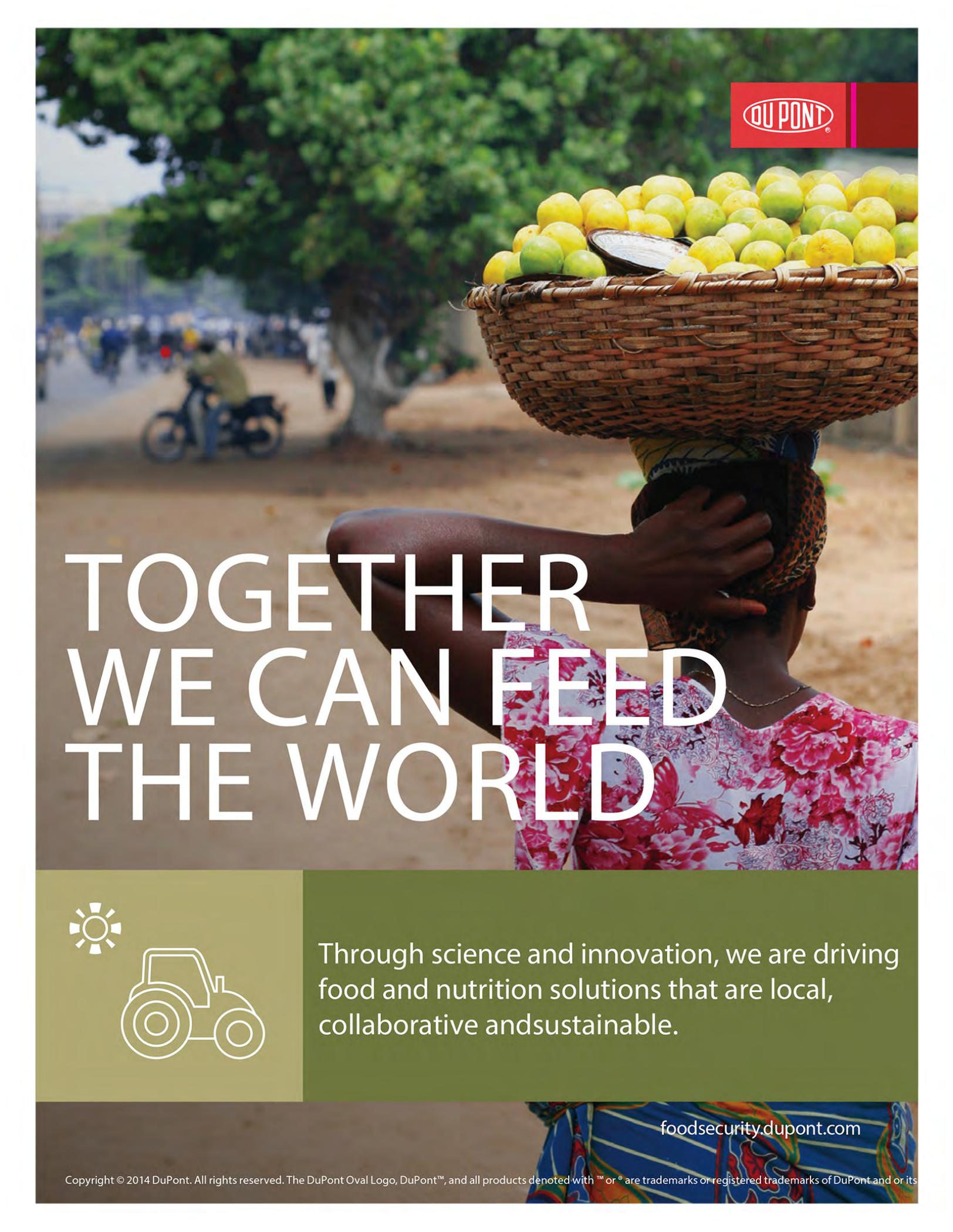




**International Food and
Agribusiness Management Review**

***Official Journal of the International
Food and Agribusiness Management Association***

**Volume 17: Issue 3
2014**



DU PONT

TOGETHER WE CAN FEED THE WORLD



Through science and innovation, we are driving food and nutrition solutions that are local, collaborative and sustainable.

foodsecurity.dupont.com



International Food and Agribusiness Management Review

Editorial Staff

Executive Editor

Peter Goldsmith, University of Illinois, USA

Regional Managing Editors

Asia, Australia, and New Zealand

Murray McGregor, University of South Australia, Australia

Nicola M. Shadbolt, Massey University, New Zealand

Europe

Jacques Trienekens, Wageningen University, The Netherlands

Vera Bitsch, Technical University of Munich, Germany

Alessio Cavicchi, University of Macerata, Italy

Diogo Souza Monteiro, University of Kent, United Kingdom

Yuliya Bolotova, Clemson University, USA (Russia)

North America

Ram Acharya, New Mexico State University, USA

Corinne Alexander, Purdue University, USA.

Vincent R. Amanor-Boadu, Kansas State University, USA

Mark Hansen, Brigham Young University, USA

David Van Fleet, Arizona State University, USA

David Sparling, The University of Western Ontario, Canada

R. Brent Ross, Michigan State University, USA

Cheryl Wachenheim, North Dakota State University, USA

South America

Joao Martines-Filho, Universidade de São Paulo, Brazil

Africa

Ajuruchukwu Obi, University of Fort Hare, South Africa

Editorial Board

Filippo Arfini, *Universita' di Parma, Italy*

Stefano Boccaletti, *Universita' Cattolica, Italy*

Michael Boehlje, *Purdue University, USA*

Fabio Chaddad, *University of Missouri, USA*

Dennis Conley, *University of Nebraska - Lincoln, USA*

Francis Declerck, *ESSEC Business School, France*

Hamish Gow, *Massey University, New Zealand*

Jukka Kola, *University of Helsinki, Finland*

Jay Lillywhite, *New Mexico State University, USA*

Woody Maijers, *INHOLLAND University, The Netherlands*

Marcos Fava Neves, *FEA / USP / PENSA, Brazil*

Onno Omta, *Wageningen University, The Netherlands*

Hernán Palau, *Buenos Aires University, Argentina*

Christopher Peterson, *Michigan State University, USA*

Thomas Reardon, *Michigan State University, USA*

Mary Shelman, *Harvard Business School, USA*

Johan van Rooyen, *University of Stellenbosch, South Africa*



Earn Your Bachelor of Science in Agribusiness Management

- Learn how to integrate agriculture and business management knowledge
- Help meet the challenges that agribusinesses face to positively impact the world's food system
- Complete your course work online, studying when and where you want



