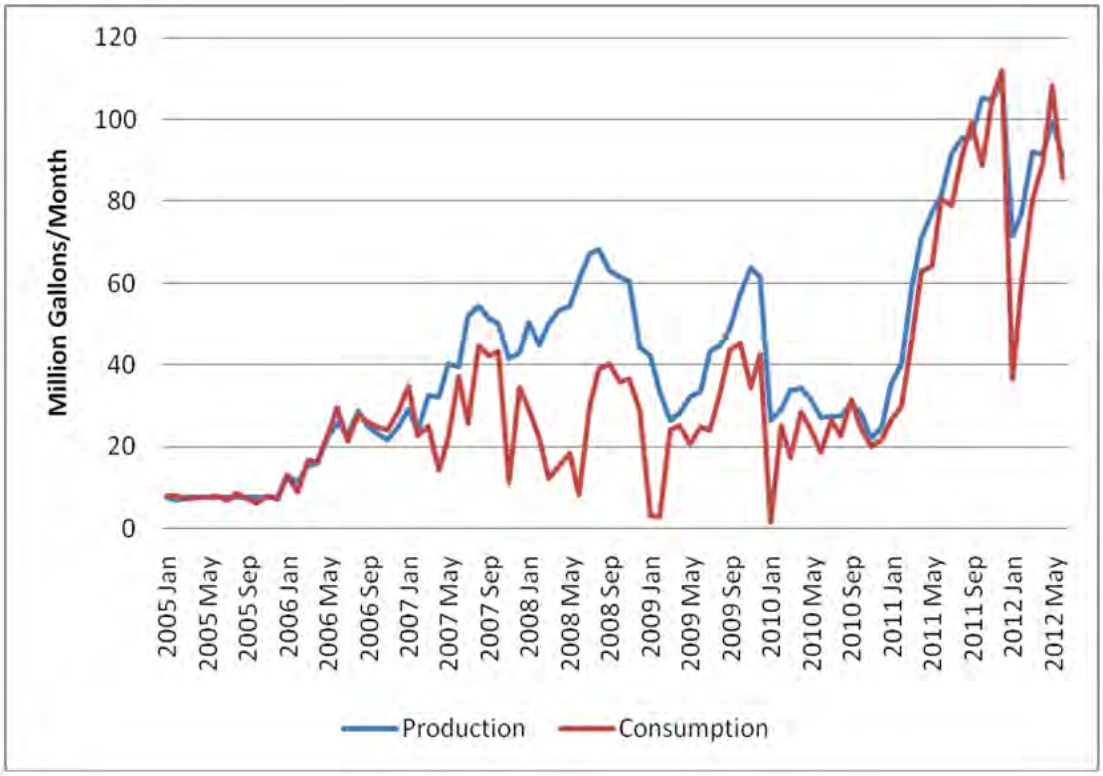

Figure 4. U.S. Biodiesel production and Consumption (monthly)
Source. U.S. Energy Information Administration, Monthly Energy Review

According to the Biodiesel Magazine (2012), 188 biodiesel plants were in operation with a total operating capacity of 2,882.71 million gallons per year and 13 other plants are under construction. This could bring the total potential operating capacity to more than 3.2 billion gallons of biodiesel per year. As the production of biodiesel increases in the country, exports are beginning to increase too. By 2007, the U.S. was already a net exporter—exporting 6,477 thousand barrels and importing 3,342 thousand barrels (Table 2).

Table 2. U.S. Production, Consumption, and Trade in Biodiesel (thousand barrels)

Year	Production	Imports	Exports	Net Imports	Consumption
2001	204.203	78.277	39.318	38.96	243.162
2002	249.620	190.893	55.549	135.344	384.964
2003	338.322	93.641	109.759	-16.118	322.204
2004	666.237	97.256	123.543	-26.287	639.95
2005	2,161.586	206.707	205.756	0.95	2,162.536
2006	5,962.838	1,069.194	827.659	241.535	6,204.374
2007	11,662.501	3,342.057	6,477.025	-3134.97	8,527.531
2008	16,145.380	7,501.598	16,128.03	-8,626.44	7,518.947
2009	12,054.161	1,843.594	6,332.165	-4,488.57	7,536.871
2010	7,365.773	545.526	2,503.392	-1,957.87	5,446.908

Source. U.S. Energy Information Administration

Biodiesel Production Costs

Estimates show that biodiesel production using oilseeds is more costly than ethanol production from corn and cellulosic sources (Table 3). In the U.S. it costs $4.60 to produce a gallon of biodiesel from soybean oil compared to $1.65 to produce ethanol from corn. However, corn ethanol production requires high capital expenditure: estimates show that construction costs for a new ethanol plant averages about $1.05 to $3.00 per gallon of ethanol (Shapouri and Gallagher 2005). In the EU, it will cost $3.52 to produce a gallon of biodiesel using rapeseed. Conventional diesel and gasoline production costs per gallon are $1.65 and $1.38, respectively. Haas et al. (2006) in their study of a medium-sized industrial biodiesel production facility estimated that the cost per gallon ranges from $1.48[1] (if degummed soybean cost 33 cents per kg) to $2.96 (if degummed soybean costs 77 cents per kg). For their 10 MMGY plant, estimated investment costs were $11.5 million ($1.12 per gallon), operating cost of 27.1 cents per gallon, and capital cost of 15 percent rate of return, assuming a 10-year life span. The co-product, glycerin, priced at 33 cents per kg, would provide a credit of 12.8 cents gallon, which could reduce production costs by about 6%. In a more recent study, Fore et al. (2011a) estimated that when feedstock is valued at production cost, canola-based biodiesel production will cost anywhere from $0.94/*l* to $1.13/*l* ($3.55/gal to $4.27/gal), while the cost of biodiesel production from soybean ranges from $0.40/*l* to $0.60/*l* ($1.51/gal to $2.27/gal). However, they also determined that when the feedstock is valued at market price (which would seem more appropriate since producers of the feedstock have to sell at market price) the cost of canola-based biodiesel is cheaper than soybean biodiesel production.

Numerous studies have compared the energy efficiency of biofuel production from different feedstocks. Several measures have been used to describe the energy efficiency of different renewable fuel production: the commonest are net energy balance (NEB) and net energy ratio (NER). Net energy balance is defined as the difference between the energy output and energy input in the production of a renewable energy (energy output-energy input), whereas net energy ratio is the energy output divided by the energy input (energy output/energy input) (Hill et al. 2006; Pradhan et al. 2008). Fore et al. (2011b) define a positive net energy balance as the situation in which there is a net gain of energy; which is to say that more energy is produced than consumed in the production of the biofuel. On the other hand, a net negative energy balance results when more energy is consumed than actually produced. A number of studies have found that ethanol production from corn and biodiesel production from soybean and canola have a negative net energy balance (Pimentel and Patzek 2005; Pimentel et al. 2008; Pimentel et al. 2009). Other researchers however found a positive net energy balance for these same biofuel sources. For example Hill et al. (2006) found that ethanol production yields a net positive energy balance of 25% while biodiesel production from soybeans yields 93% more energy than actually used in producing it. Fore et al. (2011b) estimates the NEB of canola biodiesel to be 0.66 MJ MJ^{-1} compared with 0.81MJMJ^{-1} for soybean biodiesel. Similarly, they found the NER to be 1.78 and 2.05 for canola biodiesel and soybean biodiesel, respectively Insofar as energetic productivity is concerned, Fore et al. note that canola is a more productive biodiesel feedstock than soybean, because of its higher oil content.

[1] Estimates based on 2006 dollars

Bender[2] (1999) reviewed 12 studies on the economic feasibility of biodiesel production. Estimated cost of production (including cost of feedstock and conversion to biodiesel) ranged from \$0.30/*l* (\$1.14/gal) for biodiesel from soybeans to \$0.69/*l* (\$2.62/gal) for biodiesel produced from rapeseed. Bender also reviewed the economics of biodiesel from canola and sunflower, through a farmers' cooperative in Austria that has 290 members and grows about 430 ha of canola and sunflowers with an average yield of 3 t/ha. This is a government subsidized cooperative which enables farmers to grow canola on set-aside lands. At a canola price of \$106/t, and 3000 kg of canola required to produce 1000 *l* of biodiesel, Bender's calculations showed that the cost of canola feedstock was \$0.32/*l* biodiesel. This translated into a capital and operating cost of \$0.86/*l* (\$3.26/gal) of biodiesel. At these costs, Bender concluded that biodiesel production from these oilseeds was not economically feasible, unless the government subsidized the entire cost of production, or technological development substantially reduces the cost of production.

Table 3. Cost of Biofuel production from selected feedstock

Biofuel/Country	Feedstock	Feedstock Cost (% of total)	Total production costs
Biodiesel		Percent	\$ per gallon
United States	Soybean Oil[a]	80-85	4.60
Malaysia	Palm Oil	80-85	2.23
EU	Rapeseed	80-85	3.52
India	Jatropha	80-85	2.13
Diesel			
United States	Diesel	75	1.65
Ethanol			
United States	Corn	39-50	1.65
United States	Cellulosic sources	90	2.88
Brazil	Sugarcane	37	1.05
EU	Wheat	68	2.39
EU	Sugar beets	34	3.08
Gasoline			
United States	Gasoline	73	1.38

Sources. Iowa State University Ag Marketing Resource Center (2012); Biomass Research and Development Board (2008). [a] U.S. producers of biodiesel receive a \$1.00 per gallon subsidy under the American Jobs Creation Act of 2004, extended through 2008 by the Energy Policy Act of 2005.

Graboski and McCormick (1998) analyzed the technical and economic feasibility of a 10 million gallon biodiesel facility using fats and oils as feedstock. Their calculations showed that the joint cost of feedstock and its conversion to biodiesel would be \$0.57/*l* or \$2.15/gal (\$0.81/*l*, \$3.04/ gal in 2012 dollars). They concluded that the price of feedstock was the major determining factor in the production and consequently price of biodiesel.

Noordam and Withers (1996) determined the economic feasibility of producing biodiesel from canola in the inland Northwest, specifically eastern Washington and northern Idaho, assuming a 2.7 MMGY operating capacity. Total production costs ranged from \$2.19/gal to \$3.96/gal (in

[2] Estimates based on 1999 dollars

2012 dollars these would be $3.22/gal to $5.81/gal). Noordam and Withers also determined that the economic feasibility analysis of biodiesel production using canola must also factor in the value of the meal and glycerin by-products. Canola seed meal is a good substitute for soybean meal in livestock rations while glycerin has various industrial uses, including soap manufacturing, pharmaceutical formulations, and in the food industry. The value of canola meal and glycerin can help offset the cost of biodiesel production using canola seeds.

Net Present Value

In analyzing project returns under conditions of uncertainty, Reutlinger (1970) proposed the use of probability distributions to estimate the net present value of an investment. Monte Carlo simulations have become one of the preferred methods for analyzing investments under conditions of risk and uncertainty (Richardson and Mapp 1976). In Monte Carlo analysis, stochastic variables that affect the investment's returns are assigned objective or subjective probability distributions, so that during the simulations, random values are drawn repeatedly from these distributions to determine the probability distribution of the net present value of the investment. Outlaw et al. (2007) described the net present value (NPV) as a good measure for determining the overall economic feasibility of a proposed investment.

Richardson and Mapp (1976) described the probability of economic success as the probability that the NPV is greater than zero, with the reason that if the NPV>0, then the investment will yield a return (IRR) that exceeds the investor's discount rate or opportunity cost of capital. For example, if the probability that the NPV>0 from an investment is found to be 90% at a discount rate of 5%, it means that there is a 90% chance that the project will be economically successful and will generate a rate of return exceeding 5%. Richardson and Mapp further outlined the steps involved in a Monte Carlo simulation model to generate probabilistic cash flows for business decision-making.

The simulation model we use in this paper is an annual Monte Carlo Cash Flow model which is calibrated to historical data of biodiesel prices, input prices, and other operating expenses. Data on biodiesel and electricity prices are obtained from the U.S. Energy Information Administration (EIA, 2011), canola price data are obtained from the Oil Crops Yearbook (ERS-USDA 2011), while other input prices such as methanol, caustic, labor, and glycerin are estimated based on the literature. Where there is no data on these variables for North Carolina, we use comparable national averages as proxies. Our Monte Carlo Cash Flow model is programmed in Excel using @Risk (http://www.palisade.com/risk/), a simulation and risk analysis software that is an add-in to excel. The model incorporates stochastic components to capture uncertainty or risk in the analysis. The stochastic components are variables that may exhibit risks, such as input and output prices. The risky variables are assigned probability distributions in the model based on objective (using historical data) or subjective judgment of the researchers (Table 4).

Using @Risk distribution fitting tools, we determined that the historical price of canola seeds follows a log-logistic distribution, based on Kolmogorov-Smirnov Statistics. Price of biodiesel follows a triangular distribution (based on chi-squared statistics) with three parameters; minimum ($3.08/gal), mean ($3.93/gal), and maximum ($5.57/gal). Prices of seed meal, glycerin co-product, methanol, and other inputs are approximated by normal distributions. The model is

programmed with three output variables—stream of revenues over ten years, stream of profits/loss over ten year period, and the resulting net present value (NPV). The NPV is computed as the average discounted net cash flows (NCF) less the initial equity investment, as defined below. An NPV value greater than zero indicates that the project can be economically feasible, subject to model assumptions (Table 5). The most important output variable in this simulation analysis is the NPV which determines the economic viability of the proposed plant (Palma et al. 2011).

The spreadsheet model is programmed to compute the NPV as follows;

$$(2)\ NPV = -(InitialEquity\ Investment) + \sum_{n=1}^{10} \frac{NCF_n}{(1+i)^n} + \frac{EndingNetWorth}{(1+i)^{10}}$$

where NCF refers to net cash flow, and *i* is the discount rate, assumed to be 7.5%. The model is programmed for a 10-year operating period. The NCF is derived from the revenues/incomes that accrue to the plant from the sale of biodiesel, and two co-products— seed meal and glycerin. For this reason the NCF is computed as;

$$(3)\ NCF = \left(\tilde{P}_{bd} * Q_{bd}\right) + \left(\tilde{P}_m * Q_m\right) + \left(\tilde{P}_g * Q_g\right) - Capital\ Expenses - Operating\ Costs$$

where tildes indicate stochastic variables, P_{bd} and Q_{bd} are price and quantity of biodiesel, P_m and Q_m are price and quantity of seed meal, P_g and Q_g are price and quantity of glycerin, respectively. Capital expenses include equipment and construction costs, operating costs include costs of inputs such as canola seeds, methanol, caustic (NaOH or KOH) used as catalyst in the transesterification process. Other operating expenses are labor, electricity, steam, repairs and maintenance, and overhead costs. The capital budgeting analysis assumes a 50% equity financing. The interest rate on debt financing is assumed to be 7.5% computed at the going commercial lending rate plus processing charges. A tax rate of 25% is also assumed and incorporated in the computation of operating expenses of the plant.

Results and Discussion

Table 4 presents the summary statistics of variables used in the analyses. In Figure 5 we compare monthly biodiesel prices with ethanol and regular gasoline prices. The gasoline price data are obtained from U.S. Energy Information Administration while biodiesel and ethanol prices are obtained from Iowa State University Center for Agricultural and Rural Development (CARD). A gallon of biodiesel in 2012 averages about $4.60, lower than the 2011 average of $5.70. Due to significant volatility in the price of biodiesel, the overall mean price of biodiesel in the dataset is $3.93 (Table 4). The Monte Carlo model is programmed under assumptions presented in Table 5. The 10 MMGY canola biodiesel plant is assumed to have a daily crushing capacity of 320 tons. With an annual crushing capacity of 97,280 tons, oil extraction rate of 44%, and efficiency of 90%, the plant is expected to produce 38,523 tons of oil, which yields 10 M gallons of biodiesel per year. The production of biodiesel will generate two co-products, seed meal and glycerin. Under the assumed operating capacity, 54,477 tons of seed meal, and 3,500 tons of

glycerin will be produced per annum. These co-products are expected to add to the revenues generated from the sale of biodiesel.

Mean values for estimated revenues and costs of production are summarized in Table 6. For our 10MMGY canola biodiesel plant, we estimate initial equipment and construction costs (one-time investment cost) of $20.03 million ($2/gal), while annual operating cost will average about $43.01 million. Total revenues from sale of biodiesel will average $39.3 million per year, sale of seed meal will average $9 million per year, and sale of glycerin will bring in $2 million per year. Thus, the average total revenues per year will amount to about $50.5 million (Table 6). This implies a net income of $7.47 million per year.

For purposes of determining the economic viability of the project, we performed Monte Carlo simulations with 1000 iterations using the model assumptions. The simulations were programmed over a ten year project operating period. The simulation results indicate an average NPV of $18 million with 62.7% probability of a positive NPV (Figure 6: panel A), and a rate of return of 38%. Regression analysis coefficients (shown in Figure 6: panel B) indicate that the NPV is most sensitive to the price of the feedstock (canola seeds), biodiesel price, and the price of the seed meal. Increases in the price of canola seeds decrease the NPV, while increases in the prices of biodiesel, seed meal, and glycerin increase the NPV. The regression coefficients show that a one standard deviation (or $88.50/ton) increase in the price of canola seeds will decrease the NPV by 0.81 standard deviations (or $1.8 million). On the other hand, a one standard deviation (or $0.75/gal) increase in the price of biodiesel will increase the NPV by 0.53 standard deviations (or $1.2 million) while a one standard deviation (or $52/ton) increase in seed meal price will increase the NPV by 0.27 standard deviations (or $626,586).

Additional caution should be exercised in order not to appear too bullish about the prospects of investment in canola biodiesel production. The high volatility of the feedstock implies that small changes in its price can significantly alter the results. As such, these findings need to be interpreted with caution, considering the fact that the model is quite sensitive to small changes in the feedstock price. The results are also subject to a continuation of $1.00/gal biodiesel subsidy. Removal of the subsidy will invalidate the conclusions drawn from the model.

Table 4. Summary Statistics of Data and Distribution of Stochastic Variables

Variable	Mean	Std Dev	Distribution
Price of			
Canola Seeds ($/ton)	304	88.5	Log-logistic
Biodiesel ($/gal)	3.94	0.47	Triangular
Seed Meal (S/ton)	164	47.24	Logistic
Glycerin ($/ton)	585	58.5	Normal
Methanol ($/gal)	1.5	0.15	Normal
Caustic ($/ton)	430	30.9	Normal
Electricity ($/ton of biodiesel)	8.19	0.82	Normal
Labor ($/ton of biodiesel)	5.11	0.51	Normal

Sources. Energy Information Administration (www.eia.gov) and Center for Agricultural and Rural Development (CARD), Iowa State University (www.card.iastate.edu). Distributions are determined based on the best fit for the data or normal approximations.

Most investors would prefer at least a 90% probability of success to invest in a project, and while the 62.7% probability of success (Figure 6) for this project is not as great, it certainly indicates the project is more likely to succeed than to fail. Decreases in feedstock price (canola seeds) or increases in product prices (biodiesel, seed meal, and glycerin) could increase the probability of success. Sensitivity analyses (discussed in the next section) show that it is possible to obtain a probability of success greater than 90% under conditions of increased biodiesel prices or decreased feedstock costs.

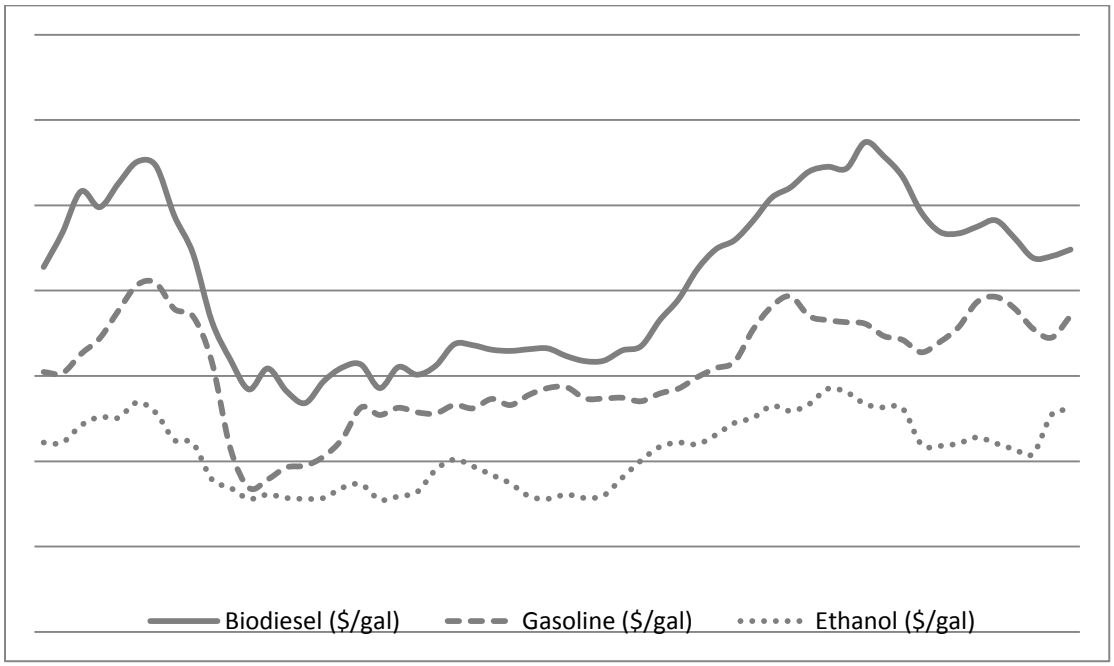

Figure 5. Monthly Prices of biodiesel, ethanol, and gasoline
Sources. Center for Agricultural and Rural Development (CARD), Iowa State University (www.card.iastate.edu), and Energy Information Administration (www.eia.gov).

Table 5. Model Assumptions for 10 MMGY Biodiesel Plant

Variable	Unit	Value
Crushing plant capacity /hr.	tons	20
Operating time/day	hours	16
Seeds pressed/day	tons	320
Production days/year	days	304
Annual tonnage pressed	tons	97,280
Oil extraction rate	percentage	44%
Extraction efficiency rate	percentage	90%
Oil output per annum	tons	38,523
No. of gallons/ton of oil	gallons	260
Biodiesel produced/year	gallons	10M
Seed meal output/year	tons	54,477
Glycerin Output/year	tons	3,500
Subsidy	$/gal	$1.00

Note. These assumptions are based on a 10 million gallon/year operating capacity. The analysis and conclusions drawn are subject to these assumptions. Any change in the assumptions will alter the results presented.

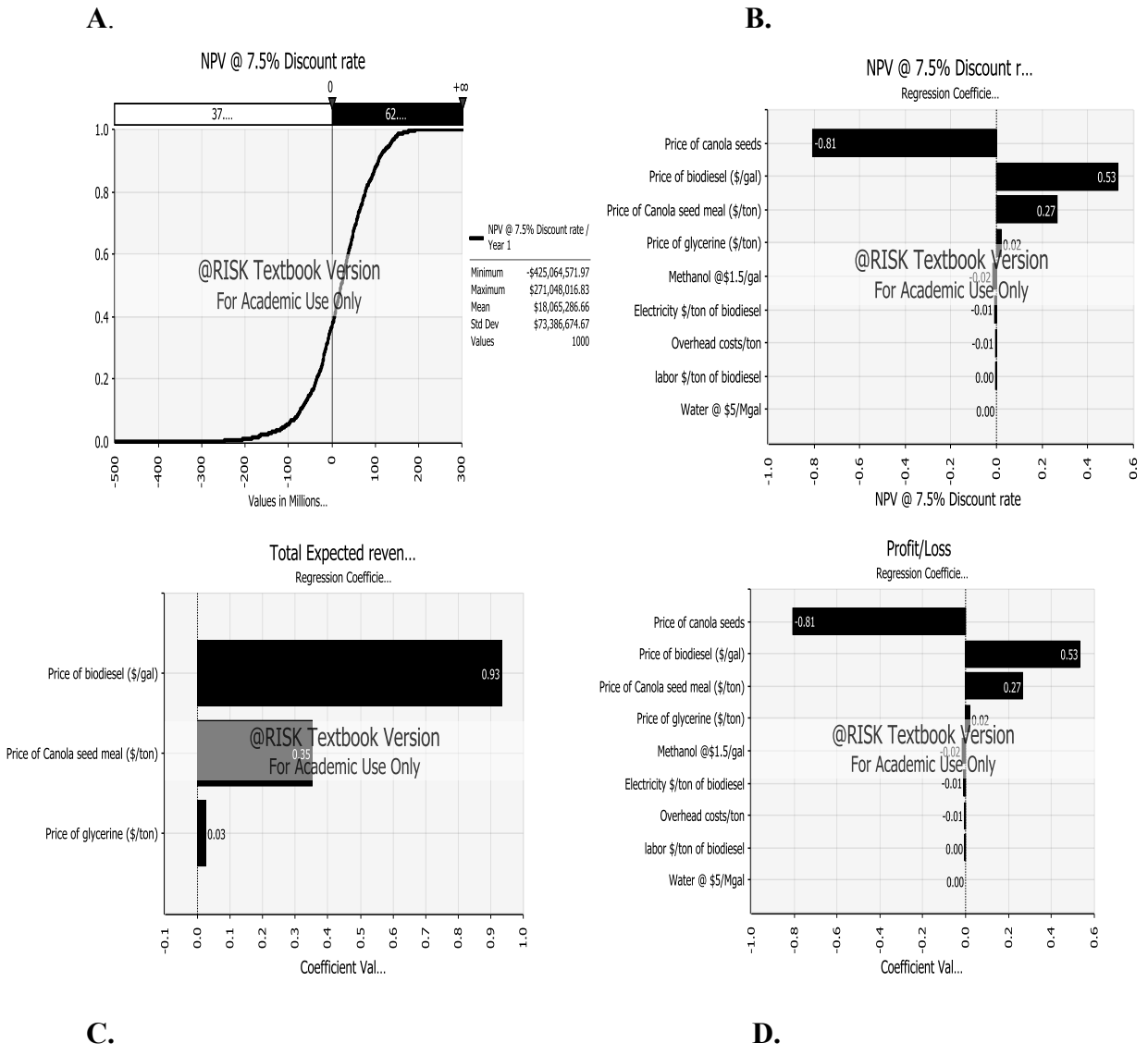

Figure 6. Economic profitability of 10 MMGY Biodiesel Plant

Regression coefficients for the responses of expected revenues and profits to changes in feedstock and product prices follow similar patterns as for the NPV (panels C and D in Figure 6). Total expected revenues increase with increases in product and co-product prices, as expected, but decreases with increasing feedstock price. A one standard deviation increase in biodiesel price (or \$0.75/gal) will increase revenues by 0.93 standard deviations (or \$237,552), and 0.35 standard deviations (or \$89,401) for one standard deviation (or \$52/ton) increase in the price of seed meal. Furthermore, a one standard deviation (or \$88/ton) increase in canola seed price decreases profit by 0.81 standard deviation (or \$273,854), while a one standard deviation increase in biodiesel price or seed meal price would increase profit by \$179,188 and \$91,284, respectively.

Table 6. Estimated Annual Production costs and Revenues for a 10 MMGY Biodiesel Plant

Item description	Quantity/Unit	Value (thousands)
Equipment/construction	$	20,031
Operating cost		
Canola seed	97,280@$304/ton	29,573
Methanol	1.167mgal@$1.50/gal	1,750
Caustic	35.8 tons@$430/ton	15
Steam	0.25mm btu/hr.	10
Water	$/mm gal	50
Utilities	$/ton	796
Labor	$/ton	497
Repairs/maintenance	1% of equipment cost	200
Interest payment on 50% debt	7.5%	751
Income tax	25% rate	9,369
Total operating expenses		**43,011**
Total Revenues		
Biodiesel	10 mmgals@$3.93	39,376
Seed meal	54,477@$166/ton	9,061
Glycerin	3,500@$585/ton	2,047
Total Revenues		50,484

Note. Estimates are based on the data and author computations

Sensitivity Analysis

Determining the economic feasibility of an investment is a very uncertain adventure owing to the difficulty of predicting economic variables. A case in point is the bankruptcy filing of Solyndra Corporation, a Solar Manufacturing firm, barely two years after it was found to be economically viable and received $535 million of Federal funding. The reason for this unfortunate situation, as in many failed business investments, is that changes in stochastic variables (factors outside the control of the decision-maker), will change the outcome (profitability or loss) of the investment. In the case of Solyndra, plummeting prices of solar panels rendered the business unprofitable. Because of this difficulty of pinning down economic outcomes, it is often necessary to perform sensitivity or "what if" analysis to determine how outcome variables will change given changes in the input variables.

In the present case, our aim is to determine how economic feasibility of the biodiesel plant, measured by the NPV, will change given changes in crucial variables in the investment decision process. In other words, sensitivity analysis helps to determine what factors significantly affect the probability of economic success as measured by the NPV. It has already been indicated in the baseline simulation results that three variables (biodiesel, canola seeds, and seed meal prices) are the most significant determinants of the NPV. Thus, we now simulate the sensitivity of the NPV to changes in these three variables.

Table 7 presents the sensitivity of the NPV to changes in canola seed price. We simulate how the NPV changes given increases in the canola seed price (10%, 20%, and 30%) and decreases in canola seed prices (-10%, -20%, and -30%). The mean NPV after 1000 iterations, using the baseline prices is $18 million, with a 62.7% probability of positive NPV. If we assume a 10% increase in canola seed price from the baseline price ($304.9/ton) to $335.4/ton, the average

NPV becomes negative (-$2.2 million), and probability of positive NPV decreases to 44.5%. Repeating this over different scenarios, the simulations show that as canola seed price increases, the mean NPV and probability of positive NPV decrease. On the other hand, decreasing the price of canola seeds increases the NPV as well as the probability of a positive NPV. At a canola price of $213.4/ton (30% decrease from the baseline price), the project is almost guaranteed to be successful (98.7% probability of success).

Table 8 presents the sensitivity of NPV to biodiesel price changes. As biodiesel price increases, the NPV increases and so does the probability of a positive NPV. A 10% increase in biodiesel price ($4.32/gal) from the baseline biodiesel price of $3.93/gal increases the probability that the plant will be economically viable to 77%; while at a price of $5.11/gal (30% increase from the baseline price) there is a 89.8% chance of success. Conversely, if the biodiesel price were lower, say $2.75/gal (a 30% decrease from the baseline) there is only a 26% chance of economic success. If for some reason, such as political instability in the Middle East, petroleum prices were to go up, demand for renewable fuels would increase, and the price of biodiesel would increase, thus increasing the profitability of biodiesel production.

Similar analysis of the sensitivity of NPV to changes in the price of seed meal is presented in Table 9. Since the seed meal is a co-product, increases in its price will increase revenues, and by extension, the NPV and probability of positive NPV would increase. Graphical depictions of these sensitivity analyses can be found in the appendixes 1-3. Appendix 1 shows graphs of the probability of positive NPV given changes in the price of canola seeds. Appendixes 1 and 2 show similar cases for biodiesel and seed meal.

Summary and Conclusion

This paper investigates the economic feasibility of producing biodiesel from canola seeds in the State of North Carolina. The 10 MMGY plant will have an annual crushing capacity of 97,280 tons, generating 10M gallons of biodiesel, and two co-products of economic value, namely, seed meal and glycerin. Assuming a project lifespan of ten years, the plant can generate an average NPV of $18 million at a discount rate of 7.5%. Cash flow analysis shows that the plant could generate average annual revenue of $39.4 million from biodiesel sale, $9 million from seed meal, and $2 million from glycerin. Total revenues ($50.5 million) exceed total operating cost ($43.01 million) resulting in a net cash flow of $7.47 million per year. The probability of a positive NPV using the baseline data is 62.7%. Three factors are found to significantly affect the NPV, i.e., feedstock price (canola seeds), biodiesel price, and seed meal price. Regression analysis indicates that the NPV is most responsive to changes in the feedstock cost than to the other factors.

A sensitivity analysis is performed to ascertain the responsiveness of the NPV to fluctuations in the prices of canola seeds (feedstock), biodiesel, and seed meal. The simulations show that as the price of the feedstock increases, the mean NPV and probability of positive NPV decrease, and vice versa for decreases in feedstock price. At the baseline canola seed price of $304.9/ton, there is a 62.7% probability of a positive NPV, while a canola price of $213.4/ton, would imply an almost 99% chance of profitability. As biodiesel price increases, the NPV increases and so does the probability of a positive NPV. At the baseline biodiesel price, there is a 62.7% chance that

the plant will be economically successful while at a price of $5.11/gal (a 30% increase from the baseline price) there is a 90% chance of success.

Given the above results, a couple of caveats are warranted: Historically, feedstock prices have exhibited a high volatility that makes it difficult to predict the direction of movement. Additionally, the results presented are subject to a $1.00/gal subsidy on biodiesel production. Thus, removal of the subsidy renders the investment in biodiesel plant unprofitable.

Managerial Implications: The renewable fuel standard of 36 billion gallons of biofuels by 2022 present investment opportunities for agribusiness managers. It is now clear that this mandate cannot be fulfilled by conventional feedstocks alone. This calls for more research on the profitability of alternative feedstocks. The U.S. Environmental Protection Agency conducted a life cycle analysis of canola biodiesel and found that it meets the requirements of an advanced biofuel. Canola biodiesel has a higher superior quality than soybean biodiesel (based on cetane number rating). Canola also has a higher energetic productivity than soybean due to its higher oil content (40% compared to 20% for soybean).