Achieve your career goals—apply today!

worldcampus.psu.edu/ifama



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

TABLE OF CONTENTS

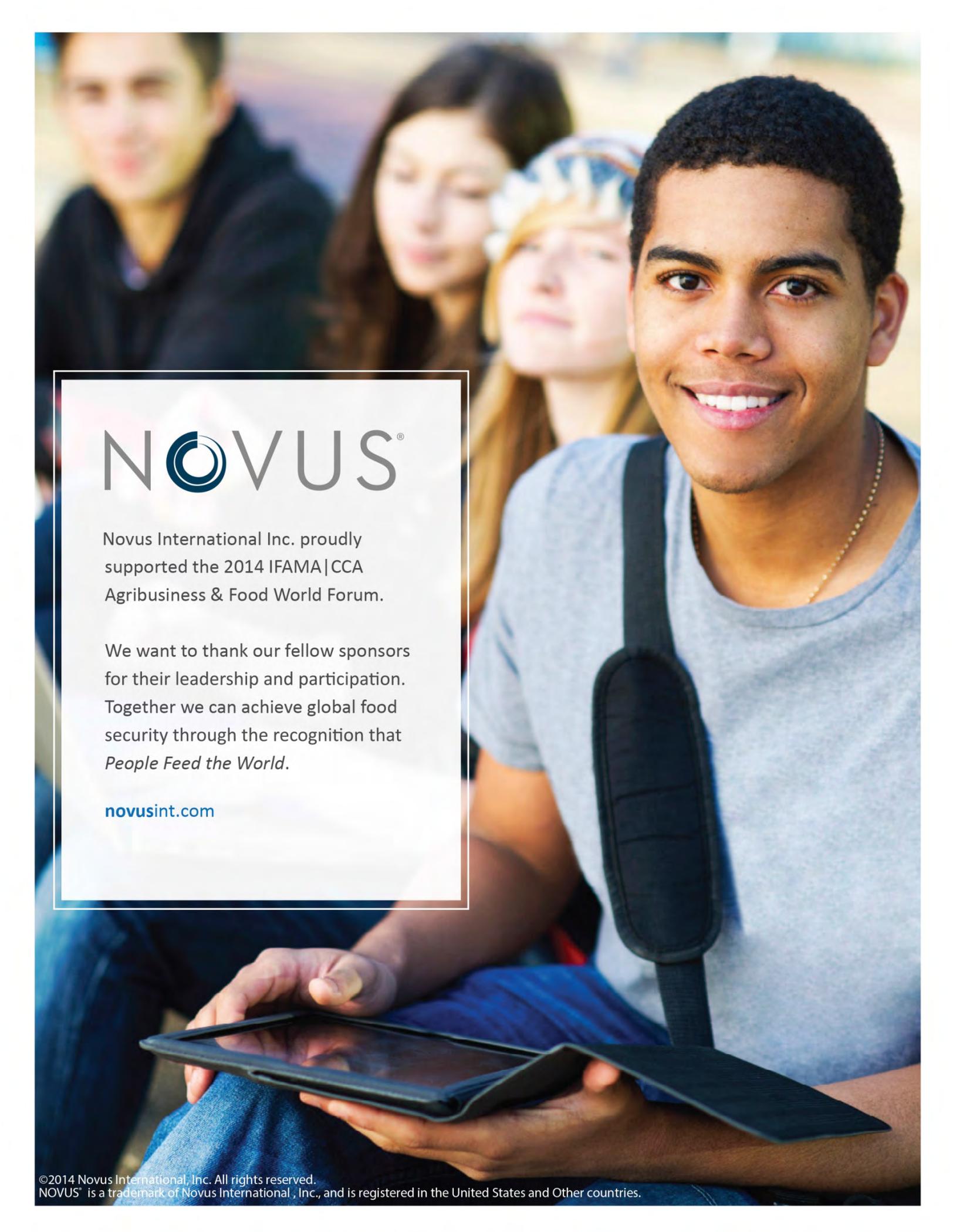
Research

1. **An Empirical Investigation into the Adoption of Green Procurement Practices in the German Food Service Industry**
Verena Hauschildt and Birgit Schulze-Ehlers
First Place Winner of the 2014 IFAMA Symposium Best Paper Award..... p. 1
2. **Development and Management of a Bio-Energy Supply Chain Through Contract Farming**
Luigi Cembalo, Stefano Pascucci, Carolina Tagliaferro, and Francesco Caracciolo
Second Place Winner of the 2014 IFAMA Symposium Best Paper Award..... p. 33
3. **Agricultural Supply Management and Antitrust in the United States System of Agribusiness**
Yuliya Bolotova
Third Place Winner of the 2014 IFAMA Symposium Best Paper Award..... p. 53
4. **Determinants of Agro-Dealers' Participation in the Loan Market in Nigeria**
Aderibigbe S. Olomola
2014 IFAMA Symposium Best Paper Award Finalist..... p. 77
5. **Risk Communication and Market Effects during Foodborne Illnesses: A Comparative Case Study of Bacterial Outbreaks in the U.S. and in Germany**
Vera Bitsch, Nevena Koković, and Meike Rombach..... p. 97
6. **Connecting Sensory Quality Characteristics and Local Designations to Willingness to Pay for Cheese at the Retail Level**
Ryan N. Barnes, Ryan C. Bosworth, DeeVon Bailey, and Kynda R. Curtis..... p.115

- 7. Bottlenecks and Opportunities for Quality Improvement in Fresh Pineapple Supply Chains in Benin**
V. Nicodème Fassinou Hotegni, Willemien J. M. Lommen, Jack G. A. J. van der Vorst, Euloge K. Agbossou, and Paul C. Struik..... p.139
- 8. Introduction of Electronic Combinatorial Auction to a Food Manufacturer**
Keith D Harris and Arlo Biere..... p.171
- 9. An Assessment of Market Strategies for Small-Scale Produce Growers**
Man-Keun Kim, Kynda R. Curtis, and Irvin Yeager..... p.187
- 10. Happy Growers! Relationship Quality in the German Organic Apple Chain**
Katrin Zander and Philip Beske..... p.205

Industry Speaks

- 11. Using Event Sponsorship to Cross the Chasm between Consumer Perceptions of Agriculture and On-farm Realities**
Catherine Keogh and Aidan J. Connolly..... p.225



NOVUS[®]

Novus International Inc. proudly supported the 2014 IFAMA|CCA Agribusiness & Food World Forum.

We want to thank our fellow sponsors for their leadership and participation. Together we can achieve global food security through the recognition that *People Feed the World.*

novusint.com



*International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014*

EDITOR'S NOTE

Dear Readers,

Welcome to the September issue of the IFAMR, our third scheduled publication of the year. In this issue we feature the Best Paper winners from the IFAMA Best Paper competition held every year in conjunction with the annual conference. This year the papers were presented in Cape Town, South Africa. Congratulations to the authors. The Best Paper Competition is a wonderful event involving collaboration between the IFAMR and IFAMA. The Competition simultaneously brings high-quality research to the conference and provides authors with a very efficient and timely mechanism for getting their research published.

Back in 2009 the editors of the IFAMR and the academic members of IFAMA decided that food and agribusiness scholars would be well served if the IFAMR had an Impact Factor (IF). At the time, and still today, most ag econ and agribusiness journals do not have an Impact Factor. Consequently, too many food and agribusiness articles appeared outside the mainstream of scientific publications, and the articles were discounted by peers in the P&T process. In 2009 we initiated a broad strategy with two purposes: 1) to qualify and receive an Impact Factor and 2) to achieve an Impact Factor on par with the leading food, agribusiness, and agricultural economics journals (1.00-1.50). In 2010 we qualified for an Impact Factor and Thomson-Reuters began cataloging the IFAMR. In 2011, the IFAMR received its first Impact Factor. In 2013 (the current year), the IFAMR achieved the highest impact factor among Agribusiness journals at 0.55, and the IF is growing at an annual rate of 24% (Figure 1).

But we aren't satisfied. We have come a long way, but we know the IF is still too low. We are dedicated to implementing strategies which will elevate our Impact Factor. If you're one of the IFAMR's published authors, a potential author, a reviewer, an editor, or serve on our advisory board don't just look at where we are now, but look into the future and think of where we will be. Join us! The IFAMR is growing stronger. The greater the commitment to the IFAMR—your journal, the faster we will achieve our objectives.

Enjoy the issue.

Peter Goldsmith, Executive Editor, IFAMR

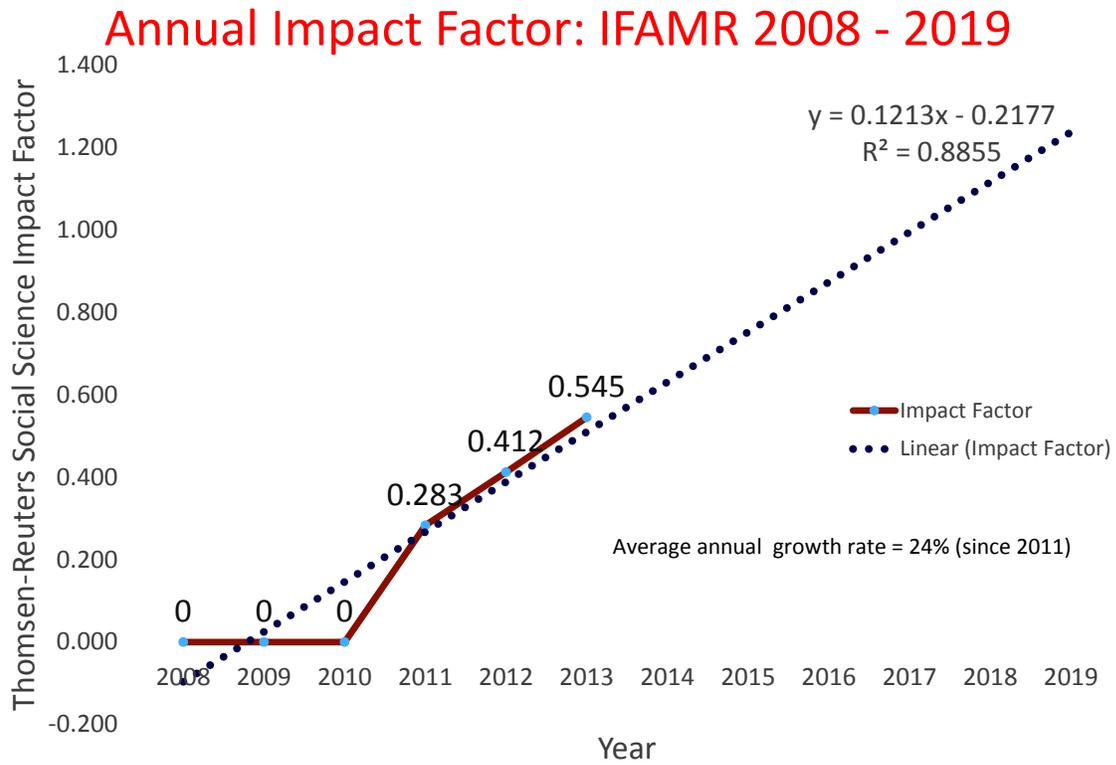


Figure 1. IFAMR Impact Factor (September 2014).



International Food and Agribusiness Management Review

Strong Roots - Bright Future

50 YEARS | **MASSEY UNIVERSITY**
UNIVERSITY OF NEW ZEALAND
TE KUNINGA KI PŌREHUŌA

WORLD LEADING IN AGRIFOOD

STUDY AGRICOMMERCE AT MASSEY

MASSEY.AC.NZ | 0800 MASSEY | THE ENGINE OF THE NEW NEW ZEALAND

Santa Clara University

Leavey School of Business

KANSAS STATE UNIVERSITY

Master of Agribusiness

The distance degree for food and agribusiness professionals

mab.ksu.edu

ILLINOIS

Food and Agribusiness Management

MARKESTRAT
Value Generation

Study **TUM**
Horticultural Science
at TUM

A master program of the Technische Universität München in Germany held in English

University of Fort Hare
Together in Excellence

The IFAMR Open Access Project is supported in part through contributions from these institutions. Scholars, practitioners, students, and policymakers may now read and download the most current and archival content from the IFAMR website. The Board of Directors of the International Food and Agribusiness Management Association feel that open and immediate access to IFAMR's articles and case studies dramatically elevates the quality of scientific inquiry and instruction around the world in the field of agribusiness. If you would like to support this effort please contact: **Kathryn White, Email: ifamr@ifama.org**.