The present study is relevant to the agribusiness industry of North Carolina in that it informs managerial decision-making regarding investment in canola biodiesel production in the state. We analyze the returns to investment in a biodiesel plant that has an annual production capacity of 10 million gallons. The study assesses under different scenarios, the riskiness involved in investing in such a biodiesel production enterprise. The risk analysis controls for factors outside the control of the decision maker by developing probability distributions of key input and output variables. The study finds that the main drivers of profitability of an investment in a canola biodiesel processing plant are; price of biodiesel, price of canola seeds, and prices of co-products like seed meal and glycerin. Like in any forecasting process, the caveat remains that the analyses herein presented are based on the assumptions of the model and outcomes are subject to change depending upon changing economic conditions. Most importantly, future changes in prices of the feedstock (canola seeds) and major products (biodiesel, seed meal and glycerin) are likely to impact the profitability of biodiesel production. Furthermore, changes in government policies, such as an increase or decrease in the current $1.00/gallon subsidy on biodiesel production could affect the industry.

It also merits mention that while canola is relatively new in North Carolina, experimental research has shown that it has a good potential as a winter annual. North Carolina farmers who already grow winter wheat could also grow canola since both crops have very similar requirements. Thus, the availability of feedstock (a major determining factor to invest in biodiesel production) depends on whether farmers will have a ready market if they choose to grow canola. This may also have implications on acreage allotment to other crops like wheat and soybean—two major crops currently grown in North Carolina. Currently, soybean is by far the largest feedstock for biodiesel production not only in North Carolina but the U.S. as a whole. Achieving a nationwide B2 target (2% biodiesel blend in diesel transportation fuel) would require about 2.8 million metric tons of vegetable oil or 30% of the U.S. soybean crop (BM&BR, 2008). The biodiesel mandate, obviously, cannot be met by soybean alone. This underscores the need to supplement with other feedstock alternatives such as canola.

Table 7. Sensitivity Analysis of the Impact of Canola Seed Price on the Probability of Success (NPV>0), Canola seed price ($/ton).

NPV/Scenario	-30%	-20%	-10%	Baseline	10%	20%	30%
	($213.4)	($243.9)	($274.4)	($304.9)	($335.4)	($365.9)	($396.4)
†Mean NPV	79.2	58.8	38.5	18	-2.2	-22.5	-42.9
†Min NPV	-32.3	-52.6	-73	-287	-113	-134	-154
†Max NPV	230	209	189	191	148	128	107
Pr (NPV>0)	98.7%	94.3%	79.5%	62.7%	44.5%	28.7%	18.3%

† Values in $ Million, computed from simulations

Table 8. Sensitivity Analysis of the Impact of Biodiesel price on the Probability of Success (NPV>0), Biodiesel price ($/gal)

NPV/Scenario	-30%	-20%	-10%	Baseline	10%	20%	30%
	($2.75)	($3.14)	($3.54)	($3.93)	($4.32)	($4.72)	($5.11)
†Mean NPV	-42.5	-22.4	-1.7	18	38	59	79
†Min NPV	-420	-400	-380	-287	-339	-139	-299
†Max NPV	83	103	124	191	164	185	205
Pr (NPV>0)	26%	40.7%	56%	62.7%	77.1%	85.5%	89.8%

† Values in $ Million, computed from simulations

Table 9. Sensitivity Analysis of the Impact of Canola Seed meal price on the Probability of Success (NPV>0), Canola seed Meal price ($/ton).

NPV/Scenario	-30%	-20%	-10%	Baseline	10%	20%	30%
	($114.9	($131.3)	($147.7)	($164)	($180.5)	($196.9)	($213.4)
†Mean NPV	-0.27	5.8	12	18	24	30	36
†Min NPV	-384	-377	-371	-287	-359	-353	-347
†Max NPV	185	191	197	191	210	216	222
Pr (NPV>0)	54.2%	59%	62.7%	62.7%	69.6%	71.9%	75.1%

† Values in $ Million, computed from simulations

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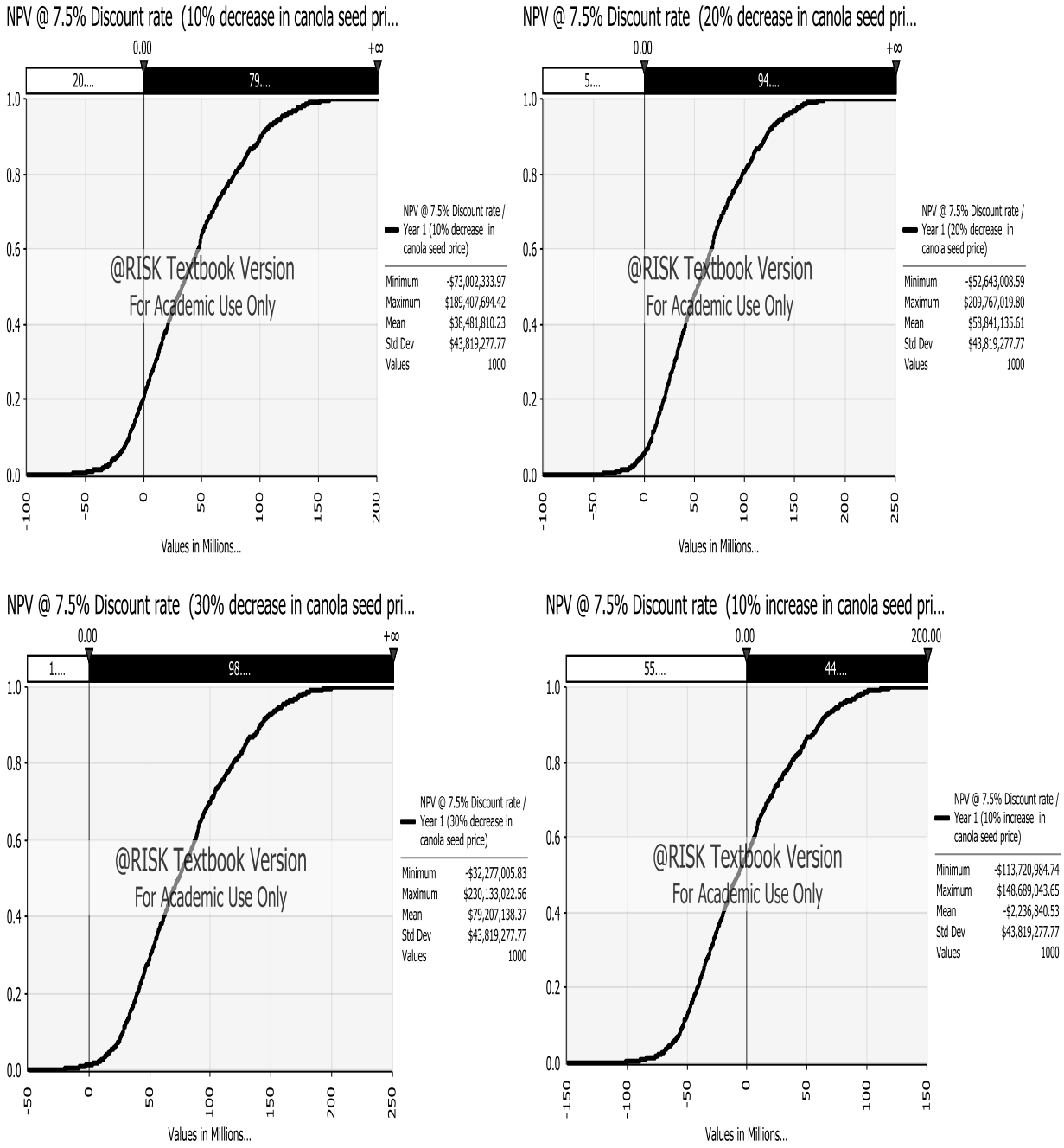
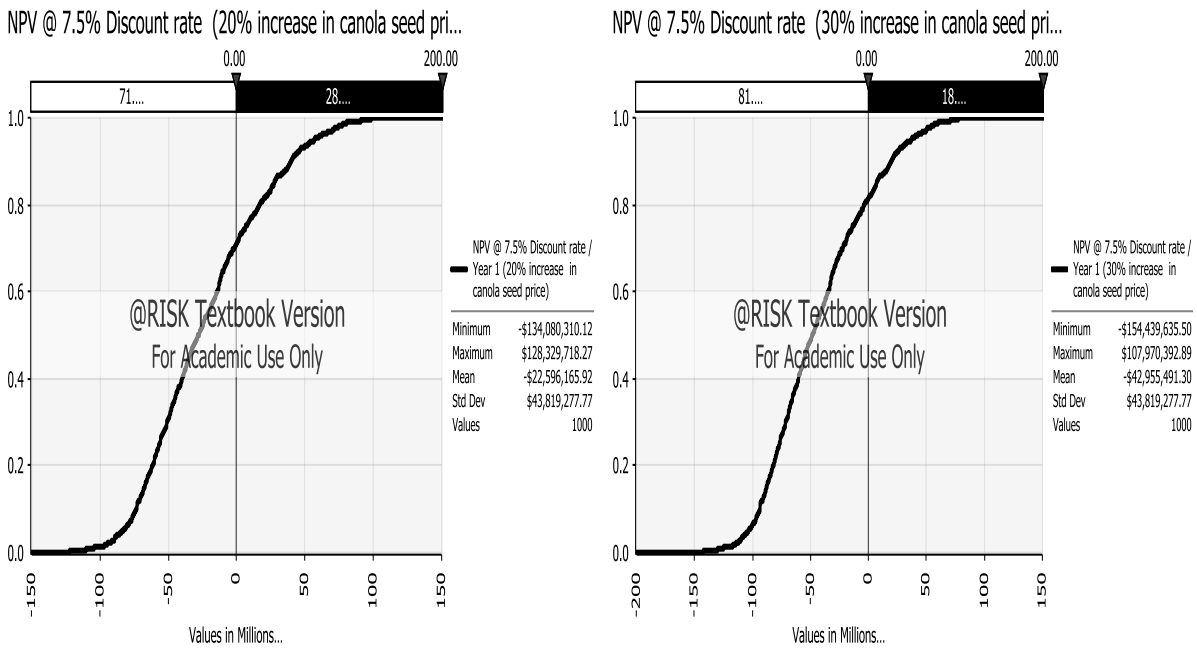
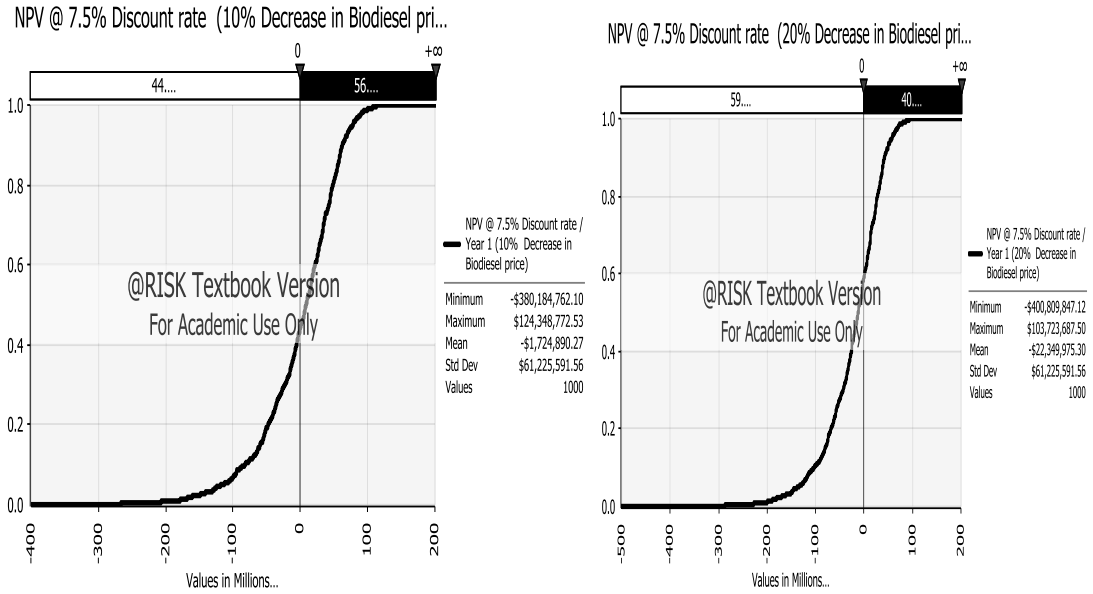
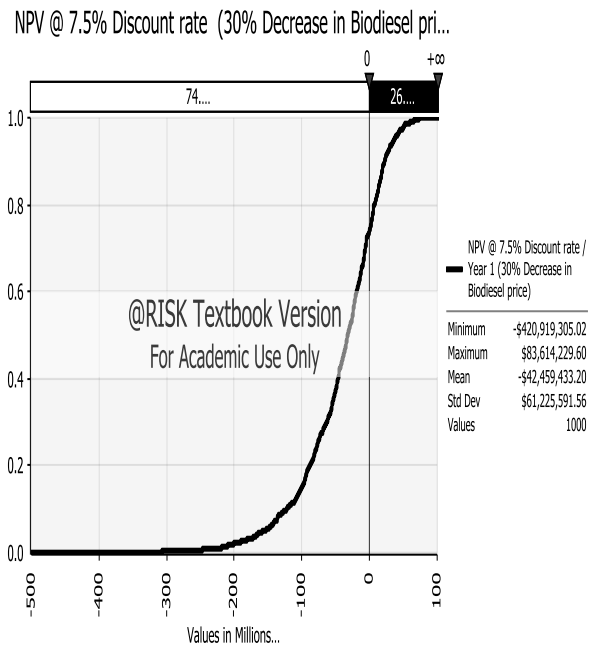
Appendix 1. Sensitivity Analysis of NPV to Changes in Canola Seed Prices (Pr NPV > 0)

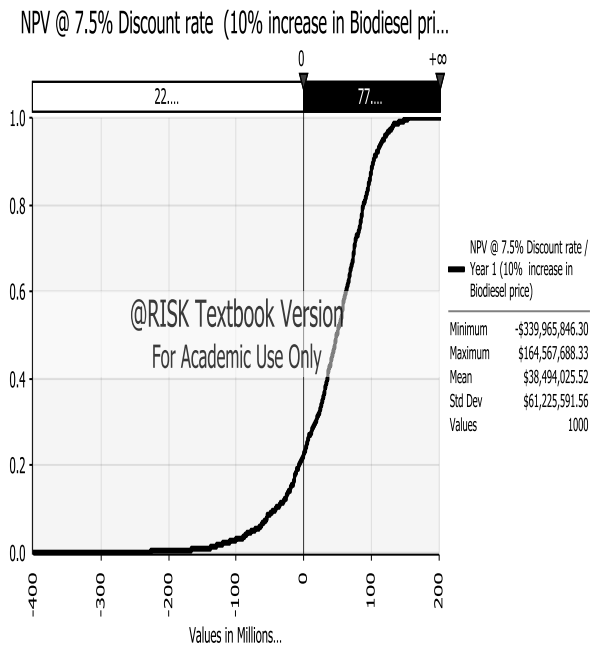


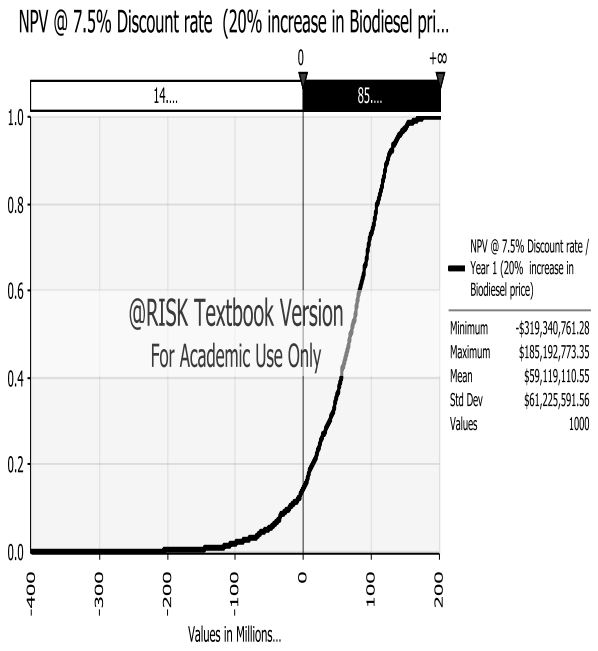


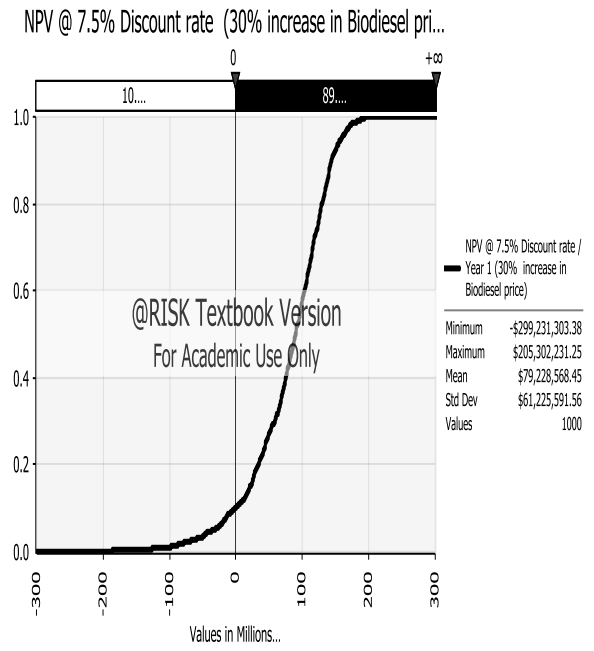
Appendix 2. Sensitivity Analysis of NPV to Changes in Biodiesel Prices (Pr NPV > 0)



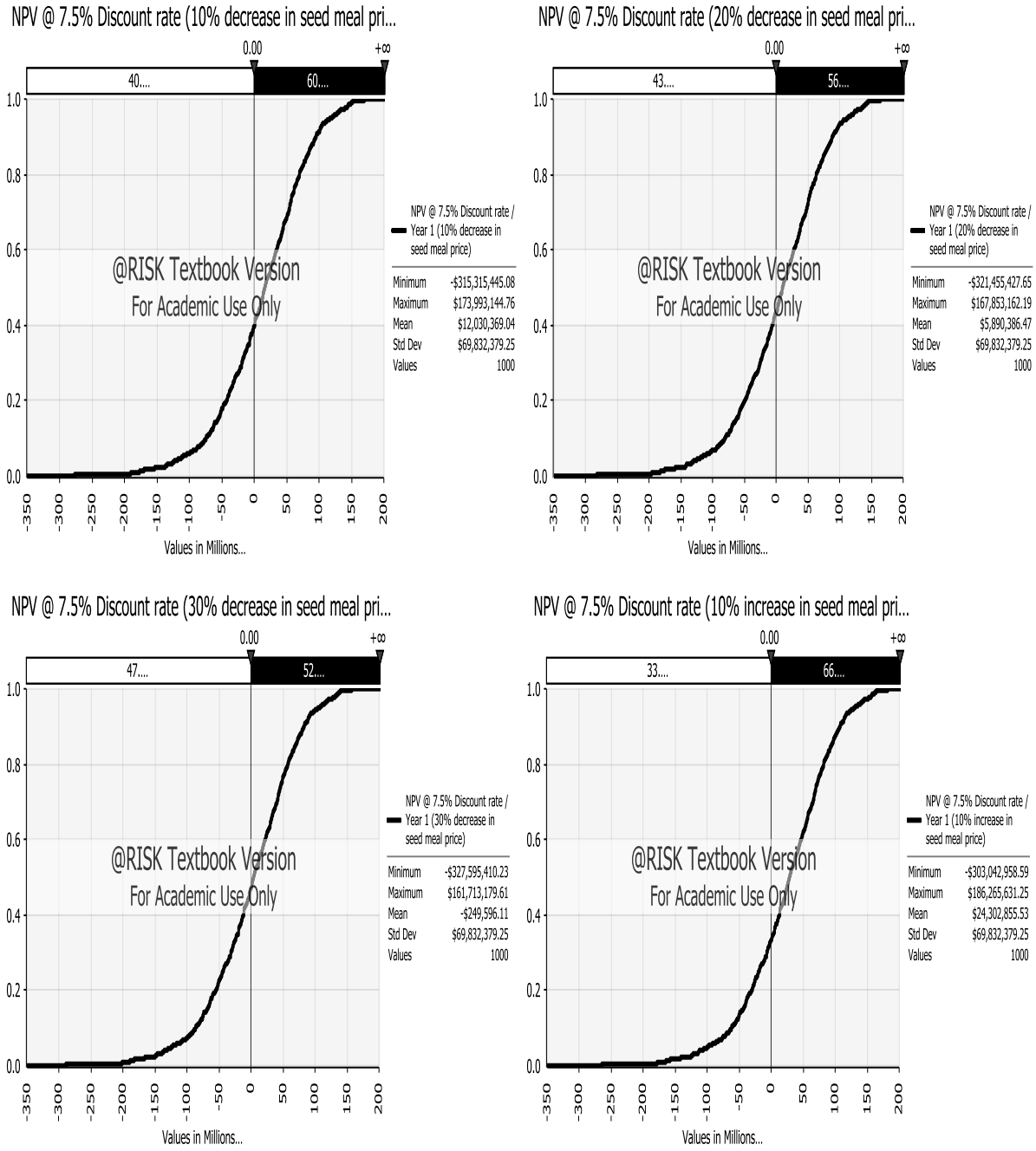


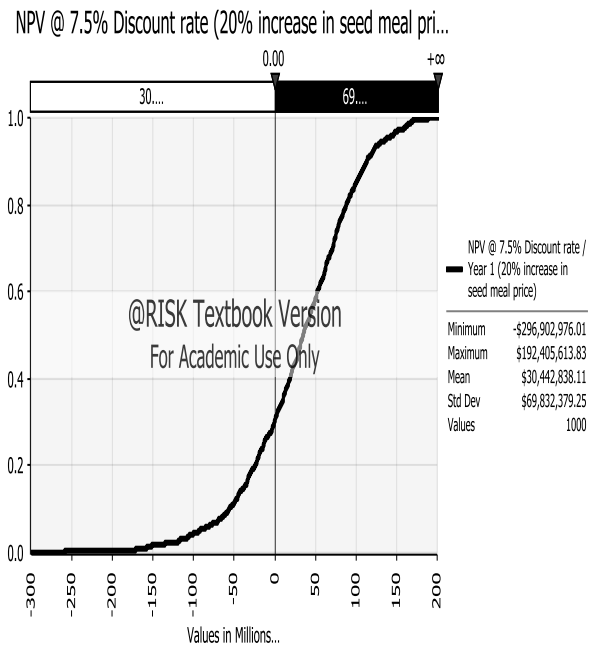


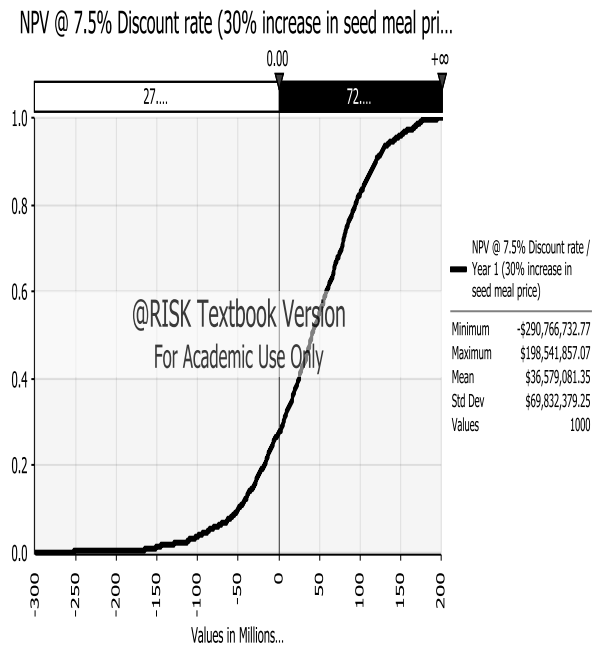




Appendix 3. Sensitivity Analysis of NPV to Changes in Canola Seed Meal Prices (Pr NPV > 0)







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Consumer Willingness to Pay a Premium for Organic Fruit and Vegetable in Ghana

Victor Owusu[ⓘa] and Michael Owusu Anifori[b]

[a] *Senior Lecturer, Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

[b] *MPhil Student, Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

Abstract

This paper analyzes the willingness of consumers to pay a premium for organic watermelon and lettuce using contingent valuation data from urban Kumasi in Ghana. The effects of the determinants of consumer willingness to pay a premium are estimated with a bivariate Tobit model. The empirical findings indicate that in addition to socioeconomic characteristics, product freshness and cleanness tend to have positive effects on consumer willingness to pay a premium for organic watermelon compared to conventional watermelon. Whereas product size has a negative influence on consumer willingness to pay premium for organic lettuce, less insect damage to vegetables tends to have a positive effect. The study estimates the willingness to pay a premium for organic watermelon/lettuce compared to conventional watermelon/lettuce. The estimated mean consumer willingness to pay premium for 1 kilogram of organic watermelon is GH¢0.5554 (US$ 0.4575) and that of organic lettuce is GH¢1.2579 (US$1.0361).

Keywords: Africa, consumer perceptions, Ghana, organic foods, willingness-to-pay

ⓘCorresponding author: Tel: + 233 242 832330
Email: V. Owusu: vowusu.agric@knust.edu.gh
M.O..Anifori: kanifori@yahoo.com

Introduction

Organic fruits and vegetables are the fruits and vegetables like watermelon and lettuce which are produced without the use of chemical fertilizers and pesticides. Due to food safety and environmental quality concerns, policy makers worldwide are attaching more importance to the production and consumption of such food products. The consumption of fresh organic food products could enhance the prevention of some of the health hazards associated with the consumption of conventional foods. Indeed, the risk of consuming conventional foods in Africa including Ghana could be traced to inappropriate use of chemical pesticides and inorganic fertilizers by agricultural producers who may or may not be aware of the associated health hazards of the chemical residues (Nouhoheflin et al. 2004).

Fresh organic fruits and vegetables could contribute significantly to employment generation, wealth creation and poverty alleviation in Ghana since they constitute important raw materials for the local food industries as well as the fast growing restaurants and supermarkets in the country (Nouhoheflin et al. 2004; Norman 2007). Organic production requires fewer inputs (energy, pesticides and so on) and tends to improve soil quality (Hole et al. 2005; Dabbert 2006). Moreover the multiplying effect on farmers' income depending on the income inequality could reduce poverty. Traditionally, households in Ghana have consumed conventional fruits and vegetables. An important approach to achieve food safety and minimize the health hazards associated with fruit and vegetable consumption is the promotion of consumption of organic fruits and vegetables in the country. This in turn requires reliable information on consumer willingness to pay a premium for organic fruits and vegetables (specifically, watermelon and lettuce) and their determinants in Ghana.

In spite of the numerous advantages of consumption of organic food products, information on their market demand and prospects in Ghana appear to be limited (IFOAM 2003). A number of consumer studies have examined the consumption of organic food products in developed countries (Wier and Calverly 2002; Cranfield and Magnusson 2003). However, few consumer studies on organic food products exist in Ghana (Nouhoheflin et al. 2004) and other developing economies (Piyasiri and Ariyawardana 2002; Rodriguez et al. 2007; Aryal et al. 2009). In particular, issues concerning consumer willingness to pay (WTP) a premium for organic fruits and vegetables compared to conventional fruits and vegetables in Ghana have not been rigorously addressed.

The main goal of the present paper therefore is to analyze the willingness of consumers to pay a premium for organic watermelon and lettuce in the Kumasi Metropolis of Ghana. The paper contributes to the literature on consumer preference for organic food products in Africa. The main hypothesis tested is that apart from socioeconomic characteristics of consumers, consumer perceptions concerning product attributes tend to influence consumer willingness to pay (WTP) a premium for organic watermelon and lettuce compared to conventional watermelon and lettuce.

The next section briefly discusses the literature on consumer WTP a premium for organic food products. Section 3 presents the theoretical foundation and the empirical model. Section 4 describes the data employed. Section 5 discusses the empirical results. Section 6 discusses implications of the study for managers and scholars. Section 7 provides the concluding remarks.

Literature on Consumer Willingness to Pay a Premium for Organic Foods

Consumer demand for organic products has received some attention in the consumer choice literature. Various authors have employed different techniques such as contingent valuation (Misra et al. 1991; Boccaletti and Nardella 2000; Gil et al. 2000; Krystallis and Chryssohoidis 2005), choice experiments (Wang and Sun 2003; Stolz et al. 2011) and hedonic pricing approach (Nouhoheflin et al. 2004). In contingent valuation surveys, hypothetical markets are set up in which consumer willingness to pay for products are solicited by asking respondents to value the products contingent on the available market. Where market prices already exist for the product, contingent valuation surveys tend to focus on the premiums that consumers are willing to pay for the product. Some contingent valuation surveys have employed the single-bounded approach where individuals are offered only one bid to pay or reject (see for instance, Haghiri et al. 2009). The doubled-bounded approach employed in this study is often used extensively in valuing nonmarket goods because it incorporates more information on individuals WTP. Also it provides more efficient estimates and tighter confidence intervals (Hanemann et al. 1991). With regards to the choice experiments (CV), one drawback is that different food quality attributes are assumed to be independent of attributes that are not provided to respondents in the survey or experiment (Gao and Schroeder 2009). The hedonic pricing approach on the other hand, imputes prices of attributes based on the relationship between the observed prices of differentiated products and the number of attributes associated with these products. However, it provides very little guidance on the choice of the proper functional form and as such may lead to inconsistent estimates.

Misra et al. (1991) and Boccaletti and Nardella (2000) used contingent valuation and analyzed consumer willingness to pay for pesticide-free fruits and vegetables in Italy and the United States of America. Gil et al. (2000) employed contingent valuation and found that the willingness of consumers to pay premiums for organic fruits and vegetables was high in Spain. With choice experiment (CE), Wang and Sun (2003) examined consumer preferences and demand for organic apples and milk in a conjoint analysis framework. Stolz et al. (2011) employed latent class models and established that consumers who strongly prefer organic products are less price sensitive than those who prefer conventional products. Nouhoheflin et al. (2004) employed the hedonic pricing approach, which is an indirect method of valuation, to assess consumer perceptions and willingness to pay premiums for organic vegetables compared to conventional vegetables in Benin and Ghana. Their empirical findings revealed a consumer willingness to pay of more than 50 percent price premium for chemical-free vegetables.

Other studies have analyzed consumer preferences for organic products on the market with various statistical techniques. Employing a two-limit Tobit model, Gifford and Bernard (2006) found out that the likelihood that consumers will purchase organic foods is influenced by the potential benefits from organic methods and perceived risk from conventional agricultural methods. Briz and Ward (2009) applied a multinomial logit model in their study on consumer awareness of organic products, and found out that awareness of organically-produced foods alone does not necessarily translate into actual consumption. Rather, the demand for organically grown products is achieved through understanding the linkages between the awareness and purchasing decisions of the consumer. Verhoef (2005) investigated consumer purchases of organic meat with a probit model and found out that not only are rational economic motives

necessary for consumers to pay premiums for organic products, but emotional motives such as fear, empathy and guilt are relevant. Michaelidou and Hassan (2010) examined the factors which affect rural consumer purchase of organic and free-range produce in Scotland and found direct relationships between consumer attitudes toward organic food and factors such as food safety concerns, ethical lifestyle and price perceptions. Cranfield and Magnusson (2003) analyzed Canadian consumer's willingness-to-pay for pesticide free food products with an ordered probit model. While the use of the ordered probit model is novel, such an analysis cannot lead to the estimation of a premium; it can only lead to what is associated with being in one of the WTP categories.

Empirical literature on consumer surveys reveal that consumers' socio-economic characteristics such as age, gender, level of education, income level, household size as well as the level of consumers' awareness and perceptions, product price, taste, size, freshness and cleanness tend to influence consumers' willingness to pay (WTP) for organic food products. Govindasamy and Italia (1999) showed that younger consumers, regardless of gender, paid higher premiums for organic products. Consistent with this finding, Liu et al. (2009) found an inverted-U-shape relationship between age and consumer WTP, indicating that WTP for additive free foods increases with age but decreases as age increases beyond a threshold age. However, Darby et al. (2008) found no significant impact of age on consumer WTP. Some consumer studies have shown females in particular to be more willing to pay higher premiums for safe foods (Williams and Hammitt 2000; Williams and Hammitt 2001; Liu et al. 2009). Darby et al. (2008) and Liu et al. (2009) found education to be positively correlated with WTP statistically.

Empirical results on the effect of income on consumer WTP for safety foods appear to be mixed. Since consumer WTP for food safety is negatively correlated with the marginal utility of money, consumer WTP is expected to increase as income of the consumer increases (Liu et al. 2009). Other empirical studies did not find income as a significant determinant of consumer WTP for organic food products (Darby et al. 2008; Voon et al. 2011). In a study on multi-ingredient organic foods, Batte et al. (2007) observed that shoppers who were aware of the National Organic Program on organic seal for food products were more willing to pay a premium price. Concurring with this proposition, Liu et al. (2009) pointed out that the level of consumers' cognition of food safety has a positive impact on WTP. Michaelidou and Hassan (2008) argue that consumers are more likely to develop positive attitudes toward the health enhancing attributes of organic food since organic food is generally regarded as more nutritious and safer than conventionally-produced food.

In addition to these factors, literature suggest that apart from consumer perceptions on private effects such as health , taste and quality, external effects such as impact on soil quality, energy use and biodiversity also matter in consumer preferences for organic foods (Stolze et al. 2000; Bengtsson et al. 2005; Hole et al. 2005). Dabbert (2006) for instance argued out that consumer perception on external effects such as ground and surface water, climate and air, farm input and output, animal health and welfare are relevant consideration in consumer choices for organic foods.

Rigorous consumer studies on organic products have not paid adequate attention to sub-Saharan Africa, and for that matter Ghana, making market information on organic products scanty. The

present paper therefore contributes to a better understanding of consumer choice of organic products in Africa. It provides empirical estimates of consumer willingness to pay premiums for organic watermelon and lettuce compared to conventional watermelon and lettuce in Kumasi, Ghana by emphasizing that apart from consumer socioeconomic characteristics, consumer perceptions of organic food attributes influence consumer preferences for organic fruits and vegetables.

Theoretical Foundation and the Empirical Model

Consumers generally face a two-fold choice decision. This comprises the specific good to choose and how much to consume of the chosen good. Consumer willingness to pay a premium for a particular good is considered as a choice problem within the framework of consumer-stated preference. This method assesses the value of non-market goods by using individuals' stated behavior in a hypothetical setting. Revealed preference, on the other hand, assesses the value of non-market goods by using the actual (revealed) behavior on a closely related market.

A rational consumer i is assumed to choose from a bundle of organic agricultural product (γ^1) and conventional product (γ^0) that gives the higher utility. Thus, the consumer is willing to pay a premium for a given organic food product if the expected utility of consuming the organic product $E[\Omega(\gamma^1)_i]$ is positive and exceeds the expected utility of consuming the conventional food product $E[\Omega(\gamma^0)_i]$. Consumer WTP a premium for a food product is specified as a function of a change in utility arising out of the consumer choice: $\text{WTP} = h[\Delta\Omega(\gamma)]$, where $\Delta\Omega(\gamma)$ is the change in utility and $h' > 0$. Notably, the consumer chooses the organic food γ^1 over the conventional food γ^0 if the change in utility is positive $\left[\Delta\Omega(\gamma) = \Omega(\gamma^1) - \Omega(\gamma^0) > 0\right]$ for all $\gamma^1 \neq \gamma^0$. The utility of the consumer is however not observable. What is observed is whether or not the consumer chooses to pay a premium for the organic product. To analyze this consumer choice behavior, the present paper employs the double-bounded dichotomous choice framework proposed by Hanemann et al. (1991).

With the double-bounded dichotomous choice approach, two consecutive bids are proposed to a consumer. The second bid is contingent upon the response to the first bid. The consumer who responds "YES" to the first bid P_i^1 is presented with a second higher bid P_i^{2H} (that is $P_i^{2H} > P_i^1$). A bid is the price of the organic food proposed to the respondent. If the response to the first bid is "NO", the respondent is presented with a second lower bid P_i^{2L} (that is $P_i^{2L} < P_i^1$). The possible outcomes are the responses "$YES-YES$","$YES-NO$", "$NO-YES$" and "$NO-NO$".

The present paper employs a bivariate Tobit model to quantify the effects of the determinants of WTP premiums. This approach is justified because it takes account of the possible zero WTP responses; it also takes account of the joint cross-equation correlation among the WTP premiums for organic watermelon and lettuce (Blundell and Meghir 1987; Carlsson and Johansson-Sterman 2000; Greene 2008). Theoretically, consumers who eat lettuce as salad tend to eat fresh watermelon as dissert. In the tropics, people tend to prefer fresh watermelon as it compensates

for the loss of water from the body due to the high temperatures. Consumption of fruits and vegetables has also increased in Ghana of late due to the government's effort of encouraging consumers to be nutritionally conscious in their dietary intakes. The bivariate Tobit model for organic watermelon and lettuce is expressed in Equation (1):

$$(1) \quad R_{ij} = \begin{cases} R_{ij}^{*} = Z_{ij}\beta + \varepsilon_{ij}, & \text{if } R_{ij}^{*} > 0;\ \varepsilon_{ij} \sim MVN(0, \sum);\ j\text{=organic water melon, organic lettuce} \\ 0, & \text{if } R_{ij}^{*} \le 0 \end{cases}$$

where R_{ij} is a censored dependent variable indicating the proposed premium or monetary amount in Ghana Cedis per kilogram (GH¢/kg) that a consumer i who responds $"YES-YES"$ or $"YES-NO"$ or $"NO-YES"$ to the two bids is willing to pay for the organic food product j, and zero observation for a consumer i who responds $"NO-NO"$ to the two bids. β is a vector of parameters to be estimated, Z_i summarizes the consumer specific socioeconomic characteristics, consumer awareness of organic fruits and vegetables and consumer perceptions of organic food attributes, and ε_{ij} is an error term which is multivariate normally distributed.

The consumer specific socioeconomic characteristics investigated in the WTP models include age, gender, marital status, number of years of schooling, children (specifically, whether a household has children below 15 years of age), and income levels (specifically, low, middle and high income). Consumer awareness includes awareness of organic food products and awareness of chemical residues in conventional foods. Also investigated in the WTP models are the consumer perceptions (specifically, concerning price and taste of organic foods) and consumer attitudes toward organic food attributes (specifically, product freshness, size, cleanness and insect damage).

Higher educated consumers are expected to pay higher price premiums for organic foods since they tend to appreciate issues of preventive health care through the consumption of chemically-free food products better than consumers with no education (Piyasiri and Ariyawardana 2002, Haghiri et al. 2009). Children within different age cluster groups are expected to influence their parents' WTP premiums for food products due to the differences in the nutrition intake of children and the cost of raising them (Lino and Carlson 2009). For instance, parents with children less than 15 years of age are expected to pay higher premium prices for organic fruits and vegetables compared to conventional fruits and vegetables. The income variables (higher and middle income) are expected to be positively related to the WTP premiums for organic fruits and vegetables compared to conventional fruits and vegetables in order to agree with economic theory (Asafu-Adjaye 2000). It is therefore hypothesized that high affordability will positively impact willingness to pay for organic foods compared to conventional foods (Voon et al. 2011). The taste and price perception dummy variables are expected to have positive relationships with the WTP premiums for organic foods compared to conventional foods. Freshness, cleanness, size and less insect damage of organic fruits and vegetables are product attributes hypothesized to have positive effects on WTP premiums. The estimated WTP premium price for organic watermelon or organic lettuce is the predicted premium bid in Ghana Cedis per kilogram (GH¢/kg) of the dependent variable of each WTP regression model. The conventional GHK–algorithm is employed to estimate the model (Train 2003).

The Survey Design, Sampling Method and Data

The data employed in this paper comes from a contingent valuation survey conducted among consumers in the Kumasi Metropolis of Ghana in 2008. While the sample used in this study is not representative of Ghana, Kumasi is the second largest and one of the fastest growing urban centers in Ghana. With an estimated population of 1.2 million and an annual growth rate of 2.6 percent (Ghana Statistical Service 2010), the economically active population in the metropolis is about 71.4 percent and a majority of them is self-employed in the private informal sector. The Kumasi Metropolitan Assembly, which has the administrative oversight over the city, has stratified the metropolis into low (50.7%), middle (30%) and high (19.3%) income residential areas based on the population density, housing quality and the level of community facilities (GLSS 2000). The low-income area comprises 28 suburbs, the middle-income areas have 32 suburbs and the high-income areas comprise 17 suburbs.

A two-stage stratified sampling procedure was employed in this study, based on the income stratification of households in the city. The income stratification supports the widely-held view that incomes of households influence their consumption patterns (Boccaletti and Nardella 2000). The city's suburbs were first randomly selected, followed by a random selection of household heads and individuals in charge of food purchases in the household. To ensure one-third proportional representation of each income stratum in the sample, 10 suburbs were randomly selected from the low-income suburbs, 11 suburbs from the middle-income suburbs, and 6 suburbs from the high income suburbs in the metropolis. Finally, 218 consumers, 127 consumers and 84 consumers respectively were randomly selected from the sampled low, middle and high-income suburbs making a total sample of 429 consumers.

Direct face-to-face interviews with respondents were undertaken during the contingent valuation survey. Carson (2002) points out that a direct face-to-face interview is a more reliable approach in contingent valuation studies. The face-to-face interview offered one-on-one interactions with the consumers and provided an opportunity to explain some of the questions to respondents with low literacy levels. This did not introduce any significant bias into the study. The views of the respondents were solicited through open-ended and closed-ended questions made up of pre-coded responses. The questions focused on consumer specific socio-economic characteristics. Information was also sought on consumer awareness and perceptions of organic food products, and their preferences for product-specific attributes. The perceptions of the consumers on the benefits and qualities of organic food products were measured on a five-point Likert scale with perception indices from averages of coded responses comprising, strongly disagree (-1), disagree (-0.5), neutral (0), agree (+0.5) and strongly agree (+1). Apart from this, specific perception dummies indicating 1 if the consumer strongly agrees that organic foods are tastier or expensive and 0 otherwise, were also captured in the questionnaire. In the double-bounded dichotomous choice framework, the relevant data on how much premium consumers were willing to pay for organic lettuce and organic watermelon were collected. The respondents were presented with a first bid. Those who accepted the initial amount were given a second higher bid but those who declined the initial bid were offered a second lower bid. In both scenarios, some respondents accepted the proposed bids while others declined.

The prices of fresh conventional watermelon and lettuce were collected from food retail points at the Asafo and Central Markets in Kumasi. Additional information on prices of lettuce and watermelon was obtained from the Gyinyase Organic Vegetable Growers' Association (GOVGA) in Kumasi, and from the Ghana Organic Agriculture Network (GOAN). The average market price of 0.5kg of conventional lettuce was GH¢0.10 (US$0.08). The consumers were asked if they would be willing to purchase organic lettuce at a premium (i.e. relatively higher price). Specifically, they were asked if they would be willing to pay a premium of GH¢0.15 (US$0.12) which is 50% more than the price of the conventional lettuce. This proposed premium was used as a lower bid price for the organic lettuce. Different premium levels (see Table 1) were randomly assigned to different respondents. Those who responded "YES" to the first bid were randomly assigned higher premium bids, computed based on the lower bid price. Those who responded "NO" to the first bid were randomly assigned discount bid prices (i.e.1% to 30%, 31% to 40% premium, 41% to 50%). Similarly, the average market price of 3.50kg of conventional watermelon was GH¢1.50(US$1.24). A price premium of GH¢1.80 (US$1.48) which is 20% higher than the conventional watermelon was computed and used as the lower bid. For those who expressed "YES" to the first bid, we then randomly assigned higher premium bids

Table 1. Distribution of WTP price premiums for organic lettuce and watermelon

Responses	**YES–YES**	**YES–NO**	**NO–YES**	**NO–NO**	**Total**
Lettuce					
WTP 1% premium				17 (4)	17 (4)
WTP 2% to 30% premium			21 (4.9)	8 (1.9)	29 (7)
WTP 31% to 40% premium		7 (1.6)	17 (4)	14 (3.3)	38 (9)
WTP 41% to 50% premium		3 (0.7)	22 (5.1)	5 (1.2)	30 (7)
WTP 51% to 60% premium	11 (2.6)	15 (3.5)		12 (2.8)	38 (9)
WTP 61% to 70% premium	105 (24.5)	9 (2.1)			114 (27)
WTP 71% to 80% premium	49 (11.4)	8 (1.9)			57 (13)
WTP 81% to 90% premium	83 (19.3)				83 (19)
WTP 91% to 100% premium	19 (4.4)				19 (4)
WTP $\geq 100\%$ premium	4 (0.9)				4 (1)
Total	271 (63.2)	42 (9.8)	60 (14)	56 (13)	429 (100)
Watermelon					
WTP 1% premium				14 (3.3)	14 (3.3)
WTP 2 % to 20% premium		10 (2.3)	7 (1.6)	18 (4.2)	35 (8.2)
WTP 21% to 40% premium	145 (33.8)	13 (3)	15 (3.5)	11 (2.6)	184 (42.9)
WTP 41% to 60% premium	103 (24)	19 (4.4)	40 (9.3)	15 (3.5)	177 (41.3)
WTP 61% to 80% premium	11 (2.6)				11 (2.6)
WTP 81% to 100% premium	6 (1.4)				6 (1.4)
WTP $\geq 100\%$ premium	2 (0.5)				2 (0.5)
Total	267 (62.2)	42 (9.8)	62 (14.5)	58 (13.5)	429 (100)

Note: Figures in parentheses are percentages
WTP 1% price premium is the same as the price of the conventional product
Source: Authors' calculations

based on the lower bid price (see Table 1) to different respondents. Those who responded "NO" to the first bid were also randomly assigned discounts bids based on the lower bid price..[1]

Empirical Distributions of WTP and the Postulated Determinants

More consumers are willing to pay relatively higher premiums for organic lettuce and watermelon compared to conventional lettuce and watermelon. Consumers with zero WTP observations (NO-NO responses) are those who expressed unwillingness to pay (UWTP) price premiums. With the exception of the respondents who expressed WTP price premiums of 51% to over 100% for organic lettuce, respondents from all the WTP price premiums categories indicated NO-NO responses. Similarly, with the exception of the respondents who expressed WTP price premiums of 61% to over 100% for organic watermelons; all the WTP price premiums categories indicated NO-NO responses (see Table 1).

The definitions and sample statistics of the relevant variables and the analytical results of the differences in the means of the variables are presented in Tables 2 and 3. Regarding the socioeconomic characteristics, perceptions and preferences for organic food attributes, the significant levels suggest some differences between respondents who expressed willingness to pay (WTP) and those who indicated unwillingness to pay (UWTP) price premiums for organic lettuce and watermelon compared to conventional watermelon and lettuce. For instance, some significant difference exists between respondents with WTP and UWTP price premiums for organic lettuce compared to conventional lettuce with regards to children who are less than 15 years of age. Notably, the children of consumers with WTP premiums who are less than 15 years are significantly higher than those with UWTP price premiums.

The awareness on chemical residues in conventional foods by respondents with WTP price premiums is relatively higher than those with UWTP price premiums. Govindasamy et al. (2006) argue that consumer awareness on organic foods tend to influence their likelihood to pay higher premiums for organic foods compared to conventional foods. Some significant differences also exist between the preferences for freshness of organic food products by consumers. Also 50% of respondents with WTP price premiums indicated their preferences for freshness of organic fruits compared to 26% of the respondents with UWTP price premiums.

The impacts of the respondents' perception concerning private effects such as health, taste and quality of organic products and external effects such as soil quality and biodiversity on the WTP estimates are presented in Table 4. The respondents' perceptions on the benefits, quality and the environmental advantages of organic vegetables and fruits are generally positive.

[1] Respondents who declined the second higher bid but expressed their WTP the first bid (YES-NO) were assigned premium bids based on the first bid. Those who declined the first bid but expressed their WTP the second lower bid (NO-YES) were assigned premium prices based on the lower bid. Apart from the NO-NO respondents who expressed WTP of exactly 1% premium for the organic vegetable or fruit, the other NO-NO respondents (with protest bids) were further asked in the contingent valuation survey how much they would be willing to pay for the organic vegetable or fruit. They also indicated WTP of exactly 1% price premium for the organic vegetable or fruit.

Table 2. Variables used in the regression model of consumer WTP for organic lettuce

Variable	Definition of variable	WTP Mean (S.d)	UWTP Mean (S.d)	Difference in means
Socio-economic characteristics				
AGE1	1 if consumer's age is less than 35 years, 0 otherwise	0.51 (0.50)	0.52 (0.50)	-0.01
AGE2	1 if consumer's age is from 35 - 49 years, 0 otherwise	0.32 (0.47)	0.38 (0.49)	-0.05
AGE3	1 if consumer's age is above 50 years , 0 otherwise	0.17 0.37)	0.11 (0.31)	0.06
FEMALE	1 if consumer is a female, 0 otherwise	0.93 (0.26)	0.95 (0.23)	-0.02
MARISTAT	1 if consumer is married, 0 otherwise	0.61 (0.49)	0.55 (0.50)	0.05
CHILD	Children less than 15 years of age	3.48 (2.53)	2.68 (2.27)	0.80**
EDU	Number of years of schooling	8.59 (4.42)	8.28 (4.21)	0.31
INCLOW	1 if consumer's average monthly income is up to Gh¢100, 0 otherwise	0.50 (0.50)	0.57 (0.50)	-0.07
INCMID	1 if consumer's average monthly income is between Gh¢100 and Gh¢200, 0 otherwise	0.08 (0.26)	0.07 (0.26)	-0.01
INCHIGH	1 if consumer's average monthly income is more than Gh¢200, 0 otherwise	0.43 (0.50)	0.36 (0.48)	0.07
Awareness and perceptions				
ORINF	1 if consumer is aware of organic products, 0 otherwise	0.47 (0.50)	0.43 (0.50)	0.04
KNOW	1 if consumer is aware of chemical residues in conventional vegetables, 0 otherwise	0.84 (0.37)	0.93 (0.26)	-0.09**
TASTEDUM	1 if consumer strongly agrees that organic foods have better taste, 0 otherwise	0.94 (0.24)	0.96 (0.19)	-0.02
PRICEDUM	1 if consumer has strong agrees that the price of organic food is expensive, 0 otherwise	0.72 (0.45)	0.23 (0.43)	0.49 ***
Product attributes				
FRESH	1 if consumer considers freshness of vegetables, 0 otherwise	0.60 (0.49)	0.66 (0.48)	-0.06
SIZE	1 if consumer considers vegetable size, 0 otherwise	0.09 (0.28)	0.16 (0.37)	-0.07
INSDAM	1 if consumer considers less insect damage to vegetables , 0 otherwise	0.39 (0.49)	0.45 (0.50)	-0.06
CLEAN	1 if consumer considers cleanness of vegetable, 0 otherwise	0.01 (0.13)	0.02 (0.12)	-0.01

Note. 1 US Dollar ($) =1.2141 Ghana Cedi (GH¢) in 2008.
WTP indicates consumer willingness to pay and UWTP indicates consumer unwillingness to pay

Table 3. Variables used in the regression model of consumer WTP for organic watermelon

Variable	Definition of variable	WTP Mean (S.d)	UWTP Mean (S.d)	Difference in means
Socio-economic characteristics				
AGE1	1 if consumer's age is less than 35 years, 0 otherwise	0.51 (0.50)	0.53 (0.50)	-0.30
AGE2	1 if consumer's age is from 35 - 49 years, 0 otherwise	0.33 (0.47)	0.36 (0.48)	-0.40
AGE3	1 if consumer's age is above 50 years , 0 otherwise	0.17 (0.37)	0.10 (0.31)	0.06
FEMALE	1 if consumer is a female, 0 otherwise	0.92 (0.26)	0.97 (0.18)	-0.04
MARISTAT	1 if consumer is married, 0 otherwise	0.61 (0.49)	0.52 (0.50)	0.09
CHILD	Children less than 15 years of age	3.52 (2.54)	2.47 (2.16)	1.05***
EDU	Number of years of schooling	8.74 (4.06)	8.52 (4.25)	0.22
INCLOW	1 if consumer's average monthly income is up to Gh¢100, 0 otherwise	0.50 (0.50)	0.55 (0.50)	-0.05
INCMID	1 if consumer's average monthly income is between Gh¢100 and Gh¢200, 0 otherwise	0.07 (0.28)	0.09 (0.26)	-0.01
INCHIGH	1 if consumer's average monthly income is more than Gh¢200, 0 otherwise	0.43 (0.50)	0.36 (0.48)	0.06
Awareness and perceptions				
ORINF	1 if consumer is aware of organic products, 0 otherwise	0.48 (0.50)	0.38 (0.48)	0.10
KNOW	1 if consumer is aware of chemical residues in conventional fruits, 0 otherwise	0.84 (0.37)	0.93 (0.26)	-0.09**
TASTEDUM	1 if consumer strongly agrees that organic foods have better taste, 0 otherwise	0.94 (0.24)	0.95 (0.22)	-0.01
PRICEDUM	1 if consumer strongly agrees that the price of organic food is expensive, 0 otherwise	0.72 (0.45)	0.98 (0.13)	-0.26***
Product attributes				
FRESH	1 if consumer considers fruit freshness, 0 otherwise	0.50 (0.50)	0.26 (0.44)	0.24***
SIZE	1 if consumer considers fruit size, 0 otherwise	0.33 (0.47)	0.40 (0.49)	-0.06
INSDAM	1 if consumer considers less insect damage to fruit , 0 otherwise	0.26 (0.44)	0.24 (0.43)	0.02
CLEAN	1 if consumer considers cleanness of fruit , 0 otherwise	0.12 (0.32)	0.09 (0.28)	0.03

Note. 1 US Dollar ($) =1.2141 Ghana Cedi (GH¢) in 2008.
WTP indicates consumer willingness to pay and UWTP indicates consumer unwillingness to pay

Table 4. Consumer attitude and perceptions on organic food products

Statements	*Percentage of Consumers*					*Mean score*		
	Strongly disagree Score = -1	Disagree Score =0.5	Neutral score = 0	Agree Score = 0.5	Strongly Agree Score= 1	Consumer aware	Consumer not aware	Overall
Private effects								
Organic products are healthier	2	5	3	20	70	0.67	0.81	0.75
Organic products are tastier	2	3	4	21	70	0.69	0.83	0.76
Benefit perception index (BPI)						0.68	0.82	0.76
Organic products have no harmful effects	1	6	3	36	54	0.58	0.77	0.68
Organic products have superior quality	7	9	4	33	47	0.5	0.52	0.51
Quality perception index (QPI)						0.54	0.65	0.6
External effects								
Production of organic products improve the soil fertility	5	6	9	34	46	0.51	0.58	0.55
Production of organic products improve the soil flora and fauna	8	10	8	26	48	0.46	0.49	0.48
Environment perception Index (EPI)						0.49	0.54	0.52

Source: Authors' calculations.

For instance, more than half of the respondents strongly agree that organic lettuce and watermelon are healthier, tastier and have no harmful effects. About 20% of the respondents agree that organic foods are healthier and tastier whereas 36% and 33% respectively agree that organic foods have no harmful effects and are of superior quality than the conventional foods. Also about 46% of the respondents strongly agree that the production of organic products improves the fertility of the soil whereas 48% strongly agree that the production of organic products improve the soil flora and fauna. Averaging the scores for health and taste perceptions led to a positive benefit perception index, BPI=076 and averaging the scores for quality perceptions gave a positive quality perception index, QPI=0.60. Hughner et al. (2007) point out

that WTP price premiums of consumers are influenced by their perceptions on the benefits from consuming the organic food products. Similarly, averaging the scores for the soil fertility and biodiversity perceptions of the respondents led to a positive environment perception index (EPI) of 0.52. The positive soil quality perception (Bengtsson et al. 2005, Hole et al. 2005), and the biodiversity perception (Stolze et al. 2000, Dabbert 2006) of organic farming could influence the consumers' WTP for organic produce and also under certain circumstances, justify policy intervention. The perceptions of the respondents on the private effects are relatively higher than the external effects. These findings concur with empirical evidence provided by Haghiri et al. (2009). The results however need to be interpreted with caution because Dabbert (2006) pointed out that the comparison between the environmental effects of organic and conventional farming could pose a number of methodological challenges.

Empirical Regression Results

The maximum likelihood estimates of the bivariate Tobit model are presented in Table 5. The results of the relevant likelihood ratio test show that the null hypothesis that the estimated coefficients are jointly equal to zero is rejected at the 1% significance level in each WTP model (Table 5). The estimated correlation coefficient is positive and significantly different from zero at the 1% level, indicating that unobserved variables involved in each organic food product option are significantly positively related, and confirms that it is more efficient to model the two organic food products jointly rather than separately. The variable representing the presence of children less than 15 years of age in the household (CHILD) exhibits positive significant relationship with consumer WTP premiums for the two organic food products compared to the conventional food products. These empirical results concur with Gao et al. (2011) who observed that consumers with children within the cluster group of 6 to 12 years tended to have more preference for quality of fresh citrus fruits than those without children. The education variable (EDU) representing the number of years of schooling of consumers is positive and significant at the 5% levels in the WTP premium models for organic watermelon and lettuce. The results thus indicate that as the number of years of schooling of consumers' increases, they are likely to pay higher premiums for organic watermelon and lettuce compared to conventional watermelon and lettuce. The empirical results also agree with the studies by Du Toit et al. (2003) for consumers in South Africa and by Akgüngör et al. (2007) for Turkish consumers but disagree with a study by Pascucci et al. (2011) who found no significant impact of education on consumers' probability to change their consumption habits toward high quality food products.

The variables representing high income (INCHIGH) and middle income (INCMID) earners exhibit the hypothesized positive signs and are significant at the 10% level in the WTP premium model for organic lettuce. Asafu-Adjaye (2000) pointed out that income is expected to have significant positive relationships with consumer WTP premium, in conformity with economic theory. The study's findings are also consistent with that of Haghiri et al. (2009) with Canadian data. However, in a study by Voon et al. (2011), the hypothesis that high affordability will positively impact willingness to pay for organic foods compared to conventional foods was statistically rejected. They argue that the behavioral intentions of consumers are antecedents of their actual behavior. Statistically, age and gender are insignificant even at the 10% level. The empirical results agree with a study by Gao et al. (2011) on consumer preferences for fresh citrus in the U.S.

Table 5. Bivariate Tobit estimates on consumer WTP premiums for organic food products

	Lettuce		**Watermelon**	
	Coefficient	z-value	Coefficient	z-value
CONSTANT	-0.8055 *	-1.80	0.3730 ***	4.43
Socio-economic characteristics				
AGE 1	0.2039	1.08	0.0217	0.60
AGE 2	0.2254	1.12	0.0025	0.06
FEMALE	-0.1197	-0.48	-0.0688	-1.44
MARISTAT	-0.0425	-0.32	0.0304	1.20
CHILD	0.0664 ***	2.55	0.0136 ***	2.72
EDU	0.1736 **	2.05	0.0325 **	1.94
INCMID	0.4639 **	1.95	0.0352	0.73
INCHIGH	0.2388 *	1.76	0.0287	1.11
Awareness and perception				
ORINF	-0.0033	-0.03	0.0613 **	2.41
KNOW	0.3011 *	1.67	0.0811 **	2.33
TASTEDUM	0.5992 **	2.03	0.0514	0.95
PRICEDUM	1.3615 ***	9.12	0.2158 ***	8.22
Product attributes				
FRESH	0.0062	0.07	0.0465 **	2.69
SIZE	-0.3415 **	-2.08	-0.0192	-1.03
CLEAN	0.0389	0.27	0.0562 **	2.12
INSDAM	0.1924 **	2.06	-0.0145	-0.75
Observations	429			
Log-likelihood	-532.999			
$\chi^2 - statistic$	179.53***			
Cross-equation correlation (ρ_{L_WM})	0.7612 ***			

Source: Authors' calculations
*** =significant at 1%
** =significant at 5%
* = significant at 10%

Awareness of consumers concerning organic food products (ORINFO) has a positive significant relationship with the WTP premium for organic watermelon compared to conventional watermelon at the 5% level. The empirical result agrees with a U.S. consumer survey by Govindasamy et al. (2006) which posits that when consumers are aware of organic products compared to conventional products, they are likely to pay higher premiums for them. Consumer awareness of chemical residues in conventional food products (KNOW) positively influences their willingness to pay premiums for organic lettuce and watermelon compared to conventional watermelon and lettuce. The empirical results support the awareness hypotheses posited by Nouhoheflin et al. (2004) and Haghiri et al. (2009). The empirical results indicate significant positive relationships between consumer perceptions of taste and price of organic products and the WTP premium for the organic food products compared to conventional food products. The findings concur with a preposition by Voon et al. (2011) that positive perception towards organic food compared to conventional food positively impacts willingness to purchase organic food.
Freshness and cleanness of watermelon have significant positive effects (Table 5), indicating that consumers place higher premium on organic watermelon that is fresh and clean. In reality

freshness and cleanness are relevant for both organic and conventional foods. However in a situation where conventional produce is not handled properly, one is likely to observe our empirical results. The results also concur with an empirical finding by Pascucci et al. (2011) that consumers who are motivated to pay premiums for high-quality foods look out for freshness of organic foods. The negative significant coefficient of vegetable size indicates that consumers are not influenced much by the size of organic lettuce. Consumers on the other hand, pay more attention to insect damage to organic lettuce. The empirical findings thus suggest that consumers tend to consider less insect damage to organic lettuce more than its size when purchasing organic lettuce. Also freshness and cleanness are relevant product attributes consumers tend to look out for when they are purchasing organic watermelon for consumption.

The estimated mean WTP price premiums for 1 kg of organic lettuce and watermelon compared to conventional watermelon and lettuce are GH¢1.2579 (US$1.0361) and GH¢0.5554 (US$ 0.4575) respectively. The median WTP premium for 1kg organic lettuce is GH¢1.5257 (US$1.2567) and that of organic watermelon is GH¢0.5829 (US$0.4801).

Table 6. Estimated consumer willingness to pay premiums for organic food products

Statistic	**Watermelon**		**Lettuce**	
	WTP (GH¢/kg)	WTP (US$/kg)	WTP (GH¢/kg)	WTP (US$/kg)
Mean	0.5554	0.4575	1.2579	1.0361
Standard deviation	0.1289	0.1062	0.6733	0.5546
Median	0.5829	0.4801	1.5257	1.2567
Maximum	0.9092	0.7489	2.6465	2.1798
Minimum	0.2284	0.1881	-0.6207	-0.5112

Source: Authors' calculations
1 US Dollar (US$) =1.2141 Ghana Cedi (GH¢) in 2008

Implications of the Empirical Results for Managers, Management Scholars and Other Stakeholders

Based on the results of this study, the following implications of relevance to agribusiness managers, management scholars and other stakeholders are made. Governments, non-governmental organizations and other stakeholders could formulate policies that would encourage and promote the consumption of organic fruits and vegetables in the Kumasi Metropolis in Ghana. These policy measures should include creating awareness concerning the relevance of consuming organic watermelon and lettuce through effective marketing strategies and educational campaigns. In particular, these strategies should focus on labeling to assist consumers to differentiate organic food products on the market from the conventional foods. Educational campaigns should put emphasis on the socio-economic benefits to smallholder producers and the environmental benefits accruing to all society emanating from consuming organic watermelon and lettuce.

Business managers and retailers of organic watermelon and lettuce in the Kumasi Metropolis should pay more attention to handling and storage of the organic food products, as freshness,

cleanness and insect damage are crucial to consumers' willingness to pay premiums for these products. Agribusiness managers, wholesalers and retailers of fresh fruits and vegetables could be assisted and provided with the technical expertise on how to maintain the freshness of organic watermelon and lettuce so as to attract the maximum price premium and increase the patronage of the consumption of organic foods in Ghana.

Apart from consumer perceptions on private effects of organic foods, one of the key motivations for the interest in organic farming is the perceived environmental advantages. Although this study could only analyze the external or environmental effects such as soil quality and biodiversity, management scholars should examine in future studies the external effects such as ground and surface water, climate and air, farm input and output, animal health and welfare on consumer WTP for organic food products.

Concluding Remarks

This study has analyzed the willingness of consumers to pay premium prices for organic watermelon and lettuce compared to conventional watermelon and lettuce, using a contingent valuation data collected in 2008 from 429 consumers in the Kumasi Metropolis of Ghana. Consumer knowledge and perceptions of organic food products have been measured with perception indices. The factors which influence consumer WTP price premiums for organic watermelon and lettuce compared to conventional watermelon and lettuce have been analyzed with a bivariate Tobit model. Consistent with existing studies on consumer preferences for organic food products, the empirical results show that consumer socioeconomic factors, awareness and perceptions tend to influence their WTP premiums for organic watermelon and lettuce compared to conventional watermelon and lettuce. Consumers tend to pay premiums for organic melons that are fresh and clean. Whereas consumers do not pay much attention to the size of the organic product, they are willing to pay higher premiums for vegetables that have less insect damage. The estimated median WTP premium for 1kg organic lettuce is GH¢1.5257 (US$1.2567) and that of 1kg of organic watermelon is GH¢0.5829 (US$0.4801). Finally, the study makes recommendation of the relevance to agribusiness managers and management scholars.

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ANZCO Foods Limited: Pursuing the Chinese Market[1]

Daniel Conforte [a], Nicky Jones [b], Nicola M. Shadbolt [ⓟc] and Xiaomeng (Sharon) Lucock[d]

[a] *Senior Lecturer,* [b] *Student, Agribusiness, College of Sciences, Massey University, Private Bag 11 222, Manawatu, Palmerston North, 5451, New Zealand*

[c] *Professor, Farm Business Management, College of Sciences, Massey University, Private Bag 11 222, Manawatu, Palmerston North, 5451, New Zealand*

[d] *Lecturer, Agribusiness Management, Faculty of Commerce, PO Box 84 Lincoln University, Lincoln 7647, Canterbury, New Zealand*

Abstract

ANZCO Foods Limited is a dynamic, multi-national group of companies which procure, process and market New Zealand beef and lamb products. ANZCO is one of New Zealand's largest exporters of beef and sheep meat worldwide. The Chinese market is growing rapidly. ANZCO is looking to decide whether to further pursue the Chinese market and analyze its potential for sheep meat. This case provides an opportunity to analyze a large, fragmented and varied new market offering substantial growth potential. The case content and analysis is particularly relevant for courses focused on international business, marketing, supply chain management, strategy, entrepreneurship, management, and the food and agribusiness industry in general. It is relevant for use in undergraduate and graduate level courses as well as a problem solving exercise with industry professionals.

Keywords: Case study, meat, lamb, New Zealand, ANZCO, China, international business, marketing, supply chain management, strategy, and food and agribusiness industry.

ⓟCorresponding author: Tel: + 64.63569099
Email: N.M.Shadbolt@massey.ac.nz

IFAMA Agribusiness Case 16.1 A

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[1] This case was written exclusively for IFAMA's 2012 International Student Case Competition which occurred in Shanghai, China.

Introduction

Graham Parker, CEO of ANZCO's lamb division, and Alan McDermott, the Agricultural Manager, were sitting in the company's headquarters in Christchurch, New Zealand. ANZCO is one of New Zealand's largest exporters, marketing beef and sheep meat around the world. Since its founding in 1984, it's made an operating profit every year, but one. ANZCO earned NZ$1.1 billion in sales in 2010. The division sold little product in China and was anxious to pursue the tremendous opportunities they saw in that market.