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

An Empirical Investigation into the Adoption of Green Procurement Practices in the German Food Service Industry

Verena Hauschildt[Ⓐ], and Birgit Schulze-Ehlers^ᵇ

[Ⓐ] *M.Sc., Department of Marketing, University of Hamburg, Welckerstr. 8, 20354, Hamburg, Germany*

^ᵇ *Jun.-Professor, Institute of Agricultural Economics, University of Kiel, Olshausenstr. 40
24118, Kiel, Germany*

Abstract

This paper analyzes the relationship between sustainability views, drivers and barriers and concrete procurement practices for sustainability in the German food service industry (FSI), building on earlier work of Rankin et al. (2011) on this topic. Further innovation lies in the explicit regard to product-specific differences in the importance and level of implementation of sustainable sourcing, as well as in the special focus on the FSI, a sector with significant economic importance, for which only small amounts of information can be found. For this study, qualitative interviews among head chefs and quantitative standardized surveys among decision makers from the FSI were conducted.

Keywords: sustainability, Food Service Industry, green procurement strategies, sustainable buying behavior

[Ⓐ]Corresponding author: Tel: + 49. 40.42838.8699

Email: V. Hauschildt: verena.hauschildt@wiso.uni-hamburg.de

B. Schulze-Ehlers: bschulze@ae.uni-kiel.de

Introduction

Sustainability Management is one of the most pressing challenges of this century (Raskin et al. 2010). One step towards the management of this wicked problem of sustainability (Peterson, 2009; Rittel and Webber 1973) is creating transparency about the impact of companies' processes on their ecological and societal environment ("inside-out-linkages", Porter and Kramer 2006). Taking a strategic management perspective, it can be assumed that firms can create competitive advantages by quickly adapting to new trends, as is postulated in the dynamic capabilities approach (Teece et al. 1997). This research therefore aims at investigating the state of the art of sustainability management in the Food Service Industry.

As today it is commonly understood that sustainability management has to be extended beyond the single enterprise and to the whole supply chain, this also includes upstream (external) processes (Brindley and Oxborough 2013; Crespín-Mazet and Dontenwill 2012; Seuring and Mueller 2008). Close cooperation between all companies along the supply chain (manufacturer, retailer and consumer) and involved organizations (NGO's, governmental and agricultural organizations) are required to reach the goals of sustainability; environmental quality, social justice and economic prosperity (Elkington 1994).

A number of studies tackle this question of how to integrate suppliers into corporate sustainability activities using green procurement strategies (Baden et al., 2011; Ciliberti et al. 2008; Wognum et al. 2011). Such strategies are often translated into additional requirements to suppliers. These go beyond classical evaluation criteria such as quality, price, or reliability (Walker et al. 2008), and also beyond existent environmental laws and regulations. Lists of potential criteria have been proposed, e.g. by Handfield et al. (2002) for the environmental aspects. Walker et al. (2008) reviewed the literature on drivers and barriers to environmental supply chain management. They broadly distinguished internal (organizational) and external (regulatory, customer, competition, society, and suppliers) drivers, and internal (cost, training, lack of legitimacy) and external (regulation, poor supplier commitment, industry specific) barriers.

For the food sector, Walker and Brammer (2009) found that retailers engaging in green procurement were able to implement these strategies rather easily due to their power position. Other studies dealt with local organic food networks and the role of ecological citizenship (Seyfang 2006), the environmental effects of local food shopping (Coley et al. 2009; Mundler and Rumpus 2012), information systems employed to create transparency (Wognum et al. 2011), and with opportunities for reducing greenhouse gas emissions (Garnet 2011). Studies on drivers and barriers for implementing green procurement in the food sector (Walker et al. 2008), however, are rare.

Rankin et al. (2011) developed a framework to "establish levels of sustainability in agribusiness companies in terms of sustainability views, actions, and performance measures" (Rankin et al. 2011, 4). Their goal is to categorize companies into different levels of sustainability. The sample of their study consists of managers of agribusiness firms along the whole supply chain, with a focus on input and production companies. However, the sustainability actions taken into account

in this paper are broad and only comprise one general action “Sustainable Supply Chain Management”.

The contribution of the study is threefold. First, the approach of Rankin et al. (2011) will be modified by explicitly connecting sustainability views, drivers, and barriers to concrete procurement practices for sustainability in the food service industry (FSI). Second, product-specific differences in the perceived importance and level of implementation of sustainable sourcing will be explicitly regarded. Third, this research focusses on the FSI, which is an economically important part of the food sector, but has been rather neglected by researchers so far (Baldwin et al. 2011). It consists of a diverse group of public and private organizations from restaurants to company and school canteens and hospitals and nursing homes. Little research has been conducted on the specific sustainability challenges of caterers (Mikkola 2009; Rimmington et al. 2006), and none of these have focused on Germany.

This study aims to specifically answer these research questions:

- Which views on sustainability prevail in the German food service industry?
- Which actions of sustainability management do companies in the food service industry use both internally and with respect to procurement?
- How are companies’ practices connected to the stated views of the participants on sustainability?
- Which are the drivers and barriers companies face in their attempts “to green” their procurement

Given the small amount of available information on this sector, qualitative as well as quantitative methods were used in this study. The measurement instruments for sustainability views for both external and internal influences were taken from Rankin et al. (2011). The potential green procurement practices in the FSI were derived from qualitative interviews with eight decision makers from different food service organizations, from principles developed by Rimmington et al. (2006), and from the Green Seal Standard for Restaurants (Baldwin et al. 2011).