Parker brought considerable experience to formulating a marketing strategy for China. He has a background in finance and many years in the industry. He joined ANZCO Foods in 2001 as Operations Manager of Canterbury Meat Packers' processing site in Canterbury. He then became the General Manager of the CMP Canterbury Ltd., and finally CEO of ANZCO Lamb.

But the decisions were not easy ones. Many factors were involved: How fast should ANZCO seek to grow the business? Moreover what should the product, price, channel and promotion be? Finally, how much of ANZCO's supply should be sent to China? This last decision was constrained by the need to balance what it might do in China with the other international markets it served and the availability of stock in New Zealand. ANZCO's approach was to optimize overall performance by using different prices on different products in different markets at different times as it sold the meat available to it.

In seven days Parker would present marketing options for the Chinese market to ANZCO's board. He wanted a marketing strategy that would contribute to the company's success. He kept this in mind as he started collecting and analyzing the material he had on the Chinese market for sheep meat and discussed the supply situation with McDermott.

New Zealand's Sheep Industry

Sheep Farming

Sheep farming plays a major role in New Zealand's economy as the country's climatic conditions allow sheep to be raised at low cost on natural grass fed pasture systems. There are 12,250 sheep and beef farms in New Zealand. This number had declined from 22,000 in the 1980's due to the removal of government subsidies and farm land was moved into other agricultural enterprises; mainly dairy production. Consequently sheep numbers fell from 70 million in 1982 to 55.2 million head in 1990 then to 31.9 million in 2011. While the national flock declined, productivity increased and, as a result, production volumes declined at a slower rate than sheep numbers.

The ownership structures of farms range from larger corporate farms and multi-farm enterprises with complex partnership arrangements, to smaller sole operator farms also known as family farms. When farmers want to sell their stock, they can sell directly to the meat processing company. Alternatively they can sell to procurers or stock agents who move stock between the farmers and processors. Two large independent rural services firms dominate the procurement business—Elders Rural Holdings and PGG Wrightsons.

Sheep Meat Processing

Around 100 processing, manufacturing and meat exporting companies are located throughout New Zealand. Four Companies (Alliance Group Limited, Silver Fern Farms, AFFCO, and ANZCO Foods) dominate the industry with around 75% of the market. The processing sector is highly competitive due to excess capacity and the seasonal characteristic of production (see **Exhibit 1A**). While the pasture based production system offers a cost advantage at the primary producers level, its seasonal nature creates excess capacity at the processing level during certain times of the year.

The continuing decline in total sheep numbers has also created excess capacity in the processing industry which has depressed its profits. Packers have reacted in various ways to this problem. Some initiated diverse value adding and quality programs at the processing and marketing levels of the value chain so they could get higher prices. Others allied and partnered with international retail and foodservice customers to develop specialty products. Some of these initiatives required specific production and supply programs with farmers to assure consistent and timely supply of finished lambs.

In conjunction with these challenges is the age old dilemma of disassembly; that the disassembly of an animal produces a particular set of parts or cuts (see Exhibit 1B for a breakdown of an average sheep carcass by cut). Given the competitiveness of the industry, all these cuts as well as the by-products need to be sold if the processor is to operate profitably.

Sheep Meat Trade

New Zealand only produces 6% of the world's sheep meat, but accounts for 38% of the global trade. It plays such a big role because over 90% of the sheep meat produced there is exported. In 2011,[2] the exports of sheep meat were worth US$ 1.9 billion contributing to 6.3% of New Zealand's merchandise exports. This close and direct dependency on international trade keeps New Zealand's exports exposed to exchange rate risk and fluctuations in international commodity prices.

The price of many commodities traded are set in US dollar so constant variation and volatility on the exchange rate alters export price signals in New Zealand dollar terms. When the local currency is weak, exporters (along with farmers) are at an advantage. However, if exchange rate of New Zealand dollar strengthens then exporters are at a disadvantage unless product prices have also risen.

Industry participants attempt to move lamb away from the commodity market by value adding initiatives and fixed price contracts with suppliers to minimize this risk and optimize the greatest return they can receive for their product.

[2] 2010-11 (Sept. Yr.)

New Zealand's reliance on exports highlights the importance of international relationships and trade agreements for the New Zealand economy. New Zealand had worked for preferential access to markets through Free Trade Agreements and closer Economic Partnerships.
The EU was New Zealand's largest market for sheep meat export. One reason for this was because New Zealand historically received 80% of the tariff-free quota for the EU. The amount of the quota has dropped over time and for 2010-2011 was only 30,000 tonnes. In recent years, however, New Zealand has not met its quota limit because it was able to sell meat in other markets at prices that were as good as or better than in the EU. (See Exhibit 2A for price per tonne received for sheep meat for New Zealand's major markets from 2000-2009).

Sheep meat exported to China increased from 17,876 tonnes in the 2000-2001 year to 34,919 tonnes in 2010-2011 (an overall increase of 95 percent). In the same period, the price paid for New Zealand lamb increased from $1,948 per shipped tonne of lamb to $4,573 (more than by 135 percent). The trade with China surged after a Free Trade Agreement with that country came into effect in 2008. By 2011, China was New Zealand's second largest export market for sheep meat, buying NZ$195 million.

The compound annual growth rate (CAGR) in percent for major markets for New Zealand's sheep meat from 2000 to 2009 is shown in the following table.

Table 1. Growth of New Zealand's Major Sheep Meat Markets from 2000-2009

	Volume (%)	**Value (%)**	**Price per tonne (%)**
China	8.1	21.8	12.7
France	-0.9	9.5	10.6
Germany	-2.7	7.3	10.3
United Kingdom	-0.3	8.4	8.6
United States	0.3	5.9	5.6

Source. Data sourced and analyzed from FAO (faostat.fao.org).

The future markets for sales (by value) of sheep meat are estimated as follow:

Table 2. Expected Proportion of Sheep Meat Exports by Value in 10 to 15 Years

Proportion of Total Sheep Sales	**Current (%)**	**10-15 Years (Average %)**	**Standard Deviation***
European Union	64	55.1	8.6
Middle East and North Africa	6	15.8	3.6
China	3	7.3	2.9
North America and Mexico	14	9	3.1
Japan	2	2.6	1.2
Other (including Russia and India	12	10.2	5.0

***Note.** Standard deviation is a measure of the dispersion of individual answers from the mean. Generally speaking, the higher the standard deviation, the lower the degree of certainty.
Source. Meat: The Future," Ministry Of Agriculture And Forestry, Wellington, New Zealand, 2009, www.maf.govt.nz

Since the mid-1980s, packers shifted away from shipping whole sheep carcasses. In 1971 over 90% of sheep meat was exported as whole carcasses; in 2006 this dropped to 3.9%. The export of lamb as cuts has increased from less than 10% in 1971 to 81.5% in 2006. A further change is an increased volume of chilled exports which have sold at higher prices than frozen meat. They have grown since 1988 when Captech packaging, which uses carbon dioxide to extend the life of chilled red meat, became commercially available. Chilled products made up just below 15% of total export tonnage from 2002 to 2005, while over this same period the value of chilled exports fluctuated at around 20% of total sheep meat exports, peaking in 2004 at 25%. The percentage of chilled products was still around 20% in 2011.

While disassembly of an animal produces different cuts, each market prefers particular cuts. Exporters in New Zealand recognize these preferences by sending the appropriate cuts to each market. For example, Chinese consumers consider mutton a premium meat, while Americans and Europeans consumers consider it of lower value. Saudi Arabia consumers prefer forequarter cuts, while France, Germany and UK consumers prefer racks and legs. US consumers provide New Zealand with its main market for racks.

The majority of sheep meat sent to the North Asia region (which includes China, Hong Kong, Japan, Korea and Taiwan) still have the bone in, and around 98% are frozen, indicating lower value cuts such as forequarters (see Exhibit 2B). There it is reprocessed into lamb rolls and other products, which are sold to local 'hotpot' restaurants and retail outlets. Currently the majority of the lamb products exported to China from New Zealand are frozen in-bone lamb flaps. When received in China, the flaps are thawed and deboned, then rolled up and refrozen—ready to be shaved for hot pots (see Exhibit 3).

New Zealand and other competitors such as Australia and Uruguay prefer to sell in medium to high-value markets where products receive higher prices.

ANZCO Foods Limited

In 2010, ANZCO Foods had sales of NZ$1.25 billion (see Exhibit 4 for ANZCO's financial reports) and employed 3,000 staff worldwide. It is a private investor-owned company with three ownership groups: Itoham Food Inc. (Japanese with 48% ownership), Nippon Suisan Kaisha Ltd. (Japanese with 25% ownership), and the directors and management of ANZCO Foods Ltd. who hold the rest of the ownership. The company's organizational structure is found in Exhibit 5.

ANZCO was originally established in 1984 to market beef and sheep meat but over time it integrated backward into the packing of meat products with seven processing plants. It has businesses that market and distribute its products in New Zealand (My Butcher, New Zealand Meat Marketing (NZMM), and Westmeat). Worldwide, ANZCO Foods is in: Australia, Europe, Japan, North America, Taiwan, and the United Kingdom, and The Lamb Company in Canada and the USA. These businesses are tasked with finding the best markets for ANZCO's products and for the day-to-day management of its customers to ensure long lasting, mutually beneficial partnerships. ANZCO's brands include: Canterbury, Maori Lakes, Kumanu, Angel Bay, Wakanui, Ocean Beef and Riverlands. Additional activities of the company include a Food and Solutions division which develops value added products that fit with the latest consumer trends.

The company also produces a large number of other products using the by-products of slaughter including: pelts, skins, casings, wool, rendered products including tallow, meat and bone meal and blood meal as well as pharmaceuticals/nutraceuticals, extracts and ingredients.

To supply its processing plants, ANZCO contracts with farmers through forward fixed price contracts and individually tailored contracts. In general these contracts are linked to specific customers such as Waitrose in the UK. Under these contracts, farmers commit to supply a certain amount of stock to ANZCO, although some flexibility is built in and in return, they are guaranteed killing space. To fulfill its other supply requirements, ANZCO also purchases stock at spot markets. The company acquires stock of a quality that meets its marketing requirements and works with its farmers so they are aware of what its customers want. ANZCO's philosophy had always centered on being close to the end user. Parker explained, *"Having a direct presence in the marketplace is an important part of our business model. It allows us to be closer to the customer, and we can get a more realistic and greater insight to the market".*

The ANZCO reputation, Parker explained, *"is earned through producing healthy, superior beef and lamb, using our quality assurance programs, which include traceability and sustainable farming practices. This protects the integrity of our animal welfare, our food safety programs and our products. This means that our partnerships throughout our value chain and within the industry are important to the success of our business".*

ANZCO is New Zealand's fifth largest exporter. It supplies lamb under the Canterbury, Maori Lakes and Kumanu brands to around 53 countries worldwide. Its main markets include: the UK, Europe, US, Canada, China, Japan and the Middle East (see Exhibit 6 for breakdown of ANZCO's markets in detail).

Table 3. ANZCO's Export Markets for Sheep Meat by Cut

Cut*	Main Market(s)	Minor Market(s)
Leg	UK/ Europe	US/ Canada
Rack	US/ Canada/ Europe	Japan
Loin	Europe / UK / USA/ Canada	
Shoulder	UK/USA/Japan/Mexico/Middle East	Europe/Caribbean
Flap	China	Pacific Islands

Source. ANZCO

By volume, 35% of ANZCO's product is chilled, and around 66% is sent to the UK and US.

China's Value Chain for Sheep Meat

Sheep Meat Production[3]

China is a major producer of animal protein. It was the largest producer of sheep meat in the world, producing 2,070,000 tonnes in 2010, the largest producer of pork, the second largest

[3] Statistics retrieved from FAO

producer of poultry and the third largest of beef. China's number of sheep has remained stable since 2000 and the flock is concentrated more heavily in the north western regions.

China consumes much of the sheep meat it produces and is a major importer. In 2009, it was the fourth largest sheep meat importer by quantity and seventh by value in the world, importing 82,223 tonnes; up from 39,490 tonnes in 2000.

Imported Meat

Amongst all the countries that have bilateral agreements with China, only Argentina, Australia, Brazil New Zealand and Uruguay are allowed to supply China with beef and lamb, due to the strict quarantine regulations at the Chinese border. Under New Zealand's Free Trade Agreement with China, tariffs on sheep meat will be eliminated by 2016. New Zealand was the first and only OECD country to have secured a Free Trade Agreement with China.

Australia and New Zealand are the main suppliers of sheep meat and beef to China, with Uruguay having increased the amount of beef and sheep meat it supplied to China since 2007. Premium chilled lamb accounted for 6% of all sheep meat imported, of which Australia supplied 99 percent. Products from New Zealand sold in China are mostly lamb rolls and shoulder chops in selected retail outlets and in the food service industry, particularly the hot pot restaurants. Exhibit 7 shows the distribution flow of sheep meat imported in China.

Distribution

In 2010, the distribution system was developing but still had serious weaknesses. China lost $9.25 billion of food products during transportation according to an estimate in 2008; and 90% of the meat products were shipped without cold chain facilities. Few food companies own or operate their own truck fleets. Most outsource this service to companies that operate out of regional distribution centers. Ownership of product changes hands many times before it reaches the final client due to many stages in the value chain. Some food companies appear to be increasing their investment and capability in cold store development.

More recently, some large Chinese sellers/processors and manufacturers sourced directly from exporting countries. This practice, which reduces costs and enhances product traceability, is spreading.

Food Processing Industry

The processed food market grew between 2007 and 2011 at a CAGR of 13% reaching US $140.4 billion in 2011. This market was expected to grow at a CAGR of 10% between 2012 and 2016. The majority of China's 36,000[4] major food processors were focused on primary processing of agricultural products (which included animal slaughter and refining) and accounted for 63% of the total industry[5]. Major centers of processing were in the most developed regions such as

[4] Firms with annual sales in excess of RMB 5 million
[5] This is both in terms of number of firms and sales revenue

Beijing, Shanghai and Guangdong. The processing industry was developing rapidly in the top emerging city markets in Southwest China: Chengdu and Chongqing.

Two major processing companies were Shuanghui Group in Henan Province and China Yurun Food Group Limited in Jiangsu Province. Both corporations focused on processing pork, and had industrial scale production chains, from slaughtering through to final packaging. Shuanghui Group slaughtered 10 million pigs per year, and produced 1.8 million tonnes of fresh and processed meat product every year (www.shuanghui.com.cn). China Yurun Food Group also had its own transportation fleet. Its annual turnover increased from HKD 13.9 billion in 2009 to HKD 21.5 billion in 2010.

The quick-frozen products industry had developed rapidly in China due to improvements in the cold chain infrastructure and rising domestic refrigerator ownership. Dominated by domestic brands, in 2009 there were 3000 quick-frozen processed food manufacturers in China.

Country-of-origin branding tended to be lost when imported raw materials were incorporated into further processed products or used in the food service sector[6].

Final Markets

Retail

The vast majority of consumers bought fresh food including meat from traditional local markets known as 'wet markets'. These markets were unregulated and a source of food safety concerns because of doubtful hygienic standards. The markets had been affected by food epidemics such as SARS in 2003 followed by avian influenza.

Supermarkets, hypermarkets, convenient stores and boutique stores were fast replacing wet markets in cities such as Beijing, Shanghai, Guangzhou and Shenzhen, especially amongst affluent shoppers. They had better food health and safety standards, an increased range of high-value products and better quality products. Various global food retailers such as Carrefour, Wal-Mart, Metro, Tesco and Makro had introduced these retailing concepts to China. Consumers in these cities now relies more on these outlets for fresh food than from traditional 'wet markets' according to a report by The Nielsen Company.

In 2011 the grocery retail sector in China had sales of US$504.4 billion. Growing at an expected rate of 7% per year, by 2016 it sales would be US$707.2 billion. In 2011 supermarkets held a market share of 44%. Of the top 10 grocery retailers in 2010, Chinese supermarkets accounted for around 40% of the grocery sales and 80% of the number of outlets.

Most imported products have their greatest success in the specialty stores and hypermarkets. Specialty supermarkets have a higher proportion of imported food products, ranging from 10% to as high as 80%. Major players include City Shop Supermarket (Shanghai), City-Super, CRV Ole, BHG (Beijing Hualian Supermarket), Hisense Plaza (Qingdao) and Jin Bou Da

[6] Knight et al. 2007

(Zhengzhou). They are situated in first tier cities and some second tier cities and located near high-end department areas and fashionable business centers.

The major hypermarket players in China were Carrefour, Wal-Mart, Metro, Lotus, Auchan and Tesco. Foreign operators tend to dominate this sector; in Shanghai, 82 foreign hypermarkets account for 79% of hypermarket sales in 2008. Furthermore, the foreign operators are planning further growth. For example, Tesco, a British company, plan to launch 80 shopping centers in China by 2016. The very distinct regional differences in China could potentially limit the spread of foreign grocery retailers, however.

Most hypermarkets have a reputation for offering high quality products (such as meat products), greater convenience (important to those who are busy), better quality control and traceability (which appeals more to the affluent Chinese consumer concerned with food safety). They have a greater range of imported products, so are more familiar with merchandising imported food items. They draw their merchandise from favored distributors; the majority of lamb sold in supermarkets was from China or Australia.

Private food labels only have one percent share of the market within all fast moving consumer goods, but their role is expected to grow because consumers believe that branded products are superior. To date, local domestic brands dominate but this is changing as leading global food retailers such as Carrefour, Great Value, Metro's IKA, Tesco and Lianhua offer their own private label lines on every day products.

Food Service

The food service sector in China was worth US$366.9 billion in 2011 and is forecasted to be US$494.8 billion by 2016. In 2010 there were 5.1 million foodservice outlets. Full service restaurants held 72% of the market share while fast food restaurants held 25% of the market. Additional facts of interest were that the top 100 restaurants only held 6% of the market, while in the four main urban cities of Beijing, Shanghai, Guangzhou and Shenzhen there were 200,000 foodservice outlets serving more than 20 billion meals per year[7].

Medium to high-end full service restaurants are growing in numbers due to rising consumer spending power, increased frequency of dining out, and business events. From 2006 to 2010 the full-service restaurant sector rose from RMB 1,010.9 billion to RMB 1,613.5 billion. Restaurants tend to be located in well-connected business districts and areas where stores sell luxury fashion brands, and in historic areas such as the 'Bund' in Shanghai. They offer greater quality and a more sophisticated, fashionable and luxurious dining experience. Premium lamb is rarely found in China's restaurants and, when it is, it has only a limited selection of the high-end cuts found in upscale western and five star hotel restaurants.

The Xiao Nan Guo Group (www.xnggroup.com), owner of restaurant brands Shanghai Min and Maison de l'Hui is an example of the expanding restaurant chains which are targeting the higher end of the market. Its revenue increased from RMB 592.9 million in 2008 to RMB 872.5 million

[7] MLA Market Information report 2010

in 2010. In 2010, Xiao Nan Guo launched its top-of-the-line concept, Maison de l'Hui, at the Shanghai World Expo. It expanded to eight outlets in Shanghai and plans for more elsewhere in China.

The growth of 'hot pot' restaurants also has stimulated a demand for sheep meat as it is a main ingredient. A meal starts with a pot filled with hot water. Shaved sheep meat is added to flavor the hot water, then vegetables are added. The fat in the meat is an important source of flavor.

Various hot pot restaurants have sprung up. Some of the less expensive are like those of the Little Sheep—a hot pot restaurant chain with 3,000 restaurants across China. A hot pot meal costs between 63RBM to 95RMB per dish. Little Sheep was the largest full service restaurant chain in the country accounting for 6% of the market and using 30,000 tonnes of sheep meat a year. It reported annual revenues of 2 billion RMB (US$315 million), in 2010. It is owned by Yum! Brands Inc. which also owns 3,500 KFC restaurants and 560 Pizza Hut restaurants in China. Recently, expensive hot pot restaurants have emerged in major cities across China such as Shanghai, Beijing and Guangzhou. The dishes in these restaurants are priced above 100RMB per dish, and at the very high end, greater than 400RMB per dish.

China's Consumers

China's total population in 2011 was 1.3 billion[8] and is increasing by over six million people each year. Several trends are noteworthy in the Chinese economy: increased urbanization, higher incomes and higher living standards. The rapid urbanization of China had meant that 607 million (over half the population) live in urban areas and by 2025, 822 million will live in them. If China's GDP growth continues, by 2025 approximately 485 million people (59%) will be upper middle class (classified as earning 40,000 to 100,000 RMB per year). Higher incomes suggest that people are able to raise their standard of living. They are more likely to pay premium for high-value products and to try new things. They are health conscious, care about the environment and consider product quality more important than brand. Thirty percent of the wealthiest 1%, or 1.6 million live in China's four largest cities: Shanghai, Beijing, Guangzhou and Shenzhen. Associated with these changes in the economy are changes in expenditures on food.

High-value, quality foods Chinese consumers with higher incomes are demanding more variety and better quality products, and are willing to pay for it. They are spending more on better cuts of meat. Of all households surveyed, the average at-home meat expenditure was 1050 RMB. Of this, 37% was spent on pork, 22% on aquatic products, 19% on poultry, 12% on beef and 10% on sheep meat. This demand for quality is also motivating Chinese hotels to buy imported produce from developed countries because it is considered to be of higher quality.

Food Safety Ninety percent of Chinese consumers are worried about food safety. Over time there has been many food scares, epidemics and contamination within China. These problems are often traced back to the farm level but implementing food safety systems at the farm level is

[8] This includes 31 provinces, autonomous regions, municipalities and CPLA but excludes Hong Kong SAR, Macao SAR, Taiwan Province, and overseas Chinese - National Bureau of Statistics of China

difficult. The farm sector consists of 200 million farm households with, on average, 1-2 acres of land divided into 4-6 plots that are not adjacent to one another. This makes monitoring and standardizing production practices difficult.

Environmental awareness and the emergence of green food A segment of Chinese consumers are more aware of the environment and the Chinese government had introduced new environmental laws and regulations that limit chemical inputs and set minimum levels for soil air and water pollutants. Food grown accordingly is called 'green food' and has been viewed as safer. However, the majority of Chinese consumers are not yet willing to pay a premium for green products or are willing to shoulder the cost for certified traceable food. Meanwhile Chinese consumers know little about organic foods. Robert Oliver, Consulting Chef for New Zealand Trade and Enterprise in China, was skeptical of foods classified as organic in China. "There is such a maze of middlemen and confusing certifications between the organic producer and the end user. You just can't be sure it really is organic! And, it is very unclear what organic even means here."

Convenience Chinese consumers are interested in more convenience foods for the same reasons that westerners are: they have less time to prepare meals, more women are in the workforce, and they want more time to pursue leisure activities. In urban China, the 20 to 40 age group in particular, tends to be more heavily influenced by western lifestyles. Consequently this group tends to eat out more frequently and, when eating at home, prefers cooked, semi-prepared and packaged foods. Frozen processed foods are becoming more popular. Products that performed best within the frozen red meat category in 2009 were seasoned mutton bunch, seasoned beef, meat balls and sausages. Ninety percent of all quick frozen food products are purchased through retail distribution channels.

Eating out Consumers are spending more money eating out. McKinsey reported that China's new class of wealthy consumers spent 17% of their household income on eating out, compared with mainstream consumers who spent 7% of their household income on eating out. When eating out, they were more likely to spend money on meat, in particular on sheep meat followed closely by beef. On average, 109 RMB was spent on mutton and 100 RMB on beef, compared to 79 RMB on poultry and 66 RMB on pork. This may be as a result of willingness to try different things when they ate out, and the unfamiliarity of preparing dishes with beef or sheep meat at home.

Chinese Consumption of Sheep Meat

Of the total meat consumed in China in 2009, pork accounted for 64%, poultry 23% while beef and lamb together only accounted for 13%. The overall consumption of sheep meat was 3,890,000 tonnes of sheep meat (3.0 kg per capita consumption).

Overall consumption hid regional differences in consumption. However, there is a difference between the Northwest and the East. Sheep meat is a major part of consumer diets in the northwest areas due to the influence of Muslim and Mongolian cultures. Eating sheep meat is less common in eastern China where many of the tier one and tier two cities are located. There is also a difference between urban and rural areas. Sheep meat is more popular in urban areas

compared to rural areas. In rural areas, consumers tended to spend proportionally more money on pork because it is cheaper. In rural China eating habits are more strongly influenced by traditional culture and use of traditional Chinese recipes.

Chinese preferences are also reflected in how sheep meat is bought and cooked. All sheep meat and even goat meat is referred to as "yang rou" (羊肉). No distinction is made between the age of the animal or quality of the sheep meat. In China older meat is considered more nutritious and delicious. In many cases, mutton flaps are seen as a premium product, in particular above pork and chicken. Generally the, low-end cuts of domestic and imported sheep meat are hidden in complex dishes. As a result Chinese consumers are unfamiliar with lamb as a main stand-alone menu item.

Chinese, particularly those in the north, have developed many sophisticated ways of eating sheep meat. A simple search of "sheep meat recipes" in Chinese on Baidu (an equivalent search engine to Google in Mainland China) revealed 3,370,000 relevant results. Of these results, many came from Chinese recipe websites. One website alone offered 71 recipes for cooking sheep meat[9]. These recipes are vastly different from western ways of cooking lamb or mutton. Many spices and other accompaniments are used to achieve the colors, the aroma, and the taste by which the Chinese judge a dish. Overall low-end cuts of sheep meat are popular.

Oceania Efforts to Develop the Chinese Market

Australia's Market Development Initiatives

Meat and Livestock Australia has had numerous programs to increase the sale of Australian beef and sheep meat. First it provided retail training of staff for four outlets from CityLife and Lianhua supermarkets, both part of the Hangzhou Lianhau Huashang Group of supermarkets. In these stores its cutting and cooking demonstrations showcased Australian beef strip loin and knuckle. Customers were given samples to taste. Sales of beef knuckle were eight times greater than when no promotion or sampling was provided. Second, it conducted a series of chef programs targeting second tier cities where Australian beef and sheep meat were incorporated into the modern Chinese cuisine. This included a training workshop in Tianjin for chefs of the Starwood Hotel Group. Third, it participates in culinary contests including the 98th Black Box Culinary Challenge, held at the Renaissance Hotel in Beijing on February 21, 2012, in which the secret ingredient was lamb neck fillet. Fourth, it exhibits at popular food trade shows such as the Food and Hotel China tradeshow. The three-day event based in Shanghai attracted where 30,000 visitors. Fifth, it produced a website targeting the Chinese market with its beef and lamb (see Exhibit 8).

New Zealand's Market Development Initiatives

New Zealand industry organizations such as Beef + Lamb New Zealand and New Zealand Trade and Enterprise are involved in generic marketing. Beef + Lamb promotions in China centered on

[9] www.allrecipes.cn

creating awareness and demand for New Zealand grass-fed beef in the hotel and restaurant sector. Attributes promoted are natural, nutritious, and safe to eat.
These organizations also taught chefs the best way to cook grass-fed beef, run seminars for food industry professionals in Beijing, Dalian and Shanghai, have point of sale materials to support the food service sector, and participate in joint promotions with hotels, restaurants and importers.

New Zealand Trade and Enterprise has renowned Chef Robert Oliver serve as a Consulting Chef in China. Robert's role includes establishing relationships with the Hotel and Restaurant Institution (HRI) and other food industry professionals. He has developed menus and recipes highlighting New Zealand food and beverage products. He is also a regular contributor to the "New Western Cuisine Magazine," the most influential bi-lingual food magazine in China with a significant reach into the Chinese food industry. In his travels, he found a company that was aware of produce from New Zealand and chose to deal with a large supplier. Unfortunately, the leaders of this company got confused after being approached by many different suppliers from New Zealand. "This doesn't help the national brand," commented Robert Oliver.

New Zealand's Reputation for Sheep Meat

New Zealand is well recognized as a source for sheep meat. A search of "New Zealand sheep meat" in Chinese on Baidu, reveals 1,690,000 relevant results, many of which are websites providing information on New Zealand sheep meat suppliers.[10] On one particular website, 32 suppliers were found.[11]

Food safety is one of New Zealand's major national assets, according to Robert Oliver, "New Zealand foods and beverages are famously clean and safe." New Zealand sheep meat has a good reputation in terms of quality and safety. This has led counterfeiters to produce "fake" New Zealand lamb rolls using locally produced sheep meat, or even other animal meat (including pork and duck meat). Reports appeared on the internet regarding investigation into false New Zealand sheep meat.[12] This called into question the authenticity of New Zealand lamb rolls observed on shelves in supermarkets in China. (See Exhibit 9 for packaging and branding of New Zealand lamb in Chinese retail outlets). Although China was New Zealand's second largest market for sheep meat, New Zealand has little visibility in the Chinese market.

Supplying the Chinese Market with Imported Sheep Meat

Amongst the Chinese importers of beef and sheep meat, there were three Australian firms and one firm from Uruguay operating in China. Many distributors in China also act as importers. No New Zealand-based companies have a business based in China that are importing sheep meat. Rather, the New Zealand companies rely on importers to sell their meat in China. The largest importer of New Zealand sheep meat for 11 years was Northern Chinese meat processing company Heilongjiang Grand Farm Group (Grand Farm). It had been buying its meat from Alliance, New Zealand's biggest meat processing company, since 1999. It advertised New Zealand products on a separate 'international trade' webpage on which the claim was made that

[10] www.baidu.com
[11] www.21food.cn
[12] http://news.ycwb.com/2011-05/24/content_3443434_3.htm

New Zealand is a place ideal for livestock farming, with no pollution or epidemic disease for over 200 years.[13]

Those distributing and selling imported meat targeted the major cities on the eastern coast. One reason was that China's fragmented logistics industry has hindered cold-chain development for high-value, temperature sensitive products. Another reason was that the more affluent people lived in north-eastern cities, such as Dalian and Harbin. These areas were hubs for large volume importation.

The average price for sheep meat in the market was RMB 53.08 per kg (leg) at the beginning of 2012.[14] The cost of supplying the Chinese market with specific cuts from New Zealand is found in the table below:

Table 4. Lamb Value Chain

	1kg Lamb Rack		250gm Lamb Rack	
	USD	**RMB**	**USD**	**RMB**
Retail Price	66.18	450.00	24.71	168.00
Retailer Gross Margin (currency)	41.69	283.50	18.53	126.00
Retailer Gross Margin (% of retail price)	**63%**	**63%**	**75%**	**75%**
Distributor Selling Price	24.49	166.50	6.18	42.00
Distributor Gross Margin (30% of dist. sell. price)	7.35	49.95	1.85	12.60
In Country Price	17.14	116.55	4.32	29.40
Exchange rate (1USD = 6.80 RMB)	1:1	1:6.80	1:1	1:6.80
Landed Price	17.14		4.32	
Duty Clearance (1% of CIF)	0.14		0.04	
Total Import Tax (22.04% of CIF Price)	3.07		0.77	
CIF Price	13.93		3.51	
Cost of Air Freight	2.00		0.50	
FOB Price	11.93		3.01	

Source. Based on a report produced by RedFern Associates for New Zealand Trade & Enterprise 2010.

ANZCO Looks Forward

ANZCO was working with Chinese importers: Heilongjiang Tianshunyuan Muslim, Dalian Elite, Advance Marketing and Fern Ridge Ltd (see Exhibit 10). Traditionally it priced its products on an FOB (Free on Board) basis but had moved 64% of its sales to a CIF (Cost, Insurance and Freight) basis, so 36% was still FOB. The products it sent to China were on the low end.

Sitting in ANZCO's headquarters in Christchurch, Graham commented on the situation,

"The Chinese market has tremendous potential but we have to figure out what we want to sell there, where and how. Right now premium cuts of lamb are in the high-end and expat hotel chains rather than targeted at the general population. Sheep meat is generally not widely known

[13] www.dazhuangyuan.com

[14] Source: National Bureau of Statistics of China. The price of mutton was taken from 50 cities in China as of 1-10 of January 2012.

in areas situated further south like Shanghai. Beef is more widely known. How do you market lamb into those markets which have potential and don't currently know about it?"

Parker added,

"China provides an alternative to our traditional markets. We are trying to decide what our market strategy there should be so that we can optimize the value of the whole lamb carcass. Our business in Taiwan provides us with a great platform to grow a direct presence in the Chinese market, but the question is: what should our marketing strategy be?"

These were the questions that Parker needed to address as he developed his recommendation for the board.

Acknowledgements

The authors would like to fondly acknowledge the lead author of this case, our friend and colleague, Daniel Conforte, who initiated this project but unexpectedly passed away before it was completed. A special thanks to ANZCO Foods and Alan McDermott for providing interviews, data and approving the final document. Lastly, we thank Dr. Kenneth Harling and Dr. John Siebert for their invaluable expertise, serving both as case reviewers and content editors. Their significant contributions enabled us to meet the stringent timeline of completing this case for use in the IFAMA 2012 International Student Case Competition held in Shanghai, China and they further helped refine it for this publication.

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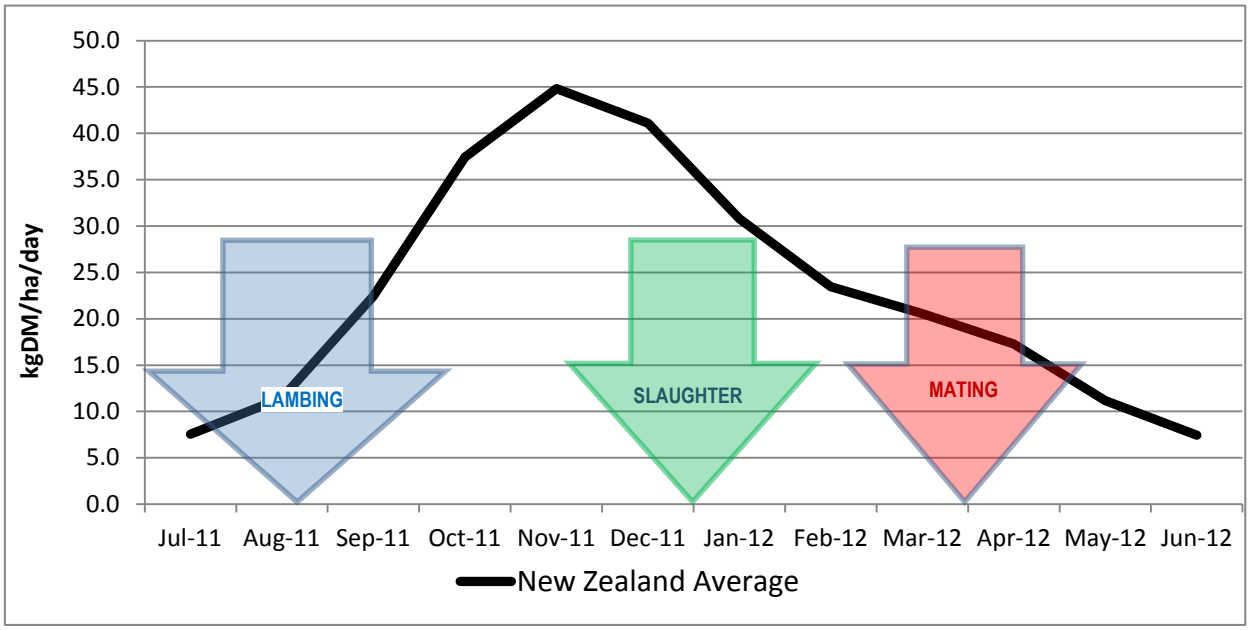
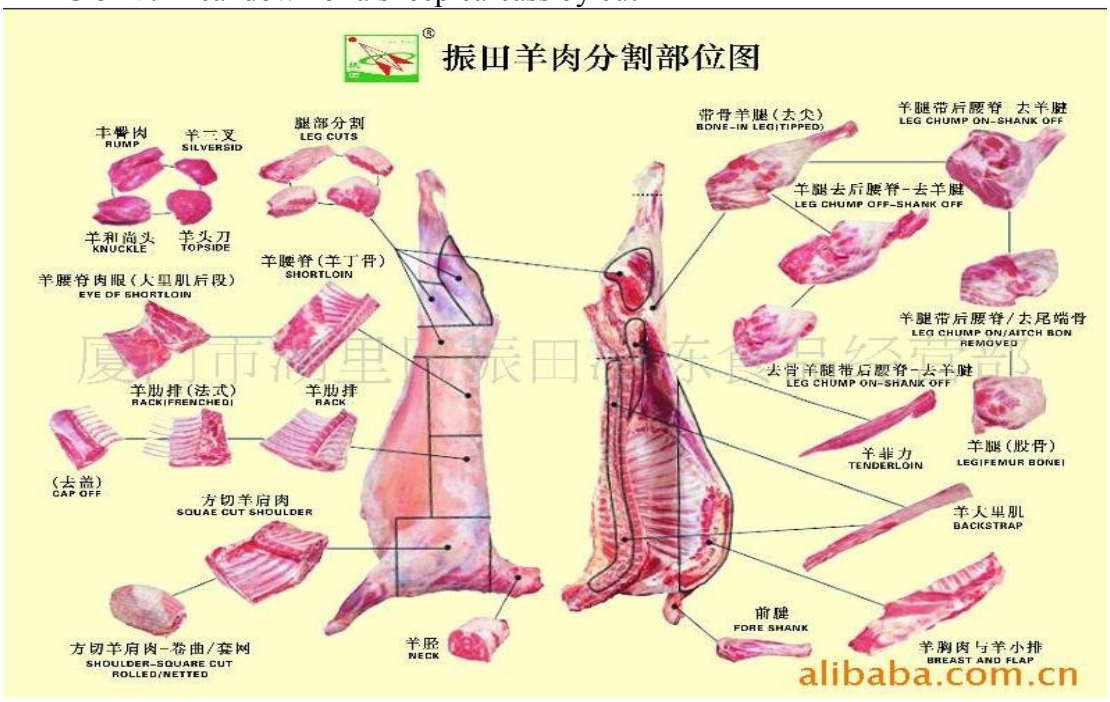
Exhibit 1A. Pasture Growth and Major Farming Seasons – REGULAR



Source. FARMAX (Hamilton)

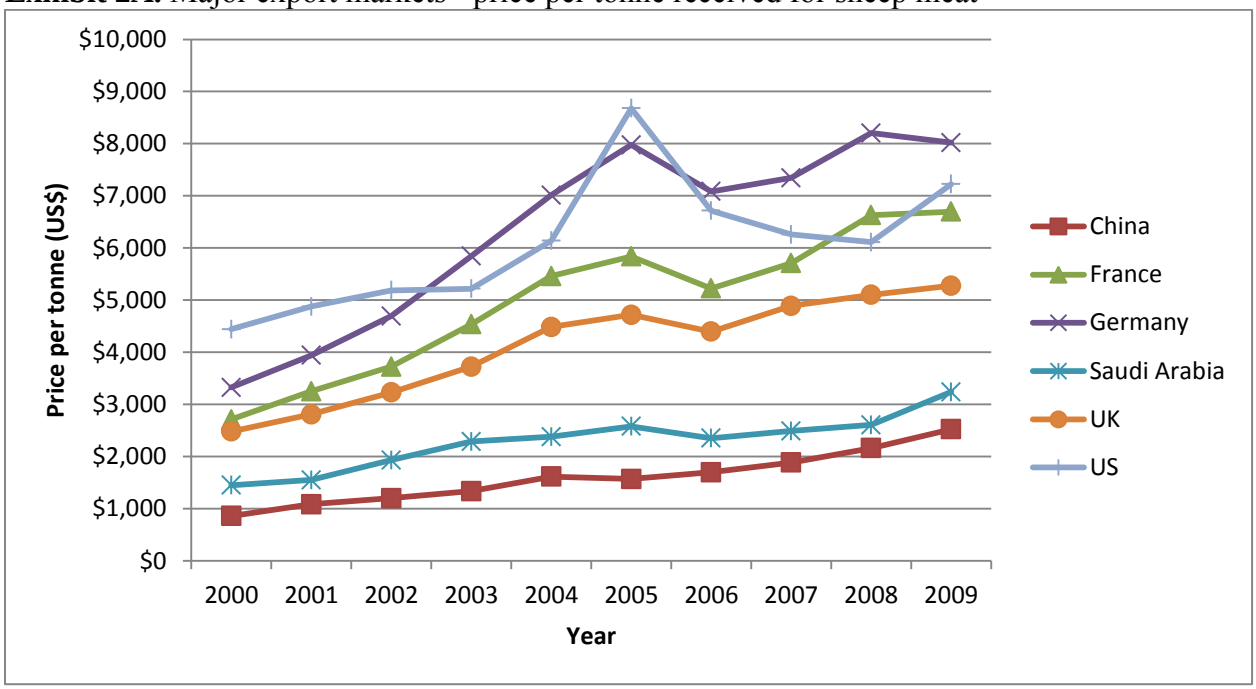
Exhibit 1B. Breakdown of a sheep carcass by cut



Source. alibaba.com.cn

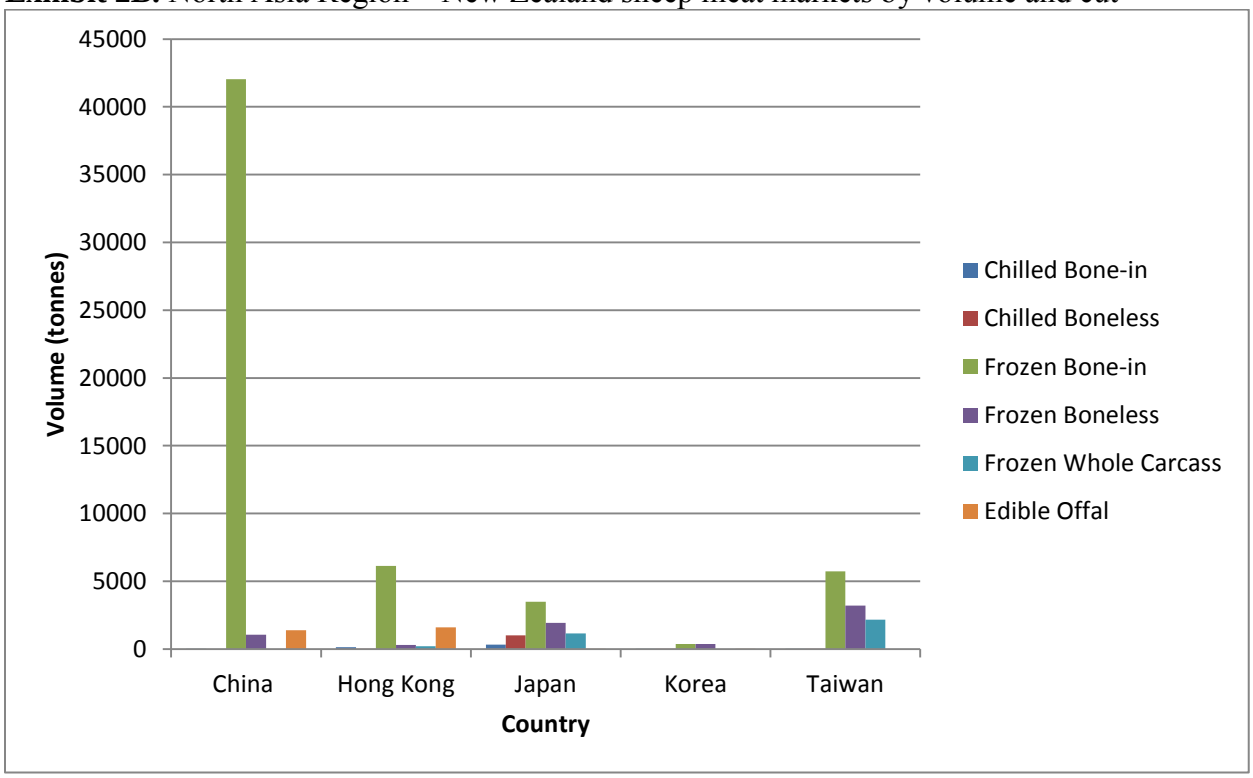
Note. This case refers to sheep meat in general but also differentiates sheep meat. The terms lamb and mutton are regularly referred to indicating a difference. Both are sheep, but have distinct differences, mainly in age. Lamb is a sheep less than a year old and is generally slaughtered between the ages of four and twelve months. Because of this lamb is tenderer than mutton and considered a better product. Mutton is an older sheep and is tougher meat with a much stronger flavor.

Exhibit 2A. Major export markets - price per tonne received for sheep meat



Source. FAO

Exhibit 2B. North Asia Region – New Zealand sheep meat markets by volume and cut



Source. Beef + Lamb New Zealand Economic Service and New Zealand Meat Board.
Notes. Figures are from 2010-11 (Sep Yr) and include mutton and lamb markets

Exhibit 3. How sheep meat products are packaged for export from New Zealand to China.

Source. www.dazhuangyuan.com

Exhibit 4. Financial Reports for ANZCO, 2010.

ANZCO FOODS LIMITED

STATEMENT OF COMPREHENSIVE INCOME

FOR THE YEAR ENDED 30 SEPTEMBER 2010

		Group		Parent	
		2010	2009	2010	2009
	Notes	$000	$000	$000	$000
Revenue	3	1,167,477	1,190,485	30,255	55,323
Expenses	3	1,151,650	1,171,395	17,657	16,556
Operating Earnings Before Interest & Tax		15,827	19,090	12,598	38,767
Share of Profit/(Loss) of Associates	10	(2,217)	2,133	-	-
Earnings Before Interest & Tax		13,610	21,223	12,598	38,767
Finance Costs	3	8,269	10,487	7,722	9,671
Profit from Continuing Operations Before Tax		5,341	10,736	4,876	29,096
Tax Expense/(Benefit)	4	3,463	3,435	(291)	(1,366)
Movement in deferred tax relating to legislative changes to tax depreciation on buildings	4	1,472	-	-	-
Profit from Continuing Operations After Tax		406	7,301	5,167	30,462
Other Comprehensive Income					
Liquidation of Subsidiary		-	-	2,111	-
Net movement on Cash Flow Hedges		(912)	2,014	-	-
Net movement on Hedge of Net Investment		(1,422)	426	(1,422)	426
Foreign Currency Translation		1,248	(515)	547	(1,869)
Revaluation of Land & Buildings		-	16,428	-	-
Depreciation transfer on De-recognition of Assets		-	(268)	-	-
Assets Revaluation – disposal of Assets		4	(496)	-	-
Income Tax on items of Comprehensive Income		190	(797)	-	-
		(892)	16,792	1,236	(1,443)
Total Comprehensive Income for the Year		(486)	24,093	6,403	29,019
Profit for the year is attributable to:					
Equity Holders of Parent		406	7,301	5,167	30,462
Non-controlling Interests		-	-	-	-
		406	7,301	5,167	30,462
Total Comprehensive Income for the year is attributable to:					
Equity Holders of Parent		(486)	24,093	6,403	30,462
Non-controlling Interests		-	-	-	-
		(486)	24,093	6,403	30,462

ANZCO FOODS LIMITED

STATEMENT OF FINANCIAL POSITION

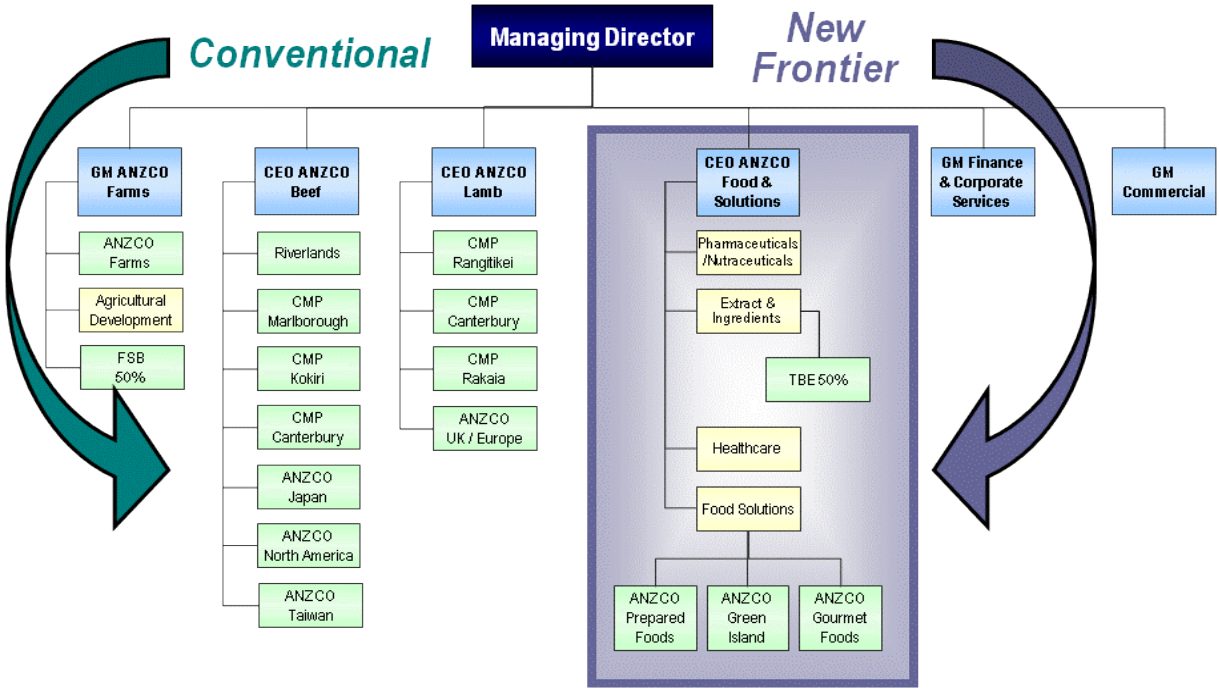
AS AT 30 SEPTEMBER 2010

	Notes	Group 2010 $000	Group 2009 $000	Parent 2010 $000	Parent 2009 $000
Non Current Assets					
Property, Plant & Equipment	6	230,242	231,922	2,344	2,536
Shares in Subsidiaries	7	-	-	81,061	84,711
Intangible Assets	8	966	-	-	-
Financial Assets	9	631	704	627	700
Investment in Associates	10	34,850	35,863	20,559	17,142
Other Investments	11	830	1,365	-	-
Deferred Tax Asset	4	8,849	7,177	321	399
Total Non Current Assets		276,368	277,031	104,912	105,488
Current Assets					
Cash & Cash Equivalents	12	13,461	9,741	-	958
Receivables, Advances & Prepayments	13	88,580	74,000	181,262	184,193
Inventories	14	85,518	100,777	-	-
Contracted Livestock	14	29,524	21,132	-	-
Biological Asset	15	1,006	2,082	-	-
Other Financial Instruments	23	1,445	6,269	-	-
Income Tax Receivable	4	1,269	443	6,356	1,215
Total Current Assets		220,803	214,444	187,618	186,366
Total Assets		497,171	491,475	292,530	291,854

	Notes	Group 2010 $000	Group 2009 $000	Parent 2010 $000	Parent 2009 $000
Equity					
Share Capital	16	59,364	59,364	59,364	59,364
Retained Earnings	17	114,405	118,432	69,978	67,133
Reserves	18	70,409	71,300	(5,219)	(4,344)
Total Equity		244,178	249,096	124,123	122,153
Non Current Liabilities					
Interest Bearing Loans	19	34,230	56,099	26,080	48,337
Provisions	20	2,532	2,089	-	-
Deferred Tax Liabilities	4	8,813	6,373	435	128
Total Non Current Liabilities		45,575	64,561	26,515	48,465
Current Liabilities					
Interest Bearing Loans	19	147,390	129,252	130,171	114,350
Accounts Payable, Advances & Accruals	21	58,057	46,156	11,721	6,886
Provisions	20	1,971	2,410	-	-
Other Financial Instruments	23	-	-	-	-
Income Tax Payable	4	-	-	-	-
Total Current Liabilities		207,418	177,818	141,892	121,236
Total Equity & Liabilities		497,171	491,475	292,530	291,854

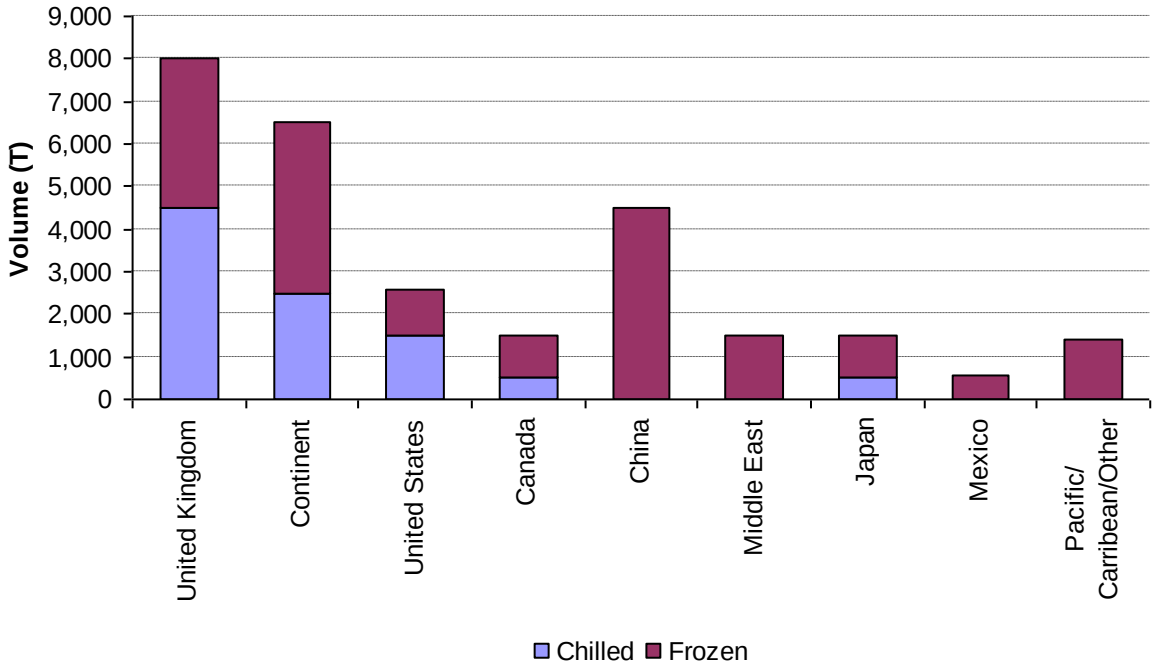
Source. ANZCO

Exhibit 5. ANZCO Foods Limited: Company Structure



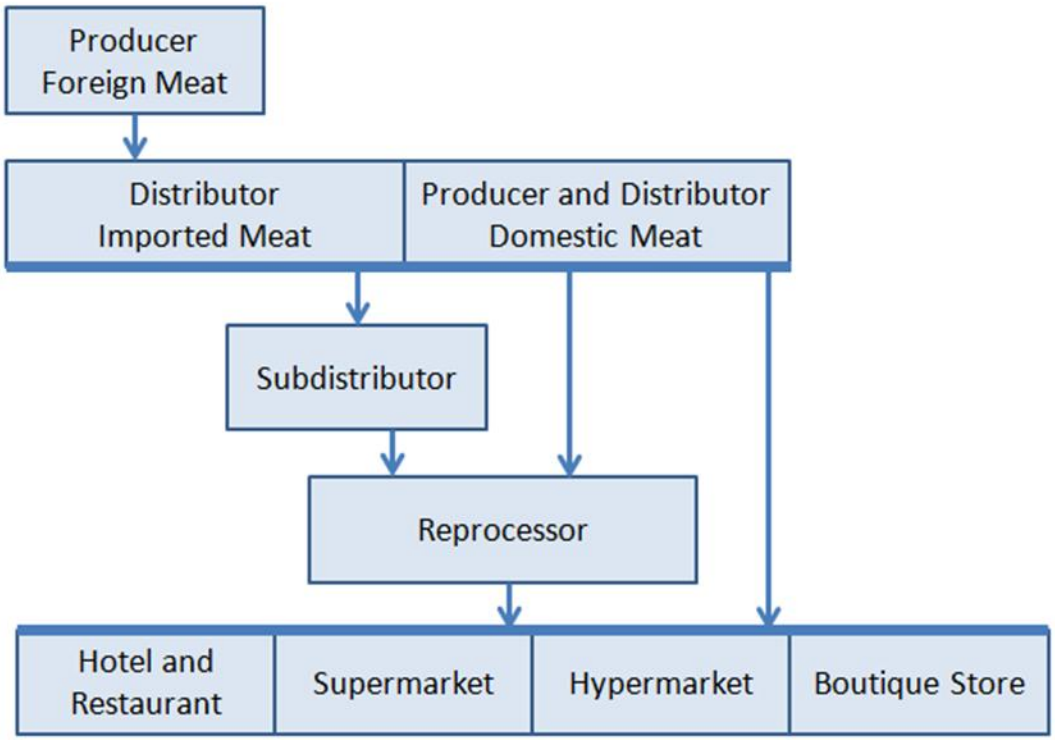
Source. ANZCO

Exhibit 6. ANZCO Chilled & Frozen Lamb Sales



Source. ANZCO

Exhibit 7. Distribution flow of imported sheep meat in China



Note. The heavy lines indicate that all industries associated with that line are involved.
Source. Based on diagram in Report for New Zealand Trade & Enterprise produced by RedFern Associates 2011

Exhibit 8. Meat and Livestock Australia (MLA) website promoting Australia beef and lamb to Chinese consumers and trade

Source. www.loveaustralianbeefandlamb.com

Exhibit 9. Packaging and branding of New Zealand lamb in Chinese retail outlets

Exhibit 10. ANZCO's current business in China

DALIAN ELITE TRADING CO LTD	$ 4,659,749.94	23.32%		
HEILONGJIANG TIANSHUNYUAN MUSLIM	$ 8,062,785.38	40.34%	63.66%	CIF
FERN RIDGE LTD	$ 4,123,909.40	20.63%		
ADVANCE MARKETING LTD Total	$ 3,139,022.87	15.71%	36.34%	FOB
TOTAL	**$ 19,985,467.59**	**100.00%**		

					Total Invoice Value in Business Unit Currency	Total FOB Value in Busines	Total Invoice Qty Inventory UOM
Customer	Level 1	Level 2	Level 3	Level 4			
ADVANCE MARKETING LTD	SALEABLE	OVINE	LAMB	LAMB FORES	$ 132,386.19	$ 132,386.19	38,679.05
				LAMB MIDDLES	$ 2,601,840.30	$ 2,590,592.28	529,775.00
				LAMB MIXED	$ 421,433.43	$ 416,044.39	243,269.82
ADVANCE MARKETING LTD Total					$ 3,155,659.92	$ 3,139,022.87	811,723.87
DALIAN ELITE TRADING CO LTD	SALEABLE	OVINE	LAMB	LAMB MIDDLES	$ 4,471,584.96	$ 4,281,199.71	906,240.00
				LAMB MIXED	$ 307,663.71	$ 283,466.83	116,239.41
DALIAN ELITE TRADING CO LTD Total					$ 4,879,636.20	$ 4,659,749.94	1,048,941.41
FERN RIDGE LTD	SALEABLE	OVINE	LAMB	LAMB FORES	$ 51,875.00	$ 51,875.00	41,160.00
				LAMB MIDDLES	$ 3,823,991.75	$ 3,823,991.75	781,965.00
				LAMB MIXED	$ 248,042.76	$ 248,042.76	128,961.16
FERN RIDGE LTD Total					$ 4,123,909.40	$ 4,123,909.40	1,074,625.07
HEILONGJIANG TIANSHUNYUAN MUSLIM	SALEABLE	OVINE	LAMB	LAMB LEGS	$ 468.39	$ 403.17	272.64
				LAMB MIDDLES	$ 7,796,765.47	$ 7,346,262.55	1,471,760.00
				LAMB MIXED	$ 715,427.40	$ 614,505.79	324,445.68
HEILONGJIANG TIANSHUNYUAN MUSLIM Total					$ 8,622,000.93	$ 8,062,785.38	1,826,800.89
Grand Total					$ 20,781,205.00	$ 19,985,467.00	4,762,091.24

Source. ANZCO

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Supply Chain Re-engineering in the Fresh Produce Industry: A Case Study of Adani Agrifresh

Mukesh Pandey[a], Gregory A. Baker[ⓐb] and Deepali Tewari Pandey[c]

[a] *Associate Professor of Agribusiness, GBPUAT, Pantnagar, India*

[b] *Professor of Management and Director of the Food and Agribusiness Institute, Leavey School of Business, Santa Clara University, California, USA*

[c] *Subject Matter Specialist (Horticulture) at GBPUAT, Pantnagar, India*

Abstract

Srinivasa Ramanujam, the Chief Operating Officer of Adani Agrifresh, faces important decisions regarding his apple business in India. In 2005, Agrifresh saw a business opportunity and set up a Controlled Atmosphere Storage (CAS) facility when the state of Himachal Pradesh adopted the amended APMC Act, which deregulated the marketing of fresh produce. Following this change in the legal environment, Ramanujam reengineered the apple supply chain, which had previously operated very inefficiently. He achieved some degree of initial success in an agribusiness environment where long chains of intermediaries dominated produce marketing despite adding little value. The case describes the challenges faced by Agrifresh including securing supplies from farmers, capacity utilization, and product portfolio issues. The case is intended to be used in teaching a variety of management topics to students at the undergraduate, graduate, and executive levels, including agribusiness, strategy, and supply chain management, particularly as they apply to emerging markets..

Keywords: agribusiness, supply chain management, produce, apples, controlled atmosphere storage

ⓐCorresponding author: Tel: + 1 408.554.5172
Email: G. A. Baker: gbaker@scu.edu

IFAMA Agribusiness Case 16.1 B

Adani Enterprises in India

Adani Enterprises, a US$6 billion Indian business group, has interests in edible oil, ports, logistics, special economic zones, power, oil exploration, coal, mining, and gas distribution. In 2006, through its wholly owned subsidiary, "Adani Agrifresh Limited," the conglomerate set up integrated storage, handling, and transportation infrastructure for fresh produce in the state of Himachal Pradesh.

In 2008, Ram joined Adani Agrifresh to lead its operations as COO. Being an agribusiness veteran with an excellent record of accomplishments across several vertical agribusiness chains, he saw much opportunity for the company. Ram was keen on significantly expanding the business by integrating its operations from farm to consumer and to emerge as the undisputed leader of India's fresh produce sector.

Apple Production and Marketing in India

The domestic Indian apple market was valued at approximately US$4.1 billion in 2010 (Dei Rosi 2010). India's three mountain states, Himachal Pradesh, Jammu & Kashmir, and Uttarakhand, produce nearly all of the apples grown in the country. Two apple varieties, Red Delicious and Golden Delicious are the dominant varieties grown and consumed in India. Indian consumers prefer apples that are red, sweet, crunchy, and uniform in shape (Venkataraman 2011). The lead apple producing state, Jammu & Kashmir, accounts for over two-thirds of the apple production. Additionally, its yield per hectare is almost twice that of the next largest producing state, Himachal Pradesh (exhibit 1). In 2009, India produced 1.98 million metric tons of apples on 274.4 thousand hectares (Indian Horticulture Database-2010 2010), one of the lowest yields amongst the world's apple producers (exhibit 2). Explanations for this low yield include mountainous terrain, monsoon dependence, and use of century-old "Delicious" variety cultivars. Apples are a fruit best suited to a temperate climate; therefore, colder temperatures are required for the trees to bear fruit and mature. As a result, the apple-harvesting season in India ranges from July to November, when the domestic supply of apples is at its peak, causing prices to decrease sharply (exhibit 3).

In India, the great majority of fresh produce is sold through informal retailers, including roadside and neighborhood stalls, kiosks, and doorstep delivery by hand carts. Organized fresh food retailing through supermarkets is still in the nascent stage and largely confined to a few big cities. In the current, supply-driven market, buyers face great variability of supply in terms of quality, quantity, specifications, and yield. For this reason, most buyers, including food processors and retailers, do not know in advance what to expect from the supply lot (Minton et al. 2009).

Diversification of Dietary Patterns in India

Compared to other apple producing countries, India's per capita apple consumption of about 1.35 kgs. per year is quite low. Turkey has the highest per capita apple consumption, approximately 36.8 kgs., followed by France, China, and the US, with 16.2, 14.0, and 9.7 kgs., respectively

(Rawat 2009a). With its rapid forecasted growth, India is predicted to be one of the world's largest economies by 2050 (Knight Frank 2012). This may portend changes in consumption patterns as fruits such as apples become mainstream commodities in Indian markets.

The size of India's workforce is expected to increase from 775 million in 2008 to 950 million by 2026. As incomes rise, Indian consumers are diversifying their diets to include a broader array of foods. With this diversification, dietary patterns that mirror global trends are beginning to emerge. Since the early 1990s, non-staple foods including dairy products, meats, edible oils, fruits, and vegetables have been the fastest growing food categories in India. The increased consumption of foods in these categories is due in large part to the rise in dual-income families, rising income levels, and globalization (Pingali and Khwaja 2004). With a burgeoning organized retail infrastructure, growing consumer awareness about healthy eating, and established perceptions about apples as a healthy and flavorful fruit, the Indian market for apples has huge growth potential. Furthermore, the potential expansion of distribution networks to medium-sized cities offers another untapped opportunity. To meet this rapidly growing demand through domestic supply, India must either increase its area under apple cultivation or improve yields by adopting improved cultivation systems.

Fresh Fruit Imports in India

Fresh fruit imports in India grew nearly 7 percent between 2005 to 2010 (exhibit 4). Between April 2009 and March 2010, India imported approximately 140,000 tons of fresh fruit valued at more than US$120 million (Narayanan 2010). Apples account for over 58 percent of these imports despite the high import tariff rate of 50 percent (exhibit 5). In comparison to the import duties on other fresh fruits in both developed and developing countries, India's customs duty on apples is high. A notable exception is Turkey, with an import duty of 60.3 percent. Besides apples, India also imports citrus, kiwifruit, grapes, pears, plums, and limited quantities of peaches and nectarines as shown in exhibit 6 (Brusco 2011).

Through surveys and discussions with various fruit retailers, the authors found that the Red Delicious variety constitutes approximately 90% of the apples imported into India. The remaining 10% includes varieties such as Fuji, Royal Gala, and Granny Smith. The authors also found that imported apples are generally priced approximately 25 to 50 percent higher than domestically produced apples. This may be explained by the high import tariff as well as the high margins charged by importers. Channel margins account for over 50% of the consumer price (exhibit 7). Risk and uncertainty faced by importers, particularly regarding enforcement of nontariff import regulations, may contribute to importers' demands for higher margins. Although India eliminated quantitative restrictions on apple imports in 1999, it imposed nontariff measures, including phytosanitary, pesticide residue, and food safety regulations, in addition to the 50 percent import tariff. Some of India's requirements for apple imports, such as those pertaining to waxing and chemical residues, differ from US and international standards. Although these regulations appear to have had little effect on India's apple trade so far, uncertainties regarding the rules and their enforcement have the potential to be disruptive and costly for traders (Landes 2006).