The remainder of this paper is organized as follows: First, the German food service sector and the increasing relevance of eating out in Germany are briefly introduced. Secondly, the main issues with respect to sustainability in the German FSI are described. Then, an overview of the literature on Sustainable Supply Chain Management (SSCM) is provided. A special focus of this section lies on green procurement as well as on general drivers and barriers to sustainability management which can be assumed to affect procurement. The research is positioned in the Strategic Management literature, more specifically the dynamic capabilities approach put forward by Teece et al. (1997). It is based on the assumption that the capability of a company to quickly adapt to societal requirements such as sustainability issues in food chains, contributes to its competitiveness. The dynamic capabilities approach will be briefly sketched in the third section as well. The fourth section presents the data and methodology, followed by the fifth section presenting results and discussion of theoretical and practical implications. The paper finishes with a brief conclusion and considerations for future research.

The German Food Service Industry

The food service industry is defined as “encompassing all providers of fresh prepared meals, including food sections of grocery deli” (Friddle et al. 2001, 4). It includes a very heterogeneous group of company types, “from full service restaurants to school cafeterias & prisons” (ibid.) and includes both public and private organizations. Rogge and Becker (2008) present a comprehensive overview of further distinctions between businesses in the sector.

The German Hotel and Catering Association (DEHOGA) analyzes and publishes the annual economic developments in the German FSI, which can be divided into the hospitality and catering industry, system gastronomy, and communal catering. Hospitality and caterings’ annual net turnover rose from 63.6 bn Euro in 2010 to 66.1 bn Euro in 2011. This increasing trend persisted with nominal growth rates of 2.1 % in 2012 and 1.2% in 2013, leading to an annual net turnover of 68 bn Euro in 2013. Separating this industry, 44.3 bn Euros of annual net turnover were due to full service restaurants and the catering industry, while lodging generated 23.7 bn Euro in 2013 (DEHOGA 2013). The annual percentage changes are shown in figure 1. System gastronomy including large restaurant chains like McDonalds, Burger King or Nordsee reached a net turnover of 11.5 bn Euros in 2012 which equals a growth rate of 3.3 compared to 2011 (Lebensmittelzeitung 2013). The area of communal catering generated an estimated turnover of 18 bn Euros in 2011, where the biggest share of 48.5 % is due to business canteens. Hospitals generated 21.4 % of this turnover, nursing homes 16.7 % and canteens of schools and universities 5.1 % (DEHOGA 2012).

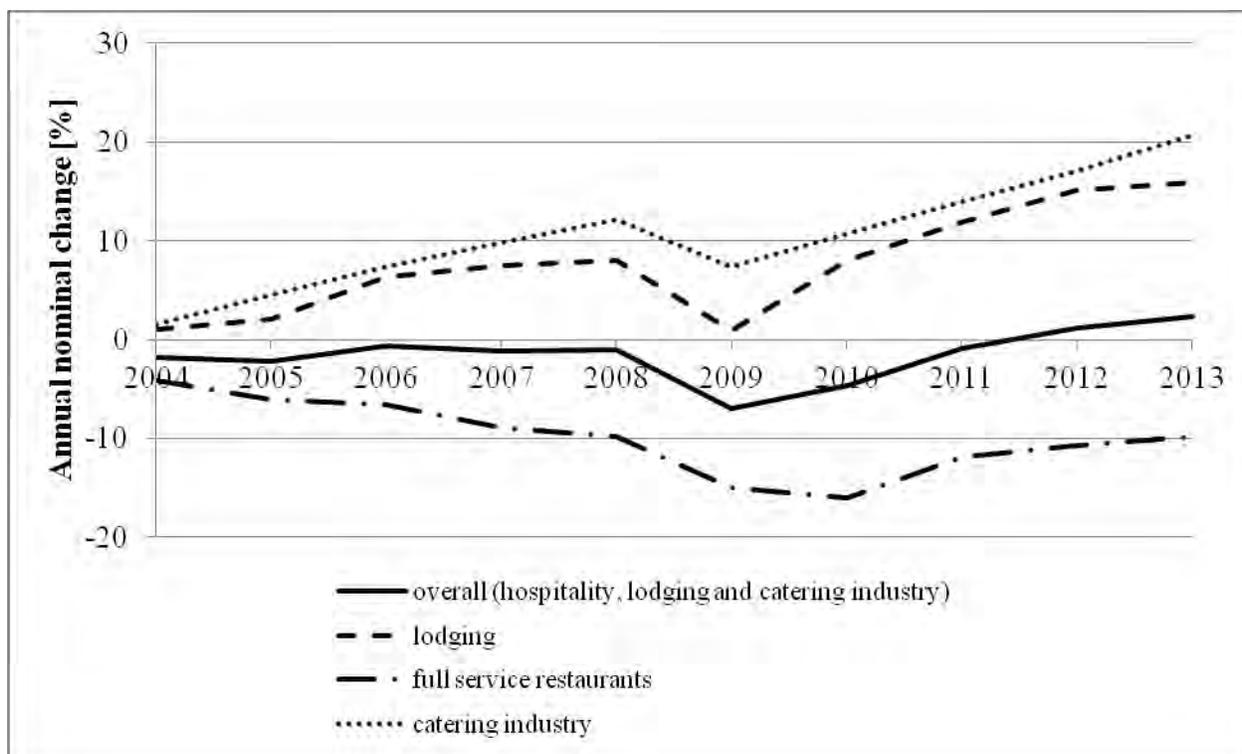


Figure 1. Nominal changes in annual turnover (hospitality, lodging and catering industry)
Source. Own illustration according to DEHOGA 2013.

The FSI is supplied mainly by different types of distributors. In this case, wholesalers, including cash & carry markets and specialized delivery services, are more important than direct suppliers of food manufacturers (compare the supply chain for the US as depicted by Friddle et al. (2001, 21)). Nevertheless, Unilever, e.g., as one of the most important food manufacturers in the world, also has its own food service division (UFS 2013) which approaches food service businesses directly to establish customer loyalty to their products using specific offers to different types of consumers.

As in the US (ERS 2012), the food service industry in Germany has gained economic importance in recent years, with almost one third of all meals being consumed away from home among the 16-69 year olds. Splitting this percentage up into smaller intervals, it becomes clear that the percentage is even higher in younger generations. Nearly 40 % of the 20-24 year olds eat their meals away from home (GfK Panel Services 2009). Employed singles and unmated retirees also show higher percentages for out of home food consumption (DGE 2004a).