Until 2008, the majority of apples imported into India came from the US. However, in the last two to three years, Chinese apples, imported mostly from Shaanxi province, have flooded Delhi's fruit markets, giving Indian apple growers tough competition. As of 2010, China and the US have approximately equal shares of the Indian apple market (exhibit 8). A prominent fruit vendor, when interviewed in Delhi, said, "The strange thing about Chinese apples is that they taste the same all year round. Though Chinese apples can at times, cost Rs 20 to Rs 40 more than the Indian varieties, Indians buy them because they look more tempting with their bright red, gleaming surface. They look the same all the time unlike Indian apples." Indian growers have made little effort to improve quality and yields to better compete with imported apples. The high price of both domestic and imported apples, relative to other Indian fruits, has limited apple consumption largely to higher income families (Rawat 2009a). This is in contrast to many industrialized countries where apple prices are relatively low and apples are widely-consumed across all income categories.

APMC Act and Its Amendment

The marketing of agricultural products in India has traditionally been controlled by the state and regulated by the Agricultural Products Marketing Committee (APMC) Act, which states use to develop their own APMC Act. These acts require all agricultural produce to be sold only in government-regulated markets (called "mandis"), which have poor infrastructure, and are typically characterized by a long chain of intermediaries (exhibit 9). These intermediaries cause long marketing delays and charge exorbitant margins in an arbitrary manner. They pay scant attention to grading, sorting, and storage, and take little care in handling the product during loading, unloading, and transport (Pandey, Sudhir, and Tewari 2010). The licensing of traders in these regulated APMC markets generates buyer power for the traders and serves to limit the income of small and unsophisticated farmers. It is a major entry barrier for entrepreneurial traders (Coulter 2004). Industry estimated losses due to poor post-harvest management are approximately 30 percent of the value of Indian fruit and vegetable production or almost US$3 billion (Pulamte 2008).

India's Ministry of Agriculture, being acutely aware of the limitations of the APMC Act, amended the act in 2003 and removed some of its principal rigidities (exhibit 10). The amended APMC Act, which has been adopted by a majority of India's states, introduced the concepts of parallel private markets and contract farming, and assigned new roles for cooperatives (Marketing Infrastructure & Agricultural Marketing Reforms 2003).

Himachal Pradesh's Business Environment after the AMPC Act Amendment

Himachal Pradesh adopted the amended APMC Act in 2005. Since then many private business have actively worked to design business models under the new regulatory environment. Under the amended APMC Act in Himachal Pradesh, private players are allowed to open and operate agricultural markets where farmers may sell their produce. Farmers need not bring their produce to the APMC market now as they have the option of selling their produce directly to private parties, food chains, and retailers. Under the amended act, food processors and retailers may also sign contracts with farmers to obtain the desired quantity and quality of produce. During the last

five years, various players like CONCOR, Reliance Fresh, Field Fresh, Mahindra Shubh Labh, and Adani Agrifresh have started procuring apples directly from farmers without going through the APMC (exhibit 11). To capitalize on the untapped horticultural business opportunities resulting from the APMC reforms, Adani Enterprises entered Himachal Pradesh aggressively and set up an extensive cold chain infrastructure.

In Himachal Pradesh, the major apple producing areas are Shimla, Kullu, Sirmour, Mandi, Chamba and Kinnaur (exhibit 12). The majority of farms in these areas are small (exhibit 13) and farmers must cope with poor roads, little or no cold storage facilities, nonexistent farm credit, little market information, and poor market infrastructure. These small apple farmers lack the ability to invest in modern agricultural practices and farm machinery, resulting in low productivity. As a result, their output is very low and they are "price takers". The Indian domestic market is characterized by an oversupply of apples in the peak season and shortages in the off-season, resulting in off-season prices that are often three to four times peak-season prices. The lack of appropriate storage and logistics infrastructure ultimately results in high prices for low-quality apples during non-peak periods.

When interviewed in 2011, Mr. Pranav Adani, Chairman of Adani Group, said "Adani group has been at the forefront of setting up infrastructure projects that significantly impact the growth of the Indian economy, be it port, power, mining, or grain storage. When the port sector was opened up to the private sector, we set up the first private sector port at Mundra in Gujarat on the west coast of India. When the Food Corporation of India invited offers to set up modern bulk silo storage facilities, we set up facilities to store, handle and transport 550,000 metric tons of grains in bulk, significantly saving a great amount of grain, which was otherwise going to waste due to inadequate storage facilities and poor handling. When we saw an opportunity to leverage our strength to contribute to reducing the wastage in the horticulture sector, we decided to set up 'Adani Agrifresh' to create an integrated cold supply chain."

At present, three different business models are practiced for the procurement and distribution of apples in Himachal Pradesh.

1. **Commission agents in traditional APMC markets:** After harvesting their crop, the farmers of Himachal Pradesh pack their apples in cardboard boxes and transport them by small trucks to the mandis, traveling an average of about 20 kilometers from their farm. A commission agent on the mandi works with the farmers by acting as a liaison between the farmers and buyers. There are major inefficiencies in this supply chain model. From the grower's perspective the major disadvantage is that he or she does not know beforehand the prevailing price of apples at the mandi. Word-of-mouth and/or cell phone communication are the only means of price discovery for the farmer. This information is often unreliable and insufficient for determining where, when, and at what price to sell the product. Once the farmer arrives at the mandi with the produce, he or she discovers the price. In most cases, the farmer must sell at whatever price the apples get at auction by the commission agent. Farmers are left with few options for two principal reasons. First, storage opportunities are not available due to the absence of cold chain infrastructure. This means that farmers must sell their fruit immediately following harvest. Second, farmers lack financial training and do not understand that transporting their apples to the mandi and incurring the transportation costs generally

puts them at the mercy of whatever price the commission agent offers. Farmers simply cannot afford to pay the cost of transportation more than once. Before the APMC Act reforms, farmers were not only dependent on commission agents to sell their apples but also to get loans in the absence of a formal credit mechanism. Reliance on a commission agent makes the entire transaction very asymmetric where the farmer has very little power relative to the commission agent. With little power in the hands of farmers, cheating in the weighing of the apples has become standard practice and farmers are not in a position to demand otherwise.

2. **Semi-direct company buyers:** Retail companies such as Reliance, Mahindra and Mahindra, and Spencers have hired their own agents in Himachal Pradesh. These agents buy from farmers on behalf of their company and compete aggressively in the field for larger volumes of good quality apples. Since most of the growers produce small quantities of apples, the purchasing company needs many buyers to handle the large volume of purchases. Moreover, since the packing and grading of apples is not standardized, a great deal of time is spent finalizing the deal with farmers. This makes it difficult to monitor and control the entire operation of apple procurement. Semi-direct company buyers purchase approximately 30% of overall apple production.

3. **Direct company buyers:** At present, the direct company buyers include Adani Agrifresh and Fresh & Healthy Enterprise Limited of the Container Corporation of India (CONCOR, Ministry of Railways, India). Unlike commission agents and semi-direct company buyers, direct company buyers work throughout the year to train farmers in scientific cultivation practices and post-harvest management. These training sessions are organized by company personnel, who send experts hired by the company to periodically visit villages and invite farmers to participate in training sessions free of charge. Both Adani Agrifresh and Fresh & Healthy own CAS facilities, which are technically far superior to conventional cold storage, as the former controls the entire atmosphere and not just the temperature.

Adani Agrifresh's Operations in Himachal Pradesh

Adani Agrifresh started investing in Himachal Pradesh after the APMC Act was amended. Their business strategy was to concentrate on marketing those fruits that are produced far from major consumption centers, are seasonal in nature, and are amenable to increased storage life using modern, integrated CAS facilities. Apples were chosen for three reasons: (a) although the two mountainous states in northern India produce most of the apples, the fruit is consumed across India; (b) in India, apples are considered a product for the "classes" rather than the "masses," and consumers' price sensitivity for apples is much less than for other commonly consumed fruits; and (c) apples can be stored for as long as seven months in a properly controlled atmosphere.

Ram remarked, "We set up the controlled atmosphere storage units in Himachal Pradesh to handle apples to start with. We are very happy that our intervention has brought about welcome changes in the way apples are handled from farm to retail, benefitting both the apple farmers and consumers." Using modern CAS facilities with sorting and packing lines, the plan is to buy, store, and market apples focusing on high quality and constant supply throughout the year.

Volume is a critical factor for Agrifresh given that the level of investment is high and margins are low.

Agrifresh realized that the prevailing market system did not incentivize growers to follow the best harvest and post-harvest practices, especially practices related to proper harvest timing and method, product handling, and packing. Agrifresh ruled out the option of buying from the mandis as they discovered that the quality of apples sold at the mandis is not high enough to build a brand at the retail level. Agrifresh researched the reasons underlying the poor quality of apples and analyzed the logistical inefficiencies that occurred when growers supplied apples through APMC markets. They found that most growers who sell through APMC markets overpacked the boxes, with some growers packing close to 30 kgs. in a box designed to hold only 20 kgs. of apples. The desire to save on costly packing adversely affected the quality of the apples. In the subsequent stage, transporters frequently loaded 25% more apple boxes on their trucks than recommended, resulting in additional damage in transit. Moreover, during the peak production months, India's largest mandi in Delhi's Azadpur market would receive more than 800 trucks of apples per day, although it was designed to handle only 400 trucks each day. As a result, apples spent hours under the hot sun in non-refrigerated trucks prior to being unloaded. The apples were further damaged at APMC markets as the boxes were unloaded, opened, and reloaded manually for further transportation to various consumer markets.

Armed with this research, Adani Agrifresh decided to design an entirely new system for handling and distributing apples. They started their operations in Himachal Pradesh in 2006 by contacting farmers directly and clearly communicating the required quality specifications. Unlike APMC mandis, Agrifresh announced its procurement price of different grades of apples for the entire week, thus enabling growers to make an informed choice. To ensure quality, Agrifresh subjected each apple to firmness and maturity tests prior to purchase. Procurement officers of Agrifresh visit farmers every two weeks in their fields to ascertain the quality and yield of their apple orchards. Agrifresh buys only those apples that meet its criteria after doing preliminary grading in the farmers' fields. The remaining apples are rejected and farmers are free to supply these apples to the APMC market. Agrifresh also invested in sturdy, reusable plastic crates and issued them to farmers who produce an adequate quantity of good quality apples. Agrifresh asked farmers to transport their apples to its CAS facilities in these crates thus eliminating the quality deterioration due to over-packing and overloading the fruit. Crop experts at Agrifresh also trained growers in scientific cropping and post-harvest practices with the aim of building a preferred-buyer relationship. This is one way that Agrifresh hopes to build loyalty among farmers.

Agrifresh maintains a concentration of 0 to 20 percent carbon dioxide and less than two percent oxygen concentration level inside its CAS. The temperature and relative humidity are maintained at -2 degrees Celsius and 90-95 percent, respectively. This modified atmosphere retards the rate of apple respiration, thereby preserving critical attributes such as texture, flavor, and appearance for up to seven months. Agrifresh also installed imported, computerized apple graders at its CAS facilities to sort apples according to their color, shape, and weight. This mechanism also helped Agrifresh to develop a transparent payment system wherein it compensates farmers based on the quality, grade, and weight of their apples. Because of this strict quality control regimen,

Agrifresh's apples conform to international codes, quality, and safety standards such as CODEX, and HACCP, and EU standards.

Adani Agrifresh sells apples through an extensive network of dealers spread across India. The company also sells apples directly to modern supermarkets countrywide and through large fruit and vegetable retailers that operate in most large cities. By investing in CAS facilities, Agrifresh is able to store apples in the peak production season and sell them to consumers during the off-season at higher prices. This strategy enables Agrifresh to leverage its logistical strength and arbitrage the price differential between the peak and off-peak seasons.

Hub Operators: the Logistical Backbone Behind Agrifresh

Agrifresh signed contracts with approximately 150 hub operators in Himachal Pradesh who in turn serve around 4000 farmers. Agrifresh delivers crates to these hub operators, who further distribute them to those growers who are interested in supplying to Agrifresh and have good quality apples available. Upon receipt at Agrifresh's CAS, apples undergo quality tests and are sorted and graded according to quality and color. Since 2010, Adani has started accepting some B grade apples that it does not store in its CAS facility but supplies directly to the smaller price-sensitive markets. Once the apples are accepted for quality, size, maturity, and color, the hub operator's account is credited based on the price declared in advance for the week. The A grade apples are then put into the CAS facility. This process continues until the procurement season is over. Agrifresh also uses this network of hub operators to sell agricultural inputs to farmers and to arrange regular meetings with growers.

The crates serve as an incentive to farmers who supply Agrifresh, as the farmers do not have to bear the costs of cardboard packing boxes, transportation to the APMC markets, and commissions, and market fees. Moreover, grading and packing apples in cardboard boxes, unlike packing in plastic crates, requires skilled labor, which is often in short supply during the peak harvest season. Furthermore, selling to Agrifresh reduces the risk of damage or weight loss that growers often experience when delivering product to the APMC markets. Exhibits 14a and 14b indicate the extent to which farmers obtain an increased share of the wholesale price. The higher revenue gives farmers the financial means to plan for future investments and purchase the latest technological innovations.

Farmpik Shoppe

The unreliable supply of agricultural inputs is a major problem in Indian horticulture. In order to supply genuine quality inputs and extension services, Agrifresh has established three agricultural input stores, called "Farmpik Shoppe," where growers may purchase inputs. These stores supply pesticides, seed, fertilizers, and other agri-inputs from reputable companies such as BASF, Bayer, and PI Industries. Representatives of these companies and technical experts from local agricultural universities also provide technical advice on cultivation and post-harvest management to farmers through village meetings. Because of these stores, farmers receive genuine, quality agricultural inputs at reasonable prices.

Farm-Pik Consumer Brand

With access to a consistent quality of fruits and vegetables throughout the year, Agrifresh now plans to set up distribution centers across India. In addition to apples, Agrifresh markets Indian pomegranate, table grapes, bananas, cherries, lychees, grapefruit, and oranges under the brand name "Farm-Pik." Exhibit 15 provides production and consumption figures for a variety of fruits grown in India. The company also imports and markets apples, pears, and kiwis from China, the US, New Zealand, and Chile using its distribution network. Agrifresh has distributors in all major cities across India selling their Farm-Pik produce. They have utilized promotional activities including dealer boards, umbrellas, posters, danglers, carry bags and have promoted their brand at retail stores, trade fairs, and other trade events.

Future Challenges

Ram is very optimistic about the future of the re-engineered apple supply chain that he and his team have developed. He is also very concerned about the scalability and profitability of Agrifresh's operations. Some of the key challenges that Ram believes Agrifresh will face are:

Challenge 1: Agrifresh buys only grade A apples (the best quality and suitable for storage) from growers whereas APMC mandi-based commission agents buy all grades, namely, grades A, B, and C. Around 60% of the apples produced in Himachal are grade A, with the rest being inferior grades B and C. Although 95% of Himachal Pradesh farms are small, a few dozen farmers own large apple plantations. Despite the financial incentives farmers receive from Agrifresh, larger farms prefer to transact with commission agents in APMC mandis as they buy their entire crop and give them personalized services. These large growers are not only well educated, but also have better managed orchards, follow scientific horticultural practices, and produce superior quality apples. Without servicing the large-scale farmers, Agrifresh's transaction costs are high due to the large number of small-scale farmers delivering small loads of average quality. How can Agrifresh secure the commitment of large-scale farms to build and nurture a long-term, sustainable relationship that will reduce its per unit transaction costs?

Challenge 2: Most apple orchards in Himachal Pradesh are over 30 years old, have declining yields, and lack uniformity in terms of the shape, size and color of the fruit. Moreover, "Royal Delicious" and "Rich Red" varieties constitute most of the apples produced. Although more than 700 international apple varieties have been tried and tested during last 50 years, the "Delicious" cultivar group still accounts for 83 percent of production. How can production and post-harvest technologies be transferred rapidly and efficiently to such a large number of small farmers across several geographical territories?

Challenge 3: Over 95% of fruits in India are sold through makeshift, non-permanent shops, push-cart sellers, and pavement and roadside vendors. These vendors sell fruit at ambient conditions in extreme heat, humidity, dust, and unsanitary conditions. The lack of integrated cold chains in India poses a serious threat to fruit quality and consequent sales, especially during the hot April to August period. While deciding on the location of its CAS infrastructure, Agrifresh had two choices: either to invest in facilities that are close to the production area of apples in

Himachal Pradesh or to locate facilities close to the big consumption centers near Delhi, Mumbai, Chennai, Bangalore, or Calcutta. Agrifresh decided that getting the apples to cold storage within 12 hours of harvest would better preserve the quality of the fruit and better serve the market. The success of Agrifresh's Farm-Pik apples is an indication that consumers acknowledge the superior quality of this fruit. However, there is a flip side to the decision to invest in CAS at Himachal Pradesh – capacity utilization and a costly infrastructure. In Himachal Pradesh, nearly 75 percent of the apples procured and stored by Agrifresh from the August to mid-October harvest are sold to domestic markets by December. Moreover, there is an ever-present threat of apple imports from countries like the US and China. Furthermore, from April onwards, mango production dominates the Indian market. The mango is considered a "fruit for the masses" as well as an exotic fruit. India is the largest producer of mangoes in the world and when mangoes flood the market between April and August, all other fruits take a back seat. How can Agrifresh best recover its large investment made in the cold atmosphere storage and logistics infrastructure in a business environment vulnerable to price and climate risks and farmers who may renege on contracts when offered higher prices elsewhere?

Challenge 4: Due to the difficulty of standardization, scalability, sourcing of quality fruits in large quantities, and consumer resistance to paying a premium for a well-handled product, Agrifresh's prior entry into the mango, orange, and kinnow supply chain was not very successful. Wanting to leverage its distribution network, Agrifresh has planned to import fruits, including apples, pears, oranges, kiwis, and grapes from the US, China, New Zealand, Italy, and South Africa. With the nutrition recommendation of five daily servings of fruits and vegetables gaining an increasing number of followers in urban Indian households, the outlook is bright for fresh fruit and vegetable sales. However, Ram believes that sales of imported fruit will be limited because the number of Indian households with the financial means to purchase fresh imported fruits is generally low. Furthermore, the structure of the fruit trade in India is very fragmented, limiting mass distribution through supermarkets. At present, over 90% of Agrifresh's business comes from apples. Ram is evaluating whether Agrifresh's operations can be profitably sustained while handling primarily apples. He has identified the following product portfolio options:

Option 1: A wide product portfolio of fruits targeted at the entire Indian market.

Option 2: A narrow product portfolio of niche-market exotic fruits.

Option 3: Off-season cultivation of exotic vegetables, which growers in Himachal have started producing on a fairly large scale. Ram's only concern with this option is whether these vegetables can be priced to cover the cost associated with storing them in CAS.

How might these portfolio options contribute to a more successful business model for Agrifresh?

Challenge 5: What incentives can Agrifresh give hub operators to ensure that they act as front-line personnel by keeping track of competitor activities and ensuring a flow of good quality apples? Can hub operators be used by Agrifresh to assist with farmer training in the areas of scientific cultivation, pest management, and post-harvest management practices?

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Exhibit 1. Production Statistics, Major Apple Producing States, India (2008-2009)

State	Area (1,000 ha.)	Production (1,000 MT)	Yield (MT/ha.)
Jammu and Kashmir	133.7	1332.8	10.0
Himachal Pradesh	97.2	510.2	5.2
Uttarakhand	32.7	132.3	4.1
Arunachal Pradesh	10.8	9.8	0.9
Nagaland	0.0	0.1	0.4

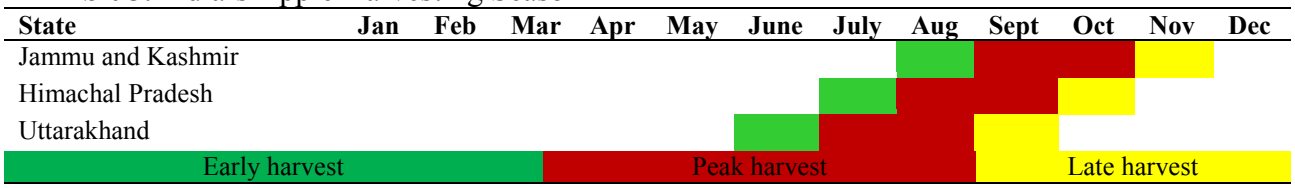
Source. Indian Horticulture Database-2010 (2010).

Exhibit 2. Production Statistics, Major Apple Producing Countries, 2009

Country	Area (ha.)	Production (MT)	Productivity (MT/ha.)
China	2,000,466	29,851,163	14.9
USA	141,676	4,431,280	31.3
Poland	171,963	2,830,870	16.5
Iran	202,000	2,660,000	13.2
Turkey	158,400	2,504,490	15.8
Italy	54,642	2,208,227	40.4
India	274,000	1,985,000	7.2
France	52,200	1,940,200	37.2
Russian Federation	243,000	1,467,000	6.0
Chile	35,000	1,370,000	39.1
Argentina	46,000	1,300,000	28.3
Brazil	37,890	1,121,468	29.6
Germany	31,800	1,046,995	32.9
Others	1,410,973	14,870,547	10.5
World	4,860,010	69,587,240	

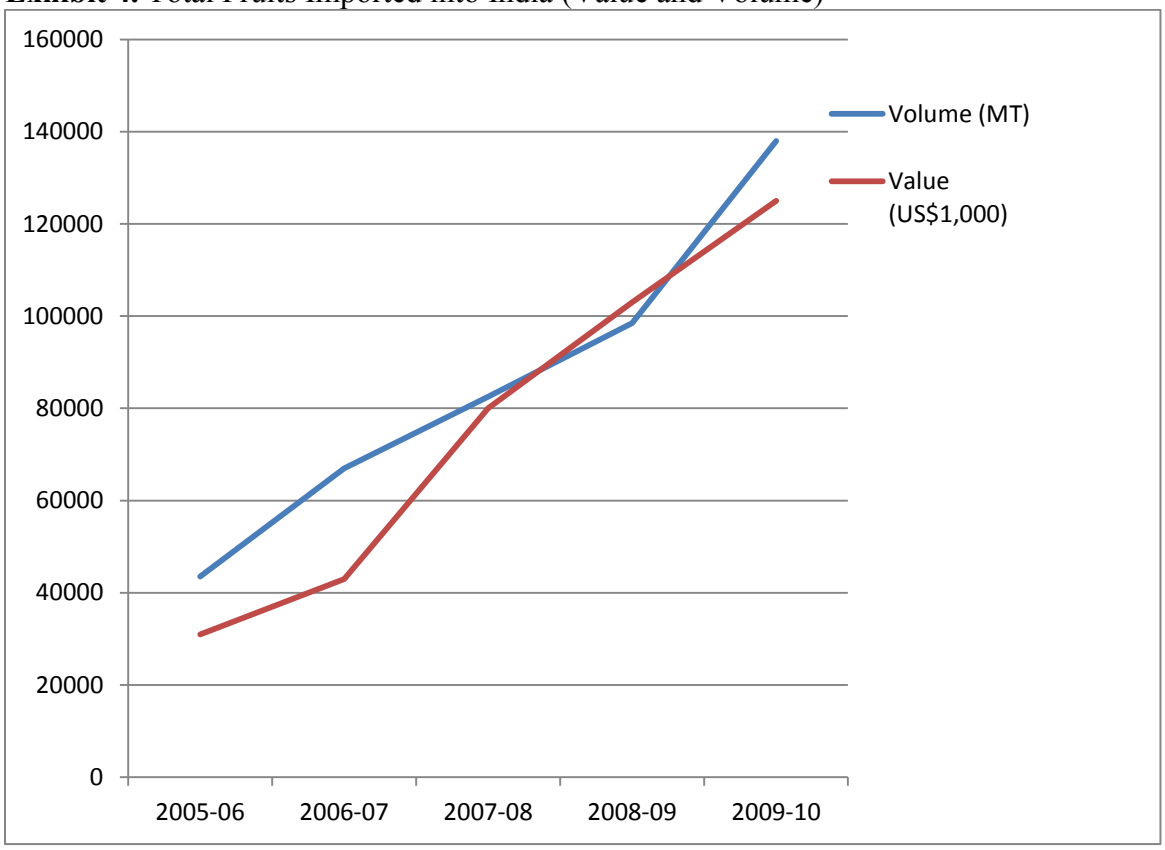
Source: Indian Horticulture Database-2010 (2010).

Exhibit 3. India's Apple Harvesting Season



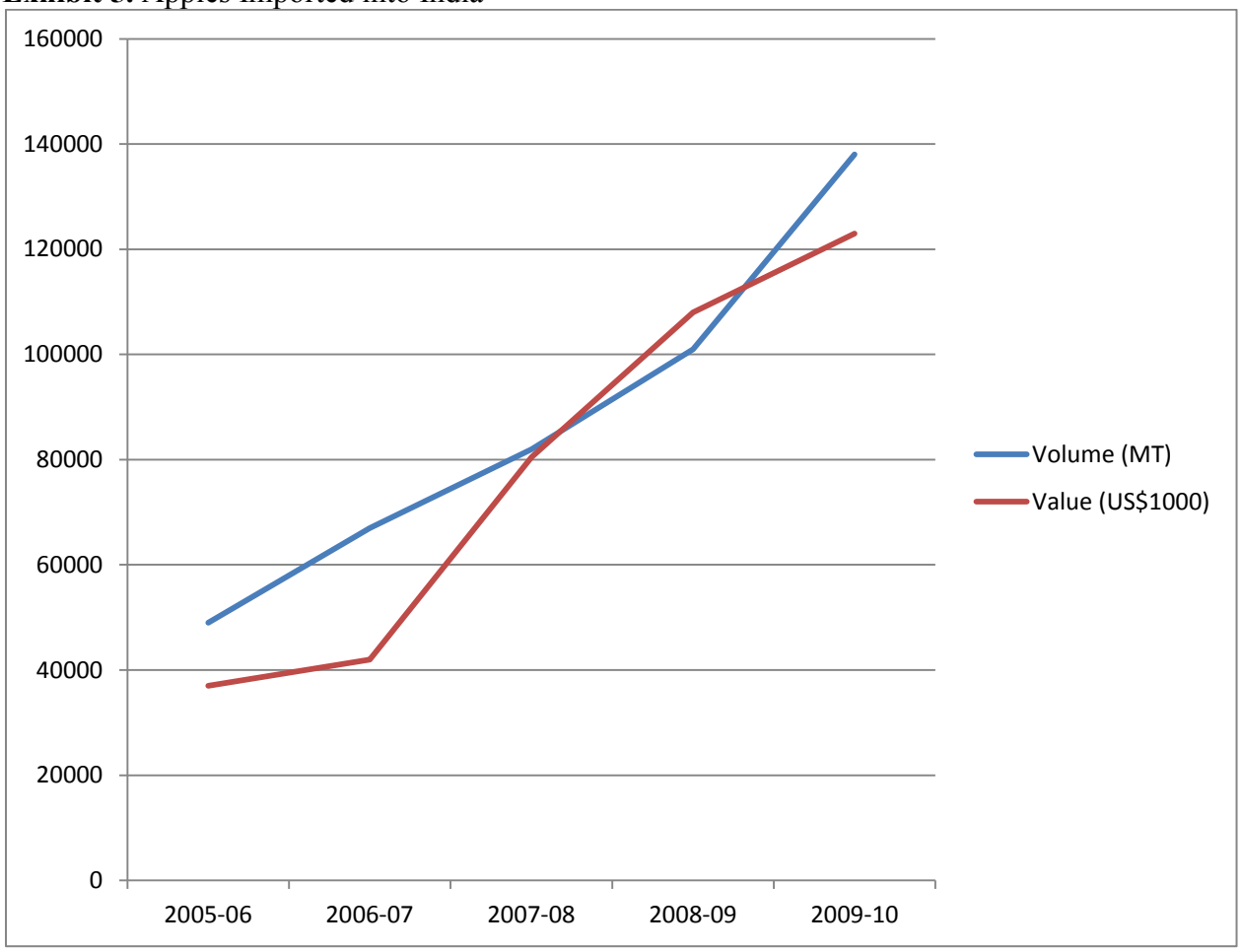
Source. Indian Horticulture Database-2010 (2010).

Exhibit 4. Total Fruits Imported into India (Value and Volume)



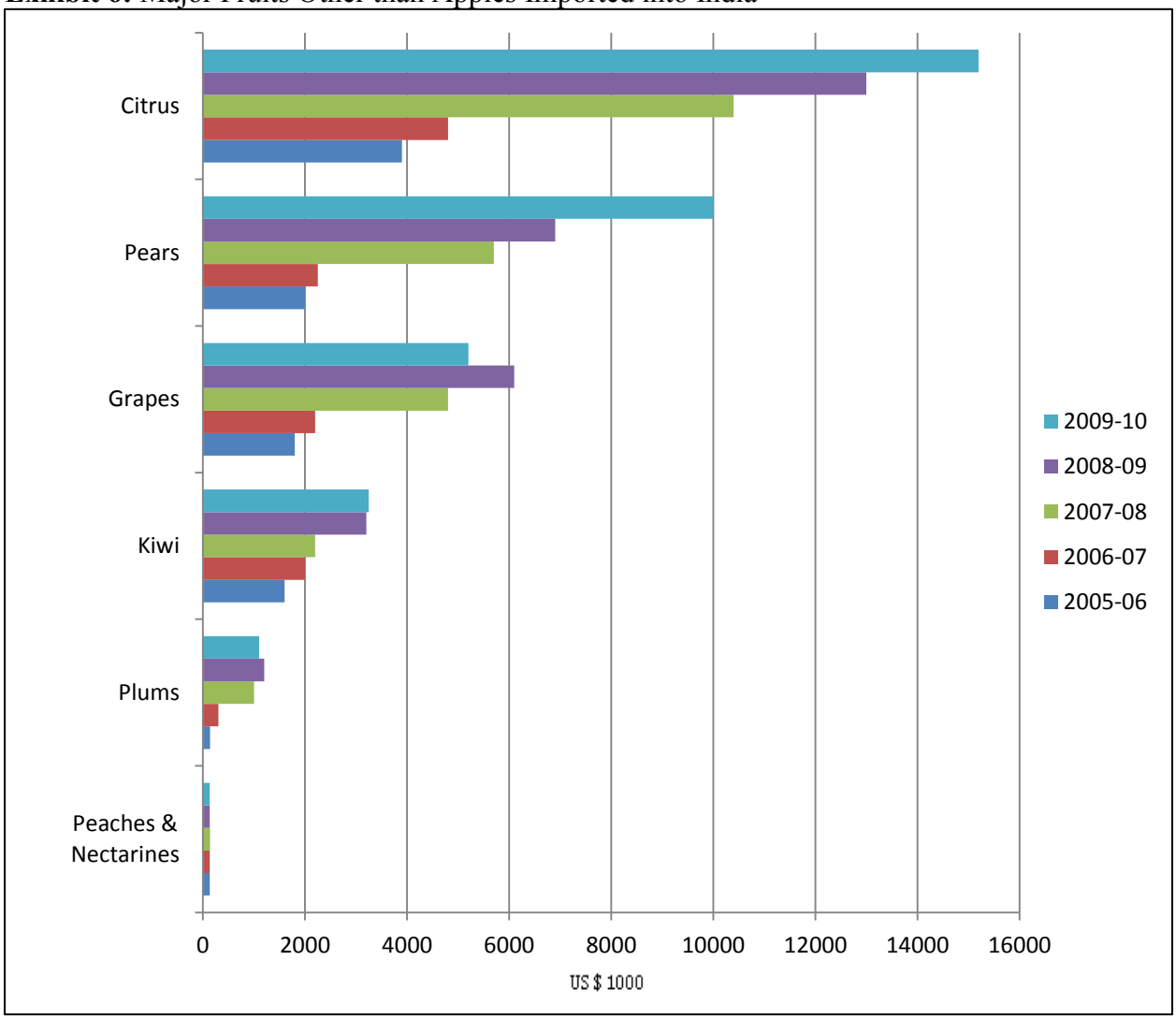
Source. DGCI&S (2010).

Exhibit 5. Apples Imported into India



Source. DGCI&S (2010).

Exhibit 6: Major Fruits Other than Apples Imported into India



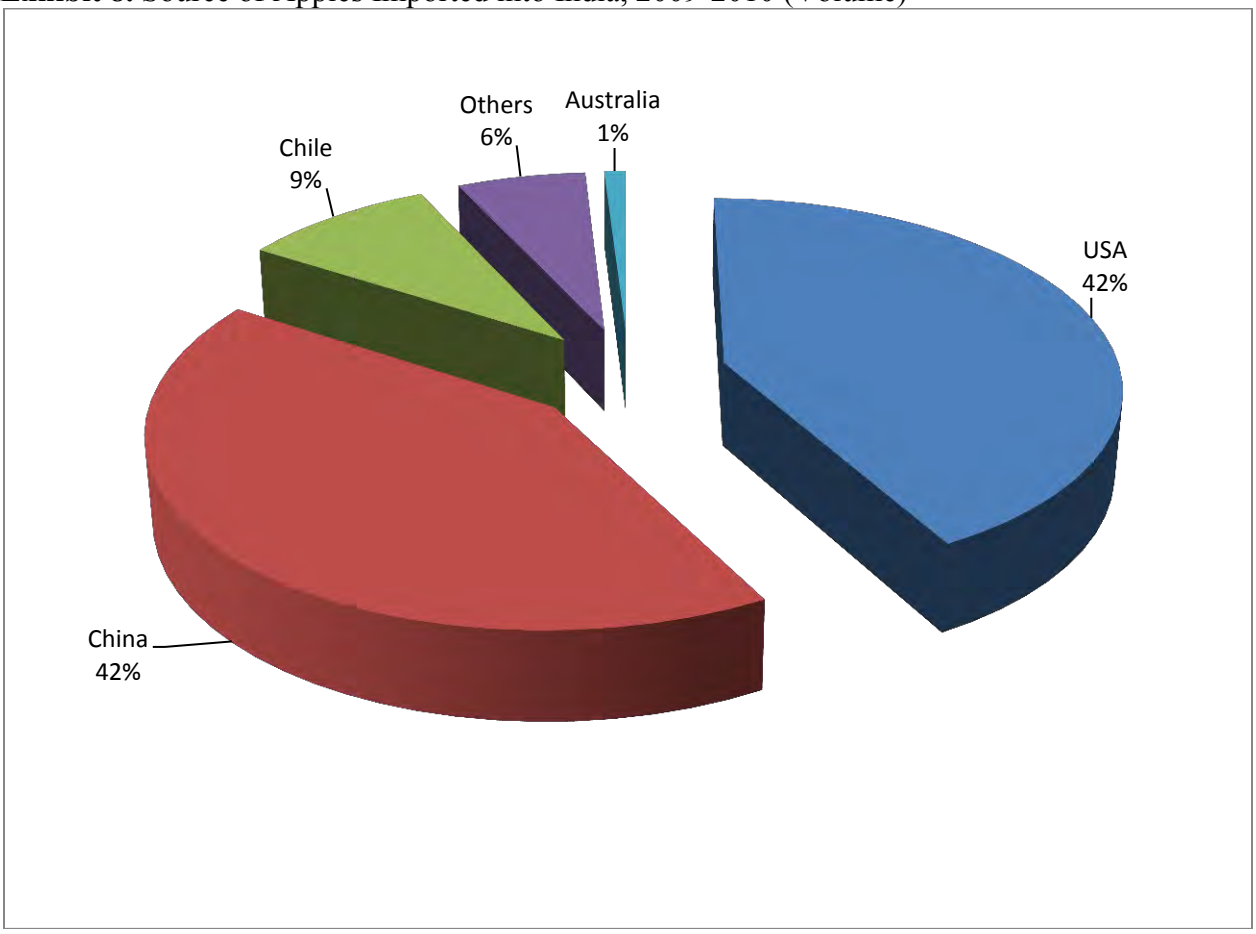
Source. DGCI&S (2010).

Exhibit 7. High Margins in Import Marketing of Apples in India

	Description	US$ per 20 kg. box
A	Import Unit price, CIF (Washington apple)	25.0
B	Expenses incurred by importer on: tariffS (50%), clearing, freight, agent commissions	17.1
C	Importer's margin	3.3
D	Realization at wholesale market (A + B +C)	45.4
E	Expenses of trader (transportation, cold storage of approximately 15 days, commission)	1.1
F	Wholesale trader's margin	2.2
G	Retailer's purchase price (D+E+F)	48.7
H	Retailer's expenses (carriage/handling, transportation, waste, other)	4.4
I	Retail margin	8.9
J	Consumer price (G+H+I)	62.0

Source. Venkataraman (2011).

Exhibit 8. Source of Apples Imported into India, 2009-2010 (Volume)



Source. Venkataraman (2011).

Exhibit 9. Intermediaries in the Indian Fruit Value Chain

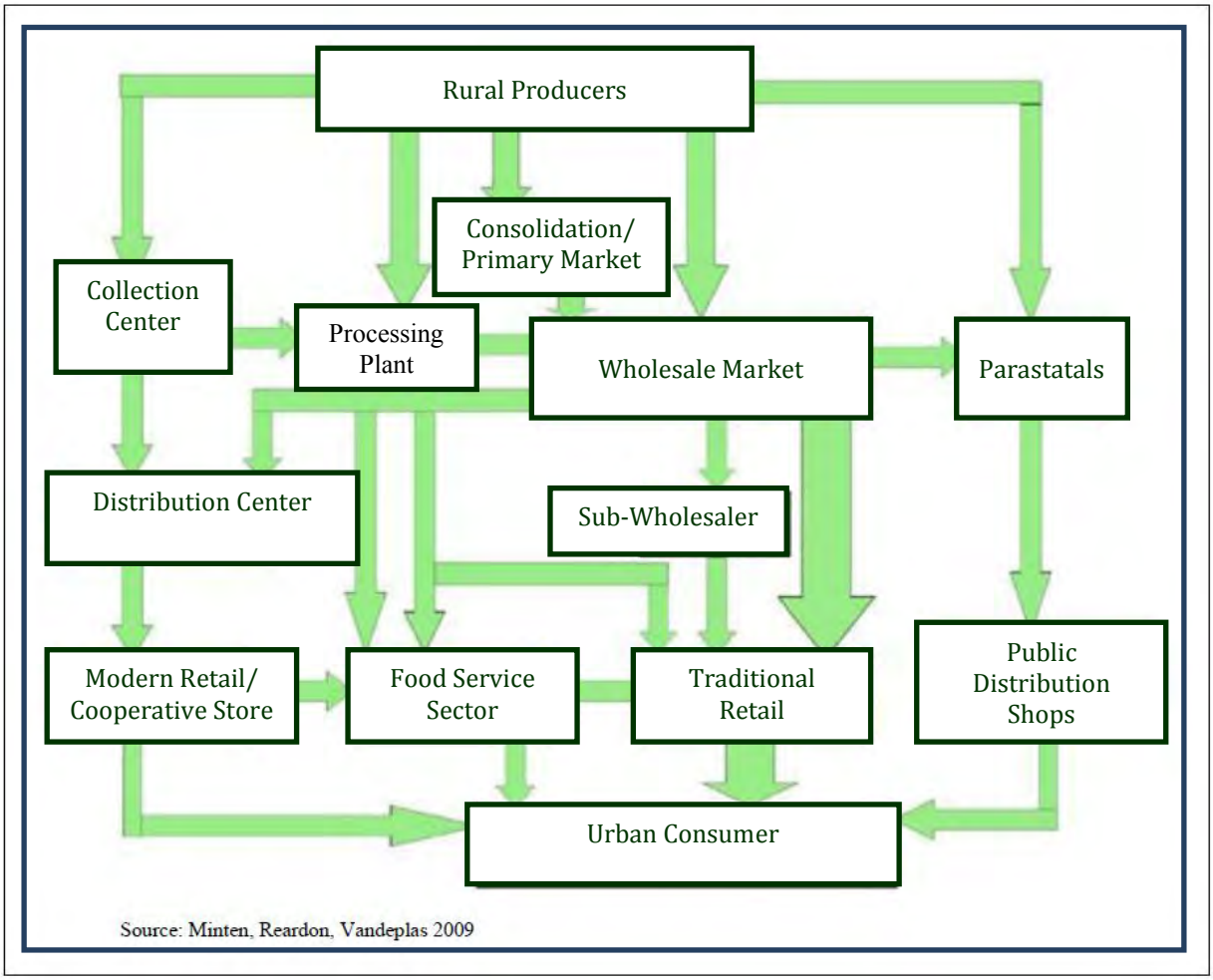


Exhibit 10. Progress of Reforms in APMC Acts in India

Stage of Reforms	Names of States/Union Territories
States/Union Territories where reforms to APMC Act have been done for Direct Marketing, Contract Farming and Markets in Private/Cooperative Sectors	Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Nagaland, Orissa, Rajasthan, Sikkim, and Tripura
States/UTs where reforms to APMC ACT been partially completed	a. Direct Marketing: Delhi b. Contract Farming: Haryana, Punjab & Chandigarh c. Private Markets: Punjab and Chandigarh
States /UTs where there is no APMC Act and hence no reforms required	Bihar[a], Kerala, Manipur, Andaman and Nicobar Islands, Dadra and Nagar Haveli, Daman and Dui, and Lakshadweep
States/UTs where APMC Act already provides for the reforms	Tamil Nadu
States /UTs where administrative action has been initiated for the reforms	Mizoram, Meghalaya, Harayana, Jammu & Kashmir, Uttarakhand, West Bengal, Pondicherry, NCT of Delhi, and Uttar Pradesh

[a] APMC Act repealed effective 1 September 2006.
Source. Patnaik and Gokul (2011).

Exhibit 11. Apple Procurement by Private Firms in Himachal Pradesh

Name of Firm	Year	Quantity (MT)	Average Price (Rupees[a] per kg.)
Adani Agrifresh Limited	2006	4,766.56	31.30 to 32.50
	2007	15,409,.99	24.30
	2008	19,704.48	25.30
	2009	8,783.94	41.75
Fresh and Healthy Enterprises Limited *(a subsidiary of Container Corporation of India, CONCOR)*	2006	1,060.00	29.62
	2007	10,940.00	27.87
	2008	7,720.00	35.50
	2009	2,720.00	44.12
Dev Bhoomi Cold Chain Pvt. Limited	2006	-	-
	2007	690.08	25.00 to 45.00
	2008	723.24	35.80
	2009	285.52	33.82
Mahindra Shubh Labh	2009	500.00	37.00

[a] 1 US$ = 54.07 Indian rupees (as of September 2012).
Source. Himachal Pradesh State Horticulture Report (2009).

Exhibit 12. Apple Production and Agrifresh CAS Facilities in Districts of Himachal Pradesh

Note. Shaded area shows apple producing areas as well as the area where Agrifresh operates its CAS.
Source. Himachal Pradesh State Horticulture Report (2009).

Exhibit 13. Total Number of Fruit Orchards in Himachal Pradesh

Size of Orchard	**Total**
Very Small (less than 1 ha.)	443,472
Small (1 to 2 ha.)	14,889
Small-Medium (2 to 4 ha.)	4,878
Medium (4 to 10 ha.)	932
Large (greater than 10 ha.)	83
Total	464,254

Source. Himachal Pradesh State Horticulture Report (2009).

Exhibit 14a. Price realization of farmers in Traditional APMC Chain

Item	Traditional Channel (Indian rupees per box)	Traditional Channel (as a percent of wholesale price)
Wholesale price at Delhi market	1200.00	100.0
Packaging, grading, and assembling labor cost	12.50	1.0
Packing materials	71.00	5.9
Transportation to road head	11.00	0.9
Freight to APMC market	78.00	6.5
Commission of forwarding agent, State tax, Octroi (local duty)	84.00	7.0
Loading/unloading charges	8.00	0.7
Total expenses	264.50	22.0
Net price received by apple grower	935.50	78.0

Notes.
a. A box sold through traditional channels weighs around 23 kgs. instead of the prescribed 20 kgs. Farmers do this to save on the cost of packaging and transportation; however, it leads to more rapid deterioration in the quality of the fruit.
b. 1 US$ = 54.07 Indian rupees (as of September 2012).
c. Farmers who sell their apples through the traditional APMC channel sell their entire stock of apples by the end of January every year due to lack of cold chain facilities.
Source. Based on extensive data collection and analysis by the authors and Adani Agrifresh during September to November 2010.

Exhibit 14b. Price realization of farmers selling through Adani Agrifresh chain

Adani Agrifresh sells almost 80% of their apples after the month of December when the domestic supply of apples through other domestic channels is exhausted. This is because it has CAS facilities which do not exist in traditional channels. During the August to November period, Adani's major focus is on the procurement of high quality, A-grade apples from farmers for storage in their CAS facilities in Himachal Pradesh. Salient features of apple sales by Adani Agrifresh are:

a) The price per 20 kg. box at which Adani Agrifresh sells in the wholesale market is apples based on the landed price of imported Washington apples according to the following rule of thumb: The selling price of Adani Agrifresh's apples in the wholesale market is equal to the price of imported Washington apples less Rs 200. During January to March 2011, Adani Agrifresh billed the Delhi wholesale market at an average price of Rs 1700 per 20 kg. box.
b) Adani Agrifresh procures its apples from farmers at a price of approximately 8% higher than what is offered by commission agents to farmers for comparable quality apples at the traditional APMC market. Adani Agrifresh does this to incentivize farmers to supply them with their high quality apples.
c) Farmers who supply to Adani Agrifresh do not have to bear the cost of packaging, the forwarding agent commission, state tax, Octroi, and loading and unloading charges. All of these costs are borne by Adani Agrifresh.
d) During the January to April period, Adani Agrifresh sells in the Delhi wholesale and other markets at a 30% price premium over traditional channels. This is because of the low quality of domestic apples and the excellent quality of Agrifresh's CAS apples.
e) The high quality CAS Agrifresh apples are well-accepted by consumers. Adani Agrifresh never over-packs its packaging boxes beyond the prescribed limit of 20 kgs.

Source. Based on extensive data collection and analysis by the authors and Adani Agrifresh during September to November 2010.

Exhibit 15. Fruit Production Patterns in India[a]

Contribution to Total Production by Volume

- Top two fruits = 56.9%
- Top three fruits= 69.5%
- Top four fruits=74.8%
- Top five fruits=77.5%
- Top ten fruits= 87.2%

Contribution to Total Production by Value

- Top ten fruits = 83%
- Top twenty fruits= 97%

Ranking of Fruit Production by Volume

1. Banana
2. Mango
3. Citrus
4. Papaya
5. Guava
6. Grapes
7. Pineapple
8. Sapota
9. Pomegranate
10. Lychee
11. Watermelon
12. Muskmelon
13. Orange
14. Sweet Orange
15. Lemon
16. Pear
17. Coconut
18. Kinoo
19. Babughosa (A type of pear)
20. Groundnut whole

Ranking of Fruit Production by Revenue

1. Banana
2. Apple
3. Lemon
4. Mango
5. Orange
6. Papaya
7. Watermelon
8. Muskmelon
9. Sweet Orange
10. Pomegranate
11. Pear
12. Guava
13. Grapes
14. Coconut
15. Kinoo
16. Sapota
17. Groundnut whole
18. Babughosha (A type of pear)
19. Awala
20. Peach

Ranking of Fruits by Margin

1. Kiwi
2. Strawberry
3. Lemon
4. Raspberry
5. Cherry
6. Jamun
7. Apricot
8. Apple
9. Dates
10. Plum
11. Grapes
12. Cheekoo
13. Peach
14. Groundnut whole
15. Lychee
16. Pomegranate
17. Orange
18. Belpathar
19. Kinoo
20. Green Badam

[a] **Sources.** Indian Horticulture Database-2010 (2010) and field surveys conducted by the authors.

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Entrepreneurial and Buyer-Driven Local Wine Supply Chains: Case Study of Acres of Land Winery in Kentucky

Blessing M. Maumbe[a], and Cheryl Brown[b]

[a]*Assistant Professor of Agribusiness Management, Davis College of Agriculture, Natural Resources and Design, West Virginia University, 2032 Agriculture Sciences Building, Morgantown, West Virginia, 26506, USA*

[b]*Associate Professor, Davis College of Agriculture, Natural Resources and Design, West Virginia University, 2034 Agriculture Sciences Building, Morgantown, West Virginia, 26506, USA*

Abstract

The Kentucky wine industry has grown rapidly over the past decade as farmers diversify from tobacco to alternative enterprises. The objectives of this paper are to; (i) describe the conversion of a family-owned tobacco farm into a fledgling wine enterprise (ii) identify market competitive and coordination strategies being used by an emerging winery, (iii) determine key challenges facing the development of a small winery and (iv) recommend future studies for improving the performance of local wine supply chains. The paper is based on a case study of Acres of Land winery in Kentucky and it uses qualitative data collected during visits to the farm in 2007, 2008 and 2009. The case study shows the development of the winery and the organization of the local wine supply chain. Results indicate that Acres of Land winery is fully vertically integrated and actively pursues both competitive and risk management strategies. The winery faces challenges such as "dry county" restrictions, government licensing requirements, changing consumer preferences, and growing industry competition.

Keywords: local, winery, marketing, promotion, strategy, Kentucky

ⓘCorresponding author: Tel: + 1 304.293.5636
Email: B. M. Maumbe: blessing.maumbe@mail.wvu.edu
C. Brown: Cheryl.brown@mail.wvu.edu

IFAMA Agribusiness Case 16.1 C

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Introduction

Kentucky's wine industry has grown rapidly over the past decade despite the difficulties of creating a reputation for high-quality products facing most new wine growing areas (Loureiro 2003). The compensation of producers from the federal tobacco buy-out program coupled with the entrepreneurial ingenuity of the local farmers has contributed to a resurgence of wine production as a statewide diversification strategy. The US tobacco "buyout program" also known as Tobacco Transition Payment Program (TTAP) was designed to ease the transition for US tobacco quota holders and producers from the Depression-era tobacco quota program to the free market (Pushkarskya and Marshall 2009). After the signing of the Fair Equitable Tobacco Reform Act of 2004, annual transitional payments for up to 10 years were made to eligible tobacco quota holders and producers with the funding coming from the $10 billion assessed on tobacco product manufacturers and importers. The end of the tobacco quota program prompted farmers to exit tobacco and pursue alternative crop enterprises (Beach et al. 2008).

In Kentucky, the emergence of entrepreneurial small wineries is part of ongoing initiatives to diversify the agricultural sector from tobacco to alternative crop and livestock income-earning opportunities. Wine production has become one of the key enterprises that are expected to grow in the future (Futamura 2007). The Kentucky Department of Agriculture (KDA) has established a website, Kentucky MarketMaker™ to provide market information to potential customers and visitors and help them locate the 60 wineries that are currently in operation in the state. Historically, wine marketing has been dominated by the "Old World," comprising Western European countries: France, Italy, Spain and Germany (Jordan et al. 2007). Recent growth in global market penetration of wines from the so called "New World," comprising US, Argentina, Australia, South Africa, and Chile, has reconfigured the marketplace making the industry highly competitive (Hussain[a] et al. 2007). The emergence of Brazil as a key global player in wine production (currently ranked third in South America behind Argentina and Chile, and 17th globally) has further intensified the already fierce competition (Fernsterseifer 2007). In the US, relatively new players from non-traditional wine producing states have entered the market leading to a significant growth in the number of small wineries in operation. Several states have experienced an emerging winery industry including Colorado, Kentucky, New Jersey, North Carolina, and West Virginia (Phillips et al. 2009; Maumbe 2012). However, California still produces 88.6% of all of the wine in the US and the top ten wine-producing states cover 98.5% of the market (see Table 1) (Dept. of Treasury 2012). Increasing production and consumption of wine from non-traditional wine producing states is also part of the rising consumer interest in buying locally grown agricultural products. The US Department of Agriculture's Agricultural

Table 1. Top Ten Wine Producing States in the US

State	Percentage of total production	State	Percentage of total production
1. California	88.6	6. Kentucky	0.3
2. New York	3.7	7. Florida	0.3
3.Washington	3.6	8. Ohio	0.2
4. Oregon	0.8	9. Michigan	0.2
5. Vermont	0.5	10. New Jersey	0.2

Source: Dept. of the Treasury, Alcohol and Tobacco Tax and Trade Bureau. 2011.

Marketing Service has been recording double digit growth in farmers markets over the last decade and major food retailers have also established policies encouraging purchases from local farmers (Martinez et al. 2010; Thilmany McFadden and Low 2012).

The driving forces behind the recent growth in the US wine industry vary from state to state. Differences in state laws regarding production and distribution of wine, new economic opportunities, buy local campaigns, growing taste for wine among the millennial generation, environmental sustainability, product knowledge, and fair pricing relative to quality are some of the key factors influencing demand for wine and the development of small wineries in the US and abroad (Nowak et al. 2006; Hussain[b] et al. 2007; Alonso 2010). Small wineries in the US face growing economic challenges of providing quality, taste, safety, cost efficiencies, and variety. Enterprise competitiveness and environmental sustainability are of strategic importance to small winery operations (Barber et al. 2010). Despite these challenges, local wine supply chains (LWSC) are booming and wineries are providing alternative income sources for previous tobacco farmers in Kentucky. The rising buyer-power expressed in terms of low switching costs to competing brands, consumer demand for consistency, healthfulness, and environmental attributes have made private vertical coordination and strategic alliances an essential part of wine niche marketing. Eco-labels are being used to signal environmental attributes, reduce information asymmetry between producers and consumers, and enhance demand for wines perceived to be environmentally favorable (Delmas and Grant 2008). The future survival of small wineries will depend on better market coordination (i.e., procurement, post-harvest cold storage, transportation services, etc.) and access to market information for better decision making. Entrepreneurial approaches being used by winery operators that are contributing positively to their success include the ability to exploit new market opportunities, provision of innovative customer centric products, enterprise diversification, and risk management (Morrish et al. 2010).

Small wineries in the US have to cope with the challenges of changing consumer demand for product quality, health and safety, business risk, and the need for better market coordination and sustainability. A growing challenge facing the food industry generally is the judicious use of scarce environmental resources (Bena et al. 2010). The ability of small wineries to address such challenges is limited by their lack of economies of scale, relatively high transaction costs due to information asymmetries and asset specificity, and the low potential for investment capital in most of the emerging wineries. Yet consumers do not discriminate between highly capitalized large agribusiness firms and small wineries in their demands for high quality, safe, healthy, environmentally friendly, and consistent products.

Nonetheless, small wineries have to maneuver within their local supply chains and limited resource endowments to find solutions to these demands or risk losing market share to well-established global wine supply chains. For their long term survival, operators of small wineries have to be innovative and entrepreneurial in differentiating their products, developing niche markets, and adopting consumer-orientated supply chains committed to creating superior value for customers. The Australian wine industry success is partly attributed to a positive relationship between market orientation (i.e., customer and competitor orientation) and business performance (Jordan et al. 2007). Further, innovative value proposition arises from a creative and innovative opportunity-seeking marketing focus (Morrish et al. 2010). Managers of small wineries have to

grapple with several issues including how to; (i) minimize long-run operating costs and negative externalities that might damage their reputation, (ii) pursue focused differentiation in niche markets, and (iii) build trust-based partnerships and diversify income in order to absorb the shocks from unexpected business failure.

The specific objectives of this case study are to; (i) gain insight into how former tobacco farmers are managing the transition from a commodity-based operation to a customer-focused direct-marketing enterprise, (ii) identify market competitive and coordination strategies needed in a vertically linked local supply chain, and (iii) determine key challenges facing the development of small wineries. The rest of the paper is organized as follows; section 2 provides an overview of the history of wine production in Kentucky and historical development of Acres of Land Winery (AoLW). Section 3 describes the conceptual framework. Data collection is described in section 4. This is followed by results and discussion in section 5. Section 6 highlights key challenges confronting small wineries in the US, and section 7 concludes the paper, including recommendations for future studies of local wine supply chains.

Establishment of Acres of Land Winery

Kentucky was home to many of America's early wineries in the 1700s. The enactment of federal Prohibition Laws in 1920 prevented the manufacture, sale, and transportation of alcohol used for consumption. This marked a decline in vineyards in Kentucky and around the US and an expansion of tobacco production. Growing public health concerns and passage of the Net-Cost Tobacco Program Act in 1982, which shifted the burden for tobacco program losses from the federal government to growers, resulted in a decline in tobacco production as local producers sought alternative sources of income (Woods 1998). (For an overview of the history of wine production in Kentucky see Appendix 1).

As shown in Table 2, AoLW embarked on alternative production activities in 1998. The family farm, which is 400 acres in size with 12 full-time and 8 part-time employees, had been in existence for over 50 years with burley tobacco as its main enterprise. It is located in Madison County, a little over 30 miles from Kentucky's second-largest city, Lexington, home to the University of Kentucky. The decline of AoLW's burley tobacco quota triggered diversification into an agri-tourism (agri-tainment) business that later became AoLW. The first grapes were planted in 2000; grape varieties currently grown are *chambourcin, vignoles vinerifa, carbernet, reliance, mars, sauvignon* and *chardonnay*. These grapes are used to make a wide variety of wines that are produced and marketed under the AoLW brand. In 2003, AoLW developed a wine producing and bottling facility with a capacity of 750 bottles per hour. A selection of AoLW wines is listed in Table 3. The wines are named after local people who owned parcels of land on the farm over the years. Online orders from the winery's wine list allow customers who are unable to visit the farm to purchase wines in their local stores. In addition, AoLW has a restaurant on site that serves not only its wine but other products produced on AoLW land and neighboring farms. As shown in Table 4, AoLW has earned brand recognition from the numerous awards it has won at major regional and international wine competitions. The main vision behind AoLW's effort to raise market awareness is the need to advance the goal of *saving family farms and communitie*s in Kentucky. Most consumers find the notion of protecting American farms a cause they can identify with, thus creating the opportunity to convert prospects into customers.

Table 2. Historical Development of Acres of Land Winery, 1998-2010

Year	Key Production and Marketing Developments
	AoLW was a typical tobacco farming operation doing business for more than 50 years prior to the winery
1998	Diversification into wine production started.
2000	First vineyards planted on 1½ acres of land.
2003	Wine production facility established.
2004	Commercial wine sales started in December
2005	A full service 150 seating capacity restaurant with gift shop and wine tasting room established.
2007	Wagon rides through vineyards added to tours of winery building and picnic locations.
2009	Winery full-service restaurant gutted by fire on March 21st.
2010	Rebuilding starts on new Acres of Land Winery restaurant.
2010	New restaurant opened to customers in October.

Table 3. List of Wines Produced by Acres of Land Winery, 2010

1. Kentucky Chardonnay
2. A.I. Vidal Blanc
3. Chenin Blanc/ Viognier
4. Vignoles
5. Maggie Adams Blush
6. Colonel's Ridge Cabernet Sauvignon
7. Phoenix
8. Marie's Merlot
9. Russell Land Reserve Chambourcin
10. Kentucky Chambourcin
11. Concord
12. Willie Mae's Blackberry

Table 4. Acres of Land Winery Awards, 2005-2010

Name of Wine	Award	Year of Competition and Description
Kentucky Chardonnay	Silver Medal	2007 Taster's Guild International Wine Judging
Kentucky Chardonnay	Bronze Medal	2007 Northern Kentucky Wine Festival
Kentucky Chardonnay	Bronze Medal	2006 Taster's Guild Wine Lover's Competition
A.I. Vidal Blanc	Silver Medal	2007 Taster's Guild International Wine Judging
A.I. Vidal Blanc	Bronze Medal	2006 Taster's Guild Wine Lover's Competition
A.I. Vidal Blanc	Silver Medal	2005 Taster's Guild International Wine Judging
Vignoles	Bronze Medal	2007 Taster's Guild International Wine Judging
Vignoles	Bronze Medal	2007 International Eastern Wine Competition
Vignoles	Bronze Medal	2006 Taster's Guild Wine Lover's Competition
Maggie Adams Blush	Bronze Medal	2007 Northern Kentucky Wine Festival
Maggie Adams Blush	Bronze Medal	2006 Taster's Guild Wine Lover's Competition
Maggie Adams Blush	Bronze Medal	2005 Taster's Guild International Wine Judging
Phoenix	Silver Medal	2010 Kentucky State Fair
Colonel Ridge's Cabernet Sauvignon	Bronze Medal	2006 Taster's Guild Wine Lover's Competition
Colonel Ridge's Cabernet Sauvignon	Silver Medal	2005 Taster's Guild International Wine Judging
Marie's Merlot	Bronze Medal	2007 Northern Kentucky Wine Festival
Marie's Merlot	Bronze Medal	2005 Florida State Fair Wine and Grape Juice Competition
Russell Land Chambourcin Reserve	Gold Medal	2005 Taster's Guild International Wine Judging
Kentucky Chambourcin	Bronze Medal	2005 Florida State Fair Wine and Grape Juice Competition
Concord	Bronze Medal	2006 Taster's Guild Wine Lover's Competition
Concord	Bronze Medal	2005 Florida State Fair Wine and Grape Juice Competition
Concord	Bronze Medal	2005 Taster's Guild International Wine Judging
Willie Mae's Blackberry	Bronze Medal	2006 Taster's Guild Wine Lover's Competition

Conceptual Framework

The conceptual framework for this study draws upon agribusiness strategic management (i.e., industry driving forces, key success factors, and competitive advantages), supply chain management, and transactions costs theory. The internal and external factors driving the operations and competitiveness of the winery are considered in the context of supply chain management (SCM) theory (Gunasekaran et. al. 2008). The SCM framework focuses on producer linkages with suppliers and customers to achieve integrated value chains using information technology. But high *transactions costs* in supply chains can lead to market failure and can hamper competitiveness (Hobbs 2003). Transaction costs which include *search costs, negotiation costs*, *monitoring* and *enforcement costs* result in different methods of organizing transactions from *spot markets* to *contracts* to *vertical integration* (Williamson 1979; Hobbs 2003). Drawing from strategic management theory, key internal and external forces confronting small wineries can be analyzed as *key industry success drivers, competitive strategies,* and *nature and sources of transactions costs* (see Figure 1). The combined negative influence of industry forces can hinder the ability of small wineries to gain sustainable competitive advantages. In contrast, effective market penetration and coordination strategies can result in competitive advantages and significant reductions in information asymmetry and transaction costs in LWSC.

Local supply chains have the advantage of geographic proximity for building trust-based relationships with supply chain partners and customers. Wineries maintain total control of the significantly shortened supply chain when they directly market their wine to consumers who are visiting the vineyard and winery. The product then takes on additional attributes related to the experience of meeting the winemaker and seeing the vineyard. Information asymmetries disappear when consumers can taste the wine and trust is built in the atmosphere of the wine tasting room or restaurant. Loyalty can develop when consumers see who is being supported by their purchase. But for small wineries to expand their markets they may need to go beyond marketing directly to agri-tourism customers. Focusing on local supply chain partners that will maintain place-based authenticity of the brand through tastings and support for a "buy local" campaign can be a useful strategy for small wineries whose main market is within their local region, especially if they are located near a metropolitan area.

Key Industry Success Drivers in Wine Marketing

The marketing of wine is constantly evolving and mature wine markets such as France, Italy and Spain are threatened by wines from the "New World" (Terblanche et al. 2008; Hussain[a] et al. 2007). The forces of change affecting the wine industry are being felt at the global and local levels. These key wine industry driving forces are growing competition, over-production, changing tastes and preferences, decline in demand for wine relative to other beverages, health and safety issues, environmental consciousness of consumers, location, and land use issues (Terblanche et al. 2008; Baer et al. 2010; Alonso, 2010). Foster et al. (2002) argue that the key decision areas affecting the success of wine supply chains are: senior management involvement, plant and equipment, quality control and assurance, production planning and control, and product design. The relative influence of buyer and supplier bargaining power, government regulations, societal attitudes and lifestyle changes, information and communication technology (ICT),

support for the local community, and supply chain distribution economies are additional key driving forces that affect competitive success in the wine industry.

Competitive Strategies

Crafting and executing strategies that are responsive to consumer preferences is critical to the success of small wineries. Consumers of wine seek specific *product* and *service* characteristics such as *product quality, price, a reputable brand, sensory qualities* (i.e. taste and smell)*, bottle design, packaging*, *labeling*, *convenience* (e.g., screw cap versus cork screw), *environmental attributes* of the grape and wine production processes, and *relative speed* when conducting purchase transactions. The consumer's perception of *quality* of wine is in turn influenced by the *variety of grapes planted, taste, age, price, place of origin, distribution channel*, and other related dimensions*. Product differentiation strategies* that capture *quality features* sought by consumers are a key component of the competitive strategies being pursued by small wineries.

Competitive strategies for wineries are driven by *market positioning* and *branding strategies*. In *market positioning strategies*, the *selling price* determines the perceived value of the wine. Price serves as a key value indicator especially when wine is used as a gift or served as part of the menu in exclusive social events. Price delivers perceived value and makes it easy for consumers to decipher cheap versus expensive wines as the latter have a unique appeal to customers. *Pricing strategies* are a central pillar for competitive strategies for small wineries and price influences substitution possibilities.

Competitive strategies in LWSC are also associated with creative *branding strategies* such as using the *place of origin*, *history*, *eco-labeling,* and *trust* to gain a competitive advantage and capture increased market share (Loureiro 2003). Product origin and authenticity are key elements sought by wine consumers; although intangible, such attributes can build *trust* and *reputation* in LWSC (New, 2010). Furthermore, gains in competitive advantage could arise through the performance of *additional marketing services* and, again, *building trust-based relationships with buyers* (Abatekassa and Peterson 2011). In that respect, wineries catering to local markets can derive competitive advantage through *image and reputation strategies*. Consumers are known to exhibit loyalty to certain wine brands and are willing to establish long term relationships with wineries of their choice. Therefore, the successful commercialization of local wines depends on a mix of competitive strategies such as *product differentiation, market positioning*, *wine branding,* and the cultivation of *trust-based relationships* and control of *positive image and reputation* along the supply chain.

Just like wines in global supply chains, the *aesthetic value of local wines* is provided by a unique combination of product characteristics (i.e., taste, smell, packaging, labeling, and convenience to stimulate consumer sales. Demand for wine is driven primarily by its "customer value" bundle which is obtained by aligning product characteristics and buyer preferences. According to Foster et al. (2002), product quality and product condition are the top ranked attributes for Chilean wine purchases by US importers. Loureiro (2003) noted that *appellations of origin* (such as Napa Valley wines) are gaining in importance as a competitive marketing strategy in the US wine industry. Market competitive and coordination strategies (i.e., vertical integration, strategic alliances, trust-based partnerships, etc.) that align *product characteristics* (supply side) to *buyer*

preferences (demand side) have a direct impact on the level of *transaction costs* facing buyers and sellers in the wine industry.

Transaction Costs in Local Wine Supply Chains

Transaction costs for wine are high, and failure to account for both *transaction* and *storage costs* when trading wine tends to overstate the value of wine investments (Fogarty 2007). Transaction costs are the frictions in market exchange that arise from *information asymmetry, bounded rationality, asset specificity* and *uncertainty. Information asymmetry* is associated with unequal access to information between parties to a market exchange. Wine entrepreneurs face market demand uncertainty due to consumers' lack of perfect information about product characteristics (i.e., prices, quality), location of buyers, and the behavior of both competitors and suppliers.