The increase in FSI companies' turnover is caused by an increase in consumer expenditures¹ and consumption per visit rather than by an increase in the number of visits (BVE 2013; npdgroup 2011). The demand for food consumed outside the home will rise even more, as more children are attending day care, schools increasingly offer catered lunches, the number of hospital stays increases, and more people live in nursing homes. Due to the German age distribution, the Federal Statistical Office (2010) predicts a duplication of the care-dependent elderly from 2.2 million people in 2011 to 4.5 million in 2050. Consequently, catering for elderly people will also play an important role in the German food service industry.

Given the strong sustainability trend among consumers (Leiserowitz et al. 2006) this raises questions about how businesses in the FSI can respond to this trend, and if they do so, in which way they are currently responding to it (Brindley and Oxborrow 2013; Rimmington et al. 2006; Walker and Brammer 2009). Sustainability issues which have been discussed with respect to the food service industry include food wastage (Parfitt et al. 2010), health issues (Young and Nestle 2002; Mentzer Morrison et al. 2011), as well as environmental issues related to transportation ("Food Miles", Davies and Konisky 2000; Mundler and Rumpus 2012). Several other developments, such as food scandals, ethical problems regarding animal welfare, external effects of food production and loss of trust in labeling, lead to novel requirements on the demand side. These, for instance, are transparency about product origin and production methods, product safety, and trust. On the other hand, consumers' information seeking behavior regarding food provenience and production methods seems to differ from their behavior when shopping for food at retailers. Rogge and Becker (2008) found that the majority of consumers were hardly interested in the origin of meat when eating out. In the same line, Mentzer Morrison et al. (2011) show that less attention is paid to the nutritional value of the food that is consumed away from home.

¹ This includes consumer expenditures for full service restaurants, quick service restaurants, leisure gastronomy, business canteens and canteens of schools and universities (BVE 2013).

Against the background of these developments, this research focusses on the sustainability-orientation of procurement strategies in food service businesses. Additionally, drivers and barriers for the adoption of green strategies are identified.

Sustainable Supply Chain Management and Green Procurement Strategies

Today it is commonly understood that sustainability management has to be extended beyond a single enterprise to the whole supply chain (Brindley and Oxborrow 2013; Crespín-Mazet and Döntenwill 2012; Seuring and Mueller 2008). Close cooperation between all companies along the supply chain (manufacturers, retailers and consumers) and involved organizations (NGO's, governmental and agricultural organizations) are necessary to attain the goals of sustainability. These include environmental quality, social justice, and economic prosperity (Elkington 1994). Walker and Jones define SSCM as "the pursuit of sustainability objectives through the purchasing and supply process, incorporating social, economic and environmental elements" (Walker and Jones 2011, 15).

Green Procurement Strategies: State of Knowledge

As a key department of any company, procurement management is responsible for improving the companies' overall sustainability. Since the procurement management department selects the company's suppliers, it has relevant impact on external environmental and social effects as well as on economic sustainability (Schaltegger et al. 2007).

Additionally, globalization is a main driver for the increased relevance of social issues in procurement strategies (Herzig and Schaltegger 2009). Global purchasing strategies require companies to consider human rights and acceptability of working conditions in developing countries, too (Schaltegger et al. 2007). A number of studies have tackled the question how to integrate suppliers into corporate sustainability activities using "green procurement strategies" (Baden et al. 2011; Ciliberti et al. 2008; Wognum et al. 2011). These are often translated into additional requirements to suppliers, which go beyond classical evaluation criteria such as quality, price, or reliability and also beyond extant environmental laws and regulations. Seuring and Mueller (2008) found that in the literature, two different approaches towards Sustainable Supply Chain Management can mainly be identified. These are supplier evaluation for risk and performance and supply chain management for sustainable products. Lists of potential criteria for environmental aspects have been proposed, e.g., by Handfield et al. (2002).

Walker et al. (2008) conducted a literature review on drivers and barriers for environmental supply chain management. They broadly distinguish internal (organizational) and external (regulatory, customer, competition, society, and suppliers) drivers, as well as internal (cost, training, lack of legitimacy) and external (regulation, poor supplier commitment, industry specific) barriers. Their qualitative study among seven large private and public organizations revealed that the organizations face very diverse internal and external barriers. The drivers, on the contrary, seemed to be more homogeneous, with regulatory compliance being mentioned by all seven organizations. Such heterogeneity is also identified by Walker and Brammer's (2009) quantitative study on sustainable public procurement in the United Kingdom. Here, Likert scales were employed to measure the degree of implementation of different sustainable procurement

practices, and open questions were used to measure facilitators and barriers. Their conclusion is that financial barriers seem to be the most important inhibitor to sustainable procurement.

Green Procurement in the Food Service Industry

Rimington et al. (2006) developed procurement principles for British catering services “to green” the company in general and their procurement specifically. Based on a literature review and an expert panel, nine sustainable principles were determined. Only five of them were considered to be feasible for the participating experts of the companies. The five principles include (1) “selecting food products from the country in which they are to be offered”, (2) “providing appropriate menu information and food offerings”, (3) “controlling the production to respect human health and the environment”, (4) “working with other companies to support smaller local and regional suppliers” and (5) “ensuring resource efficient food productions” (Rimington et al. 2006, 828f). Experts were not yet prepared to implement the remaining four principles to their companies. These were/are: (6) “fuel/energy efficient transport systems”, (7) “sourcing animal-based food products from livestock producers who comply with national and international standards and principles regarding animal welfare and health”, (8) “using the minimum amount of additives and improving information regarding additives” and (9) “working towards the adoption of a corporate code of practice” (Rimington et al. 2006, 829). As the experts explained, principle 6 describes an issue which is not under their control, meaning that obviously, this criterion so far is not taken into account in supplier selection. Principles 7 and 9 should, according to respondents, be considered and developed in purchasing policies and regulations rather than in the procurement process. Finally, the experts considered principle 8 as a matter of health issues rather than an aspect in the field of sustainable food.