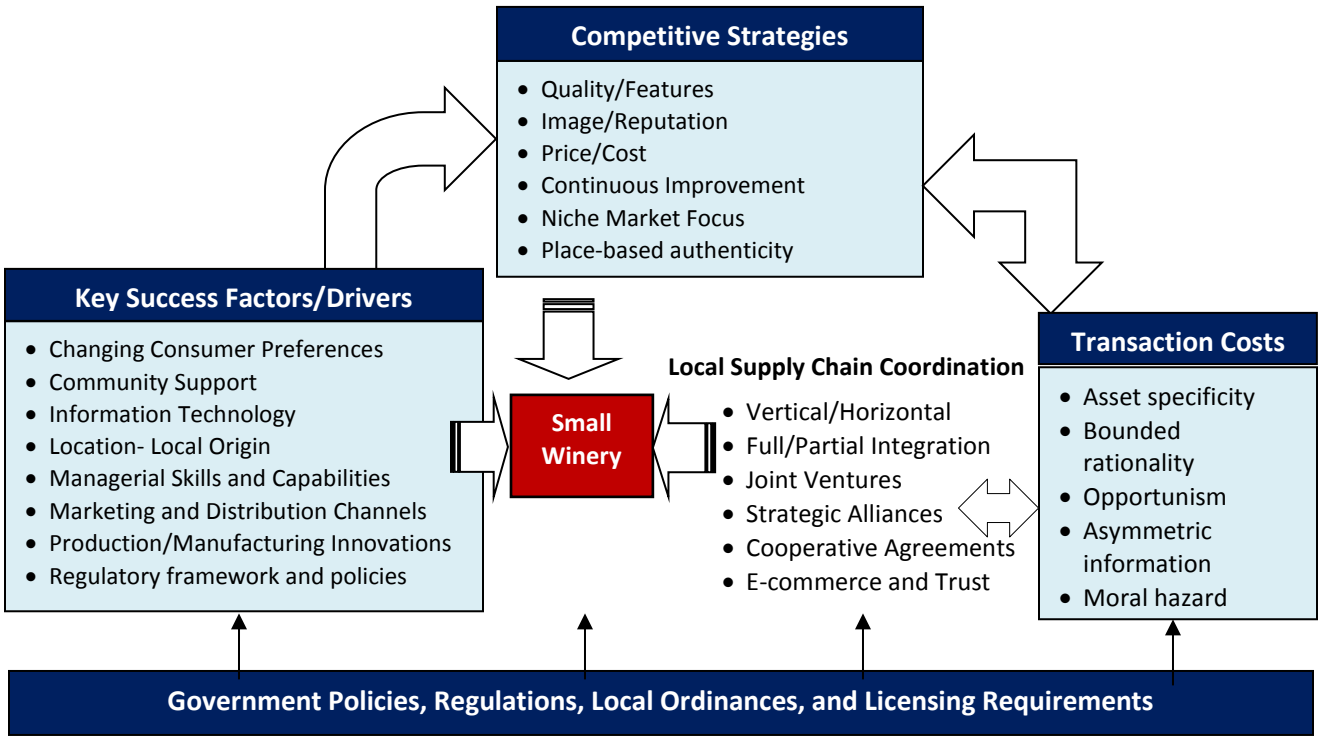

Figure 1. Conceptual framework for a local wine supply chain, 2010

State government regulations affecting Kentucky wineries, such as shipping regulations, licensing requirements and local ordinances involving consumption and sale of alcoholic beverages, impose uncertainties and raise transaction costs for wine entrepreneurs. Internet-based marketing of wine that involves social networking, blogs, vlogs, interactive e-commerce and the use of mobile broadband to facilitate transactions (i.e., mobile commerce) has gained ground (Thach 2009). The use of these innovative Internet-based marketing tools could potentially lower transaction costs across all segments of the wine supply chain and thereby increase margins of local producers. The need to increase transparency and lower transaction costs is associated with increasing use of bar codes that can be read by mobile phones and Radio Frequency Identification (RFID) tags to reveal product location and condition along the supply chain. In

California, some wineries use codes that can be entered on a website to verify authenticity of their wines and enhance market coordination with loyal customers. Such marketing approaches lower transactions costs and are beneficial to potential customers for AoLW who may be inclined to order their favorite wines from the AoLW website.

Wine consumers face transaction costs as wine has *credence attributes* that can only be determined after purchasing, hence the need for wine tasting and increased market coordination. Small wineries selling directly to consumers or to local markets are able to reduce these transaction costs by bringing consumers to the farm to see and taste for themselves the authenticity of the brand and through samples to and tastings at local retail outlets.

Wine production presents a unique case of the intersection of *horizontal* and *vertical coordination* in the food system. Investments in a winery typically involve grape production and harvesting, processing, bottling and packaging, storage, shipping and product marketing along the supply chain. Wine market coordination entails forging strategic alliances, joint ventures, and contract agreements with suppliers of key raw materials, such as wine barrels, wine bottles, and label designers among others. In addition to such forms of *market governance,* both vertical and horizontal integration enhance a firm's innovation behavior, lower production and transaction costs, and can boost the profitability of small wineries (Karantininis et al. 2010). Therefore, should the owner of AoLW reorganize the local wine supply chain? What strategic partnerships should be developed with other industry stakeholders? In what ways should the owner improve the current use of ICT and social media? What investments should be made, if any, to enhance the performance of the wine supply chain?

Data Collection

This paper is based on a case study approach, which has been proven to be an important research tool for the agribusiness industry (Abatekassa and Peterson, 2011; Bitsch 2005; Stern et. al. 1998). This approach was deemed appropriate as it helps to explore, describe, and understand a local wine supply chain including the various actors and their inter-relationships. This case study was selected for the following reasons, (i) winery location (ii) its relative success in the industry, (iii) its use of a place-based versus conventional marketing strategy, and (iv) the willingness of the entrepreneur to share his successes and challenges with the researcher. Three visits to AoLW were conducted during 2007, 2008 and 2009. During the visits, which were in the fall and spring, farm tours were conducted by the owner who is directly involved in making all production and marketing decisions. During the visits, information was gathered on production and marketing strategies, new investments, and challenges facing the winery. The researcher visited AoLW on three separate occasions as a guest in the family restaurant facility during the study period. Additional information was obtained on the winery's website, and a questionnaire mailed to the owner in October 2010 was used to verify information collected during earlier visits to the winery. The questionnaire covered farm demographics, motivations for starting the winery, wine information sources, and market competitive strategies.

Study Limitations

There are four major limitations to this study. First, the information provided by the owner might suffer from self-bias. Second, the owner operator might not be highly skilled in all the functions and operations of the different stages of the wine supply chain. This might mean that information provided may not be technical in nature. Third, the study does not provide comparative information of similar wineries at the time of the research. Fourth, it is difficult to establish causal relationships or make statistical generalizations when using a case study approach (Abatekassa and Peterson, 2011). Despite the afore-mentioned limitations, case studies generate useful detailed information that can be used to make key tactical, strategic and policy decisions.

Results and Discussion

Description of the Local Wine Supply Chain

AoLW is fully vertically integrated as the operator is actively involved in all decisions on grape production, harvesting, processing, bottling, storage, distribution and marketing. The operator demonstrates a sound knowledge not only of the farm, but its ability to sustain the competitive business of wine production and marketing. AoLW has established collaborative trust-based relationships with suppliers of key raw materials such as wine barrels (i.e. French Oak and Kentucky white oak), bottles, plastic bottle caps, and labels. Down-stream industry participants include ten wine tasting centers and distributors that are located in various parts of Kentucky. Geographically dispersed customers interested in AoLW wines can visit a local tasting center to try their wines. Figure 2 illustrates AoLW supply chain, including the key actors, market outlets, and the degree of market integration involved. According to the company website, AoLW has wine tasting centers and distributors that are scattered around rural towns in the state. AoLW wines are sold to the final consumer at a number of retail outlets including Kroger supermarkets, CVS pharmacies, liquor stores, gift shops, and inside the restaurant that is located on the farm property.

Agribusiness Competitive Strategies for a Local Wine Supply Chain in Kentucky

Vertical Integration Strategies

One of the objectives of full vertical linkages in local food systems is to strengthen the link between farm gate prices and retail prices. Most of the wines produced by AoLW are sold on their farm (i.e., restaurant and gift shop), tasting rooms, and directly to local retail stores (i.e. supermarkets and pharmacies). Direct marketing of wines minimizes the transaction costs of producers and consumers and eliminates the marketing margin that is usually extracted by middlemen as is the case in conventional supply chains. AoLW's wines are also sold in various liquor stores with the owner directly involved in launching new wine varieties at these locations.

Agri-Tourism Strategy.

The management strategy of AoLW involves integration of agri-tourism activities as part of its overall competitive strategy. The agri-tourism venture consists of community-oriented programs

that involve organized visits to the vineyard, wagon rides, panoramic views of Madison County, tours of the state of the art commercial production and bottling facility, a gift shop, a wine tasting room, and a full-service restaurant with catering, banquet, and reception facilities. In addition, picnic dinners, wildlife (e.g., wild turkey, deer, butterflies, etc.) and sunset viewing are available forms of agri-tainment at the AoLW.

Market Positioning Strategy: Kentucky Proud Label

The AoLW is positioned as an authentic Kentucky experience. According to the operator, their wines are "made with pride and love from grapes grown in the fertile grounds of central Kentucky." This market positioning strategy has led to the sale of wines and related merchandise using the Kentucky Proud label in gift shops and wine tasting rooms. Kentucky Proud is a statewide initiative that promotes the marketing of safe, fresh and nutritious food products that are grown, processed and packaged in Kentucky (www.kyproud.com). The marketing slogan for the Kentucky Proud label, which has a relatively high recognition, is "nothing else comes close." Prospective members are required to complete an application form from the Kentucky Department of Agriculture by listing their locally grown, processed and packaged products and agreeing to abide by the Kentucky Proud logo guidelines. Upon approval, members pay a royalty fee and are allowed to use the Kentucky Proud logo to market their products.

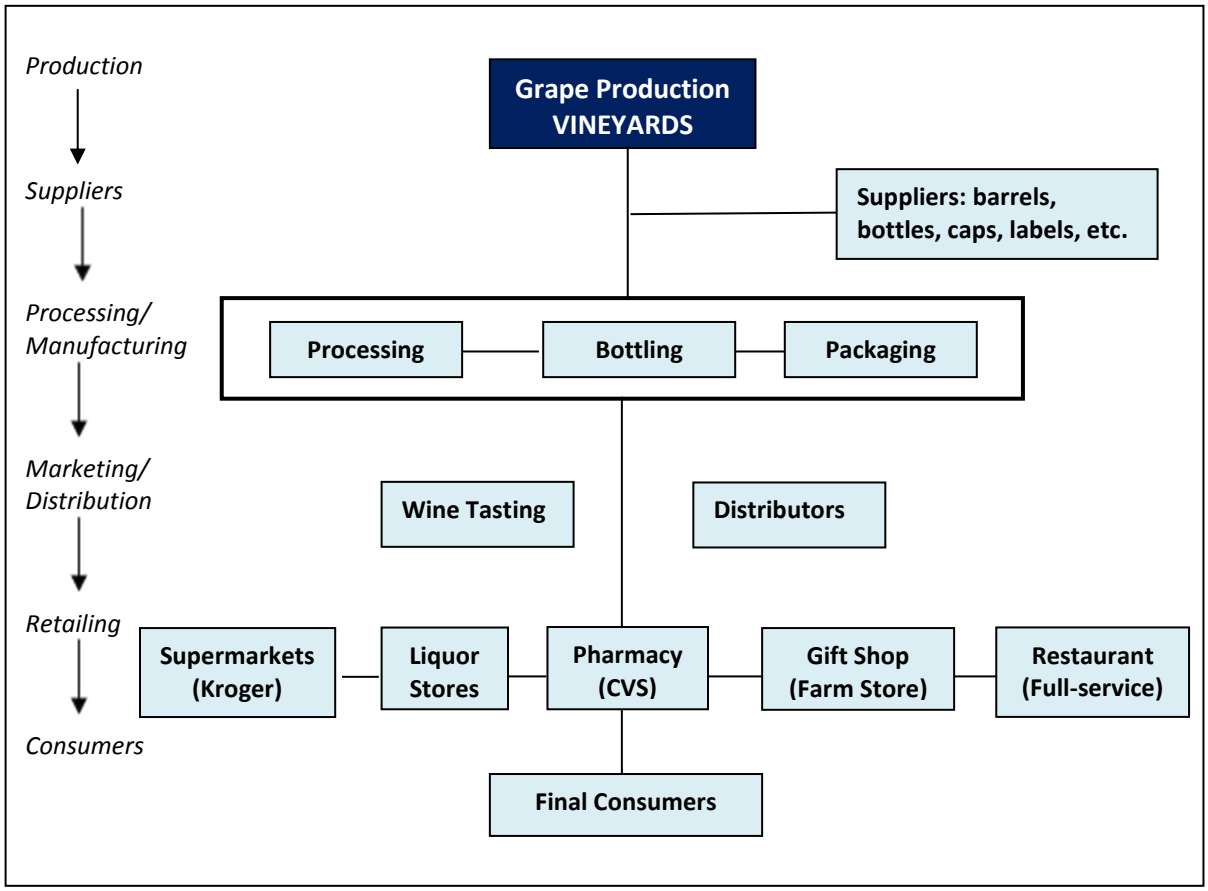

Figure 2. Description of Acres of Land Winery Supply Chain, 2010

The AoLW restaurant uses products and ingredients purchased from other local farms and producers who participate in the Kentucky Proud program. These products include ice creams, cheese, honey, jams, and sausages. The Kentucky Proud website provides marketing intelligence on other participating wineries and their respective locations in Kentucky. The key attributes for the Kentucky Proud label are low food miles, fresh, local, nutritious food, and building a sense of community. By marketing the "true taste of Kentucky," this message corresponds to AoLW's mission and goal of selling authentic Kentucky wines. As already highlighted, there are retail outlets for AoLW where new consumers can sample wines at numerous tasting locations spread around the state.

E-commerce Marketing Strategy

Online marketing enables AoLW to market its wines on an interactive website. Customers visiting the AoLW website are able to pay for their favorite wines using credit or debit cards. The website has been in operation since 2008. Kentucky's participation in the MarketMaker™ website program complements AoLW's wine marketing strategy. The Kentucky MarketMaker™ is an interactive online portal designed to connect local food producers with newly emerging markets. It is based on a geographic mapping system that locates agribusiness producers and consumer markets in Kentucky. The initiative was first launched in Illinois in 2004, has now extended to 13 states, and is considered one of the most extensive collections of searchable food industry data in a given area in the US. Kentucky MarketMaker™ provides potential customers with information on various wineries and their locations throughout Kentucky. AoLW can be identified by visiting its website (acresoflandwinery.com) or the Kentucky MarketMaker™ website (ky.marketmaker.uiuc.edu). In addition, the use of mobile Internet broadband enables motorists and other travelers to google the location of AoLW in real-time thereby increasing its captive market.

Consumers are paying more attention to the origin of their food, and reading about the winery, its history, location and award-winning products enhances their bond with the local wines. Further, AoLW is available on *Twitter, Facebook* and *YouTube.* The use of real-time networking strategies demonstrates the entrepreneur's innovativeness and commitment to modernize the winery's marketing strategy and interact with a broad segment of its customer base beyond Madison County, Kentucky. The use of social networking tools and related ICT in agri-tourism is growing rapidly and is considered a win-win strategy for gaining competitive advantage and collaborating with other supply chain actors. Using social media tools gives AoLW the opportunity to constantly update its customers in real time about major developments at the winery including new wines and key upcoming events and contests. Furthermore, AoLW operates a toll-free number (866-714-WINE) to increase its linkages with a wider customer base. The use of e-commerce strategies is critical, especially at a time when consumers are more wary of some traditional marketing strategies, hence, agribusiness entrepreneurs need to strike a balance between innovative and intrusive advertising when using modern ICT channels (Phillips et al. 2009).

Market Pricing Strategies: Price Discounting

In a recessionary economy, consumers tend to pay close attention to the final price of any purchasing decision. Pricing strategy at AoLW involves the use of price discounts to boost wine sales. The following discount schedule applies to online wine orders: 3 bottles, 5%; 6 bottles, 7% and 12 bottles qualify for a10 % discount. Those customers with exclusive membership in the "Wine Club" receive a 15% discount on the purchase of their favorite wines. The pursuit of a best cost strategy is one way of stealing 'value conscious' customers with low switching costs from established rivals and thus reinforces AoLW's competitive advantage in the marketplace.

Promotional Strategies

AoLW has adopted a variety of promotional strategies ranging from advertising on local television and highway billboards, to word of mouth, on-farm tours, gift cards, wine clubs and wine festivals. The local television channel runs a regular advertisement for AoLW. Along the I-75 south freeway, about 10 miles before Richmond, motorists are welcomed by a roadside "billboard" with AoLW advertised. The wine promotional strategy used by AoLW combines the marketing of "place of origin" and "romance". A similar strategy has been used successfully in marketing French wines as a "unique blend of historical intangibles of romance and mystery" (Terblanche, et al. 2008). Another commonly used strategy is *membership in a wine club* where information is exchanged about the winery and its latest products. *Word of mouth* is a particularly powerful tool and the owner conducts tour groups and talks to clients dining in the restaurant about the history of the farm and the available wines in the gift shop. The owner is also involved in directly marketing the new wines to potential customers in local liquor stores. This provides customers an opportunity to not only hear the history of the farm, but they get to meet the individual responsible for the production of the wines. The owner ranks tasting rooms as an extremely important market outlet followed by liquor stores and supermarket chains.

Awareness about AoLW increases through its participation in a number of *wine festivals* and *competitions*. As already noted, the winery received numerous awards in both regional and international competitions. Of the competitions held between 2006 and 2007, a total of ten wine varieties received 23 awards and recognitions from Taster's Guide International Wine Judging, Northern Kentucky Wine Festival, Taster's Guide Wine Lovers Competition, and the Florida State Fair Wine and Grape Juice Competition. These awards range from silver to bronze medals. The various awards are indicative of the brand recognition, quality, and reputation of this winery. According to the owner, their success is based on a mission of "patience, craftsmanship, and pride." Such recognition of local wine labels through the use of effective promotional strategies and market positioning is crucial given that imported wines account for one out of every four bottles sold in the US (Hussain[a], et al. 2007).

Corporate Social Responsibility (CSR)

Global and local supply chains are dealing with the rising importance of CSR as part of normal business practices. The organizational structure of AoLW's "agri-tainment" business, comprising vineyards, full-service restaurant, commercial wine production and bottling facility, gift shop, wine tasting area, and community facilities, highlights the strategic importance of building

community networks and support. As a result, AoLW has forged linkages with local communities in a number of ways. First, the winery hosts free tours and internships for local students. Its community facilities are used for weddings as part of its investment in building social capital and community networks. Second, the winery provides full-service dining, catering, and banquet and reception facilities to promote its wines and relationships with the local community. Thirdly, picnic and wagon rides are designed to further cement relations of AoLW with the local community. Forging such direct relations with the local community is a dual strategy to sell wines and promote the sustainability of its business through building a positive societal image.

Diversification Strategies

Diversification into a restaurant business is a key risk management strategy at AoLW. The full-service restaurant which opened in 2005, after renovating an old tobacco barn, is renowned for serving fresh locally-produced food. The use of place-based commitments is a central part of AoLW's branding strategy as a business whose values and culture are firmly rooted in the local community. Visitors to the restaurant are reminded by the owner that the vegetables were growing in the garden that morning. This diversification strategy is also driven by the notion that wine and food are a perfect combination. Informing diners that the vegetables on their plate, the grapes in their salad or the herbs in a sauce were picked a few hours beforehand engenders place identity and utility for their wines. The restaurant appeals to a wider customer base by serving pasta, seafood, chicken, pork, and beef entrees in addition to appetizers, soups, and salads. Information about restaurant hours of operation, lunch, dinner, beverages and dessert selections and special events is readily available on the winery's website. The wedding coordinator provides support services to weddings which also bring in additional income for the winery. The growth in farm diversification in Kentucky is similar to trends observed in Colorado where the average recreational income on farms is reported to have risen from $16,009 to $448,472 (compared to an average per farm increase from $2,738 to $7,786 in Kentucky) according to the 2007 Census of Agriculture (Phillips, 2010).

Challenges Facing Entrepreneurial Local Wineries: Business and Regulatory Risks

In the United States, local wine supply chains are facing a number of challenges that include access to markets, inadequate market information, government restrictions, business risk, changing consumer preferences and societal attitudes. The following section briefly describes the specific challenges facing the AoLW.

Dry county regulations: The location of AoLW in Kentucky presents a challenge in that some counties are legally "dry counties," meaning the sale of alcohol is prohibited. Although Madison County is not a dry county, AoLW wine sales are negatively affected by this statute. In 2008, prohibition of alcohol sales in some dry counties was repealed, allowing wine to then be sold in

Fire hazard: In 2009, an electrical fault caused a fire that burned down the AoLW restaurant. This was a major setback for the owner-operators who were trying to build a profitable business

through full vertical integration. Before this incident, the tobacco barn was completely destroyed by a tornado in 1955. The cycle of business risks associated with the barn and its subsequent renovation into a full-service restaurant symbolizes the entrepreneurship and survival strategies for this family business partnership. Despite these challenges, a newly remodeled restaurant was reopened a year after the fire.

Cork problems: Wine consumers are generally concerned about the effectiveness of corks as they sometimes allow oxygen inside the bottle that in turn spoils the wine quality. Management at AoLW has responded to these potential cork problems by investing in bottles that use plastic caps or plastic corks. The quality of the wine is critical to the stability of LWSCs and producers that consistently exceed wine quality expectations are likely to capture a relatively high market share. In contrast, wineries that compromise wine quality and taste are bound to face erosion of their market share in the wine industry.

Procurement of barrels: Aging of the wine depends on, among other things, the variety of the grapes and the type of barrels used. The barrels used by AoLW have a proven record of storing wine to develop its appropriate taste, after-taste and dryness. The key challenge is the relatively high cost of purchasing wine barrels given that French Oak barrels cost $1,000 each and Kentucky white oak ranges from $250 to $300 per barrel. Bulk purchases of such barrels could potentially reduce the market price somewhat.

Slow economic growth: Wine is considered a luxury by most consumers. Generally, slow growth of the US economy between 2008 and 2010 resulted in consumers tightening their budgets leaving little discretionary income for luxury goods. Such unexpected economic fluctuations present pricing challenges for a small winery that is striving to reap a decent profit by charging economical prices for its wines. AoLW offers various price discounts to its customers as a strategy to remain competitive.

Licensing requirements: The selling of wines at wholesale or retail prices in Kentucky requires special licensing. Although AoLW sells wines in its gift shop and through its website, it had to meet strict regulations before that permission was granted. Licensing requirements are part of the transaction costs small wineries in Kentucky have to overcome before they can become fully competitive and sustainable in the long-term.

Marketing challenges: Place of origin has been used historically in global wine markets and continues to play a significant role today (Terblanche et al. 2008; Atkin and Nowak, 2007). However, these famous geographical indications, like Bordeaux in France and, more recently, Napa Valley in the US, have been based in traditional wine-growing regions that have built their reputations over decades. Wineries in non-traditional wine-growing regions, such as Kentucky, are instead appealing to consumers who live in or travel through the region and are attracted to a product that is authentically from that locality. With local food systems, tying the final value-added product to a particular farm is critical for generating demand. For a small winery to succeed, its marketing strategy must maintain such brand identity and authenticity throughout the supply chain.

Summary and Conclusion

Kentucky was home to the first commercial vineyard in the US (kentuckywine.com). Wine production ended with the passage of federal Prohibition legislation and tobacco production increased. The end of the tobacco quota program in 2004 led to an accelerated exit of tobacco farmers and their entry into alternative cropping enterprises. As a result, a resurgence of wine production occurred in Kentucky and the state now has over 60 wineries (kentuckywine.com) with a potential agri-tourism value of $565 million (Glengariff Group 2005). This paper is based on a case study of Acres of Land Winery (AoLW) established in Madison County, Kentucky in 2003 when the family farm was converted from a burley tobacco-producing farm. The AoLW prides itself in making Kentucky's finest wine. Driven by a mission of 'patience, craftsmanship, and pride' the winery has integrated vertically across the different stages of production, processing, and marketing. Survival has been a result of commitment and sharp focus on selling a truly authentic Kentucky product. Vertical coordination led to the forging of strategic alliances and trust-based relationships with suppliers of barrels, bottles, wine labels and food ingredients for the full-service restaurant located on the farm. The owner of AoLW has deployed both competitive and coordination strategies in response to changing industry forces and a desire to reduce transaction costs. Investments in wine tasting centers around the state and participation in regional and international competitions have helped boost market awareness and a positive image of its wines. AoLW sells its wines at local liquor stores, supermarkets, pharmacies, the winery gift shop and restaurant, and through the company website.

This case study illustrates how a local wine operator deployed innovative product differentiation, effective branding, market positioning, creativity in building trust-based customer relationships, and enterprise diversification to grow market share and penetrate regional markets. Senge (2010) observed that in order to become sustainable, businesses and organizations need *technical innovation, management innovation, process innovation* and *cultural innovations*. The AoLW has created its own niche by selling the "history of its farm" and "romance". An innovative product differentiation strategy based on location-based attributes and the ability to invoke something more appealing and special as "selling romance" attracts customers from the local community and beyond. Such a mix of product differentiation and promotion strategy has earned AoLW an image of selling high quality wines and local community support, which is vital for it to stay ahead of its competition in the wine industry.

The AoLW operator has enhanced the market awareness and reputation of AoLW by winning regional and international awards, substituting more reliable plastic corks for the true cork variety, and diversifying operations by serving farm fresh vegetables and grapes in the restaurant, a treat for customers committed to eating fresh locally-produced foods. Clearly, AoLW is an example of a local supply chain that is striving to be entrepreneurial and responsive to buyer-driven needs and preferences. Therefore, AoLW has managed to achieve steady progress and success through a combination of competitive market-oriented (i.e., differentiation, place-based identity, and branding) and diversification strategies. In addition, effective supply chain coordination and integration has helped to lower transaction costs and reduce risk and uncertainties. Risk management strategies revolve around establishment of a restaurant on the farm and an agri-tourism venture with farm wagon tours and hay rides that provide additional income to expand and modernize the winery, which is the main enterprise.

Institutional and policy support from the state of Kentucky was vital to the development of the local wine industry. The state of Kentucky facilitated the development of small wineries and locally produced foods in particular through its *Kentucky Proud program, Kentucky Grape and Wine Council,* and the *Kentucky MarketMaker™* website. In some counties, the repeal of restrictive "dry county" regulations that prevented wineries from selling their products in local supermarkets, liquor stores, and other retail outlets has helped improve market penetration of local wineries. The AoLW benefited from the support provided by the Kentucky state government through its *Department of Agriculture* and other related institutions. However, challenges still remain in moving local wines across state lines which make it difficult to tap into more profitable regional markets. Licensing procedures to allow operators to sell wines from cellars are still a major constraint.

In today's world, emerging local wineries have to compete with relatively large conventional wine supply chains. Small wineries are being challenged to become creative, flexible and quick to address consumer demand for product quality. Strategic partnerships, community networks, place-based identity and branding strategies are being used to develop these entrepreneurial LWSCs. The provision of an enabling institutional and policy environment is a key element in the development of the small wineries. Given the foregoing, a few important questions arise:

1. Did AoLW take full advantage of the market opportunities, facilitative environment, and social capital gains from the community linkages to enhance the development of LWSC and the marketing of their local products?

2. How well did the operator manage risk and uncertainty in the LWSC?

3. Do you think the entrepreneur has developed effective risk management strategies to ensure AoLW's future survival and sustainability?

4. Given that market intelligence and real-time decision making play a pivotal role in agribusinesses competitiveness, is AoLW well positioned in the market place to realize full benefits of modern ICT-based channels such as e-mail, *Facebook*, *Twitter,* and *YouTube*, to appeal to more customers?

Kentucky is not a traditional wine producing region in the US, yet it has the climate necessary to support the production of wine grapes. A core strategy to enhance broad-based entrepreneurship in the wine industry across the state needs to be explored. Some key issues to address include the identification of specific strategies for operators of emerging wineries to become *entre-preneurial, proactive, creative* and *innovative* in managing their LWSCs. Additional considerations include building *strategic collaboration* with key industry firms and customers to secure *competitive advantages* for small wineries and help promote the state as an emerging wine producing region. The final strategy approaches and recommendations will always be debatable. Nonetheless, the future survival these LWSCs will likely be affected by a clear articulation of strategies on how to promote market competitiveness, effective use of new technology innovations, development of industry and local community partnerships, and the ability to respond swiftly to changing consumer preferences.

Finally, LWSC are growing in importance in the US and are beginning to receive significant attention from consumers, policy makers, and researchers. In terms of future studies, research is required to; (i) better understand the impact of modern ICT in procurement, promotion, distribution, marketing, and customer relationship management in LWSC, (ii) examine consumer willingness to pay for environmental and place-based attributes in LWSC, (iii) analyze strategic trust-based or value-added partnerships such as the Kentucky Proud label and its potential to improve the performance of LWSC, and (iv) examine the competitiveness and sustainability of LWSC and the implications of upgrading to regional markets.

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Appendix 1

Fact Sheet: History of Kentucky Wine Industry

Kentucky was home to America's first commercial wine industry that was established in 1798. The first wine maker, Jean-Jacques Dufour started the first winery in the "Athens of the West" now Lexington. With support from local businesses, the Kentucky Vineyard Society was formed and the so called "First Vineyard" was planted in 1803 in what is now Jessamine County. The first vintage was sent to Thomas Jefferson, who was then the President of the United States.

During its early years, the wine industry faced numerous problems and challenges including the Civil war and crop damage from vine diseases. By late 1800, Kentucky was ranked the third largest grape and wine producer in the United States. The Prohibition Act resulted in Kentucky's grape and wine industry going out of business and farmers switched acreage from grapes to tobacco production.

Tobacco settlement funds from the Fair Equitable Tobacco Reform Act of 2004 have proved an asset for Kentucky farmers who are now shifting from tobacco cultivation into the winery business. Many grape varieties can be grown in Kentucky. However, American varieties are the easiest to grow, due to their hardiness, and insect and disease resistance, while European *vinifera* varieties are the most difficulty, due to susceptibility to botrytis bunch rot, downy mildew, powdery mildew, and crown gall. Kentucky wine is also made out of American-French hybrids.

Kentucky offers two kinds of winery licenses: the Farm Winery License and Small Winery License. The Kentucky Vineyard Society promotes interaction and information sharing between buyers and growers of wine grapes. In addition, Kentucky wines are marketed using the *Kentucky Proud* label, a state-led marketing initiative designed to promote local products. Wine production in Kentucky is supported by a number of industry associations including Kentucky Grape and Wine Council, Kentucky Vineyards Society, Kentucky Growers Alliance, Western Kentucky Grape Growers Association, and the Northern Kentucky Vineyard and Winery Association.

To date, Kentucky's wine production is flourishing. The state has over 113 grape producers and more than 60 wineries, up from about just 15 five years ago. The Kentucky wine sector, with an annual output of 100,000 cases (or more than 200, 000 gallons) has seen tremendous growth over the past decade and is set to grow in the future. The grapevine acreage has risen exponentially from 67 acres in 1999 to about 600 acres today (kentuckywine.com). The state has comparative advantage in its climate, soils, and beautiful agricultural scenery which is amenable to investments in grape production, wineries, and agri-tourism businesses in general.

The state's wineries offer diverse entertainment including wine tastings, gift shops, local-foods restaurants, concerts, weddings and other social events attractive to visitors. The MarketMaker™ website is a useful tool helping potential visitors locate Kentucky wineries while traveling across the state. Kentucky wineries are prospering and adding excitement to wine consumer's experience in the state via annual wine festivals and wine trails. Finally, Kentucky wineries have received local, national and international recognition and the state is poised to become a key player in the small wineries industry.

Sources.
a. Kentucky Department of Agriculture
b. kentuckywine.com

Appendix 2

Fact Sheet: Case Study of Acres of Land Winery Inc.

The 8 Core Elements of Local Winery Market Positioning Strategies

1. **Agri-tourism Marketing Strategies**
   - Organized visits to vineyard
   - Tours of commercial production and bottling facility
   - Wine tasting tours, picnic dinners, wildlife, and sunset viewing
2. **Corporate Social Responsibility Strategies**
   - Business sustainability
   - Business ethics
   - Local culture - geographic origin and place identify
   - Building community networks and support
3. **Diversification Strategies**
   - Gift shop
   - Restaurant business
   - Weddings and social events
4. **E-commerce Marketing Strategies**
   - Interactive website- credit card and debit card transactions
   - Email - customer list serve
   - Kentucky MarketMarker™
5. **Market Pricing Strategies**
   - Direct marketing – restaurant and gift shop
   - Volume discounts
   - Membership discounts - "Wine Club"
6. **Market Promotional Strategies**
   - Billboards
   - E-newsletters
   - In-store product demonstrations
   - Kentucky Proud Label - "true taste of Kentucky"
   - On-farm tours
   - Television commercials
   - Toll-free number
   - Wine festivals and competitions
   - Word of mouth
7. **Mobile Commerce and Social Media Strategies**
   - Face book
   - You tube
   - Twitter
8. **Vertical Integration Strategies**
   - Full vertical integration- participation across all stages of the value chain
   - Partial vertical integration- maintain positions in selected stages of the value chain
   - Tapered vertical integration- mix of in-house and outsourcing activities in stage

IFAMA Business Office • College Station, TX 77840-3328, USA
Tel: 1-979-845-2118 • Fax: 1-979-862-1487 • E-mail: ifamr@ifama.org • Web: http://www.ifama.org

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