In the US, the Green Seal Standard for Restaurants and Food Services (Green Seal 2013) also provides recommendations for actions that procurement departments could take in order to increase the sustainability of FSI businesses. The requirements comprise defined shares of “organic or environmentally preferable” food purchases, “antibiotic-free” animal-based food purchases, and coffee from “organic, or environmentally, or socially preferable” sources, as well as avoidance of fish purchases from endangered stocks.

Drivers and Barriers of Sustainability Management and Green Procurement Strategies

Drivers and barriers of sustainability management were discussed in several studies, which will be briefly summarized in the following. External drivers for sustainable activities within a company are political circumstances (Otsuki 2011), preservation and support of the local identity and cultural values (Morgan and Sonnino 2007), competitiveness, competitive or public pressure for sustainable activities (Marcus and Fremeth 2009), and, following Herzig and Schaltegger (2009) and Smith (2008), expectations of consumers. Increasing profit based on product differentiation, increasing productivity or filling a market gap (Marcus and Fremeth 2009), improvement of reputation or moral aspects (Herzig and Schaltegger 2009; Morgan and Sonnino 2007) could be identified as internal drivers. Further, Rankin et al. (2011) and Walker and Brammer (2009) pointed out that the attitude and support of companies’ top management plays an essential role for sustainable activities to be included in the businesses’ objectives.

Seuring and Mueller (2008) focused their literature review more specifically on SSCM. From a total of 191 scientific papers, they identified general pressures and incentives, supporting factors, and barriers. General pressures or incentives for SSCM comprise legal and customer demands, stakeholder claims, competitive advantage, and the prevention of reputation loss. Concrete supporting factors were found more specifically in the technical and human resources domain. In the literature reviewed by Seuring and Mueller (2008) the supporting factors mentioned the most were company-overlapping communication, management systems and monitoring schemes, but also training of procurement staff and the integration of sustainability into the corporate policy. Their list of barriers is shorter and refers to elevated costs, complexity of coordination and related efforts, and insufficient or missing communication in the supply chain. With respect to FSI, Conner et al. (2012) analyze the potential for increased sustainability of school foods in the USA from a transaction cost perspective based on a qualitative study among supply chain actors. They point at barriers such as cost and quality concerns.

Green Procurement as a Strategic Capability

As shown above, sustainable procurement strategies are not (only) driven by moral aspects, but triggered by the expectation of direct financial benefits or competitive advantages. This is in line with Porter and Kramer (2006), who posit that companies should strive for environmentally or socially desirable activities if and only if there is a direct impact on the economic viability of the company. Here, the companies' ability to exploit new opportunities becomes crucial, as postulates the dynamic capability approach by Teece, et al. (1997), who "define dynamic capabilities as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Dynamic capabilities thus reflect an organizations' ability to achieve new and innovative forms of competitive advantage [...]" (Teece et al. 1997, 516). Taking up this idea of strategic management, a potential explanation for increased sustainable sourcing activities at least among some of the FSI companies could be their attempt to achieve first mover competitive advantage. Dynamic environments increasingly put into question the validity of Barney's (1991) Resource Based View and the postulate of carefully sticking to core resources and competencies of the company for a long time. Rather, the ability to learn and change, become more important. In the case of sustainability management, companies may have expectations that the societal awareness for these issues may be a short-lived trend, which may be over before measures have been implemented. As has been shown above for procurement, a change towards more sustainable suppliers may be both costly both in terms of time and money. Boehlje et al. (2011) put forward the difficulty of deciding in how far a company can take into account challenges along its whole supply chain and share information about potential ways to mitigate them. Since food supply chains still tend to be long and broad, creating shorter supply chains with stable relationships might be one source of competitive advantage in the future, since it might enable companies to quickly inform the whole chain about changes and trigger respective adaptations.

Having outlined the potential avenues as well as the strategic relevance of sustainability management and sustainable procurement in the FSI, the following section will now introduce the empirical procedures.

Methodology

Survey Design

The empirical approach consists of both qualitative and quantitative research. In an initial step, eight expert interviews with head chefs or owners of different companies in the food service sector were conducted. Aim of the interviews was to get insights into their reasoning on sustainability in general and on sustainable sourcing more specifically. Based on these interviews, a questionnaire that was distributed among decision makers from the food service industry was established. Survey instruments of Rankin et al. (2011) and Rimmington et al. (2006) were used during the development of the survey. An overview of the sections and questions is added in table form in the appendix (Table A-I).

The questionnaire was divided into five sections. The first section dealt with the general understanding of sustainability and sustainability management. An open question asked for spontaneous associations of respondents with the word “sustainability”. A second question asked for the importance their company places on sustainability in general. To elicit the sustainability views, 16 items developed by Rankin et al. (2011), which could be rated on a five-point Likert-scale were employed. These were extended by five items based on the results of the qualitative interviews. The first section ended with a rating of different measures for internal sustainability management. The measures include water and energy saving, waste reduction, renouncing on offering packaged foods (e.g., for breakfast), renouncing on convenience products, and an increased offer of vegetarian meals. They were derived from the literature, as well as from the qualitative interviews and correspond with the Green Seal Standard for Restaurants (Baldwin et al. 2011). The rating was performed on a scale from 1 = not useful at all to 5 = very useful for improving sustainability.

The next section dealt with the company’s sustainability orientation in procurement. First, respondents should indicate the importance their company places on sustainability in food sourcing. To account for possible trade-offs in sourcing decisions, a ranking had to be performed among five sourcing criteria, namely quality, availability, price, sustainability, and reliability of suppliers. Then, the usefulness of different procurement-related measures to achieve sustainability had to be rated in the same way as the question on internal measures. Additionally, respondents should indicate the relevance of sustainable sourcing activities in seven product categories and whether their company already employed the specific measures in these product categories. The next set of questions in this section asked for the requirements the businesses demand of their suppliers, including use of water and energy saving technologies in production and transportation, information transparency with respect to production processes, ingredients and additives, origin of products, own sustainability activities, and the sustainability activities of the suppliers’ suppliers.

The third section of the survey gathers information on drivers and barriers of sustainable procurement actions. The items were again adopted from Rankin et al. (2011), Seuring and Mueller (2008), and from the qualitative interviews. Further, respondents were asked about their knowledge and the actual implementation of different sustainability programs and standards, ranging from Fair Trade, ISO 14000 and EMAS to the Roundtable on Sustainable Palm Oil and the MSC label. To check the relevance of such standards as compared to “traditional” quality standards, such as IFS, BRC, QS, Global Gap and Organic, the respondents had to indicate

whether they supposed these standards to be of “much greater”, “greater”, “neither greater nor smaller”, “smaller” or “much smaller” relevance. Additionally, they had to state whether the respective standard was currently applied (single checkbox).

To conclude the sustainability related questions, the fourth section asked respondents to rate the level of sustainability of their company on a five-point Likert scale ranging from 5 = “very much sustainability oriented” to 1 = “not sustainability oriented at all”. Additionally, they had to rate the performance of their company in comparison to other companies. Further, the future relevance of being a sustainable company had to be rated both for the overall FSI as well as for their own company on a Likert scale from 5 = very important” to 1 = “not important”. Also, respondents were asked to state whether they were ready to pay an extra surcharge for “sustainable products”, with answer categories 1 = no mark-up, 2 = less than 10%, 3 = 10-20%, 4 = 20-30% and 5 = more than 30%. A last section of the questionnaire asked for company characteristics including the company’s main activity (catering, hotel, restaurant, canteen, etc.), the turnover, the number of sites, as well as types of suppliers (farmers, manufacturer, distributors, or caterers). The current position of the respondent had to be filled out as well.

The interviews were conducted at two fairs in Northern and Eastern Germany which were held for customers of a large wholesaler specialized in supplying the FSI. The sample contains datasets of 122 companies of different sizes and types, from small restaurants to large canteens and caterers. Table 1 exhibits the characteristics of respondents and the companies they represent.

Table 1. Characteristics of participating companies and respondents

Company type²	Public canteens (59.0 %), Catering firms (24.6 %), Quick service restaurants (4.9 %), Full service restaurants (32.8 %), Lodging (17.2 %)
Number of sites³	1 site (51.6 %), between 2 and 10 sites (13.9 %), more than 10 sites (9.8 %)
Number of suppliers⁴	Less than 5 suppliers (33.6 %), between 5 and 10 suppliers (45.1 %), more than 10 suppliers (14.8 %)
Position of respondents⁴	Owner/GM (14.0 %), Purchasing manager (14.8 %), Head chef (38.5 %), Department manager (11.5 %), Employee (10.7 %), Other (4.9 %)

N = 122

Source. Own data

² Respondents were allowed to group themselves into several categories; the shares thus do not sum up to 100%.

³ The difference between the sum of shares and 100 is the share of missing values per category.

Statistical analyses are carried out using SPSS. Principal component analysis (PCA) with Varimax rotation was employed to reduce the complexity in different parts of the survey (see below). From the answers concerning the use of different measures in procurement, company-specific adoption rates were calculated action-wise across all product categories and for each product category across all actions. Finally, a stepwise cluster analysis using the Single-Linkage method to eliminate outliers and the Ward method to define the number of clusters was performed based on the sustainability views of the firms, and the clusters are described using analysis of variance (ANOVA).

Results and Discussion

This section is structured according to the above-mentioned research questions. Thus, first the results concerning sustainability views are presented, then we turn to the sustainability actions undertaken in internal processes and supply management as well as to the drivers and barriers. The results of the cluster analysis on the sustainability views are presented at the end of the section, comparing the clusters with respect to adoption of sustainability actions, drivers and barriers, as well as firm characteristics.

Companies' Sustainability Orientation and Sustainability Views

Overall, respondents who took part in the survey are well aware of the issue of sustainability and indicate the issue to be important to their company. Furthermore, the future relevance of sustainability issues to the FSI as well as to the own company is estimated to be rather high, as can be seen in Table 2, which reports the means, standard deviations (SD), and factor loadings. A PCA was carried out to obtain a measure of the companies' "Level of sustainability". Five questions concerning the current and future importance of sustainability in the company and the perceived sustainability orientation of the own company as compared to competitors were included in the analysis, yielding a single factor which was sufficiently reliable with a Cronbach's Alpha (CA)⁴ of .83. The Kaiser-Mayer-Olkin (KMO) criterion also shows a good value of .81 (Backhaus et al. 2011), indicating that the sample is adequate for PCA.

Table 2. Principal component analysis on degree of "sustainability orientation"

Item	Mean	Standard deviation	Factor loading
Sustainability orientation	3.53	.952	.838
Sustainability orientation compared to competitors	3.29	.843	.796
Future relevance of sustainability in the company	4.19	.787	.776
Relevance of sustainability in procurement	3.64	.971	.760
Relevance of sustainability in the company	3.90	.760	.687

Scale from 1 = not important at all to 5 = very important
KMO = .807; Eigenvalue: 2.987; Variance explained: 59.7%

Source. Own data

⁴ Cronbach's Alpha is a coefficient for internal consistency and contains the level of which several items are related to each other. CA-values above 0.6 show reliable factors (Nunnally 1978).

As can be seen from Table 2, respondents rated sustainability in procurement as slightly less important (mean=3.64) than overall sustainability management (3.90). The median value was 4 for both items in the total sample, which indicates a rather high relevance of sustainability for both the whole company as well as for procurement. However, a Wilcoxon signed-rank test shows that the median value of the differences between the answers of the two variables is not equal to 0 at a significance level of .01. This difference may be explained by the often-reported situation that companies mostly focus on their internal processes and then proceed to embrace their suppliers (Herzig and Schaltegger 2007).

For sustainability views, four factors were initially identified. Three of these showed sufficiently high CA values above .6. The factors were labeled as “Rational View”, “Value Related View”, and “Societal View”. A fourth, not sufficiently reliable factor included the views of sustainability as “A source of competitive advantage”, and “A way to strengthen image” and therefore could have been called a “Market Oriented View”. Given the too low CA, these items were deleted from the final analysis. The initial solution also contained two items which did not show factor loadings above .5 for any factor. These items, namely “A value integrated into the business” and “An integral part of the core business”, were also excluded from the final PCA. Table 3 reports the item means and standard deviations as well as factor loadings and respective CA values for the final solution.

Table 3. Results of the PCA on sustainability views

Items: “Sustainability is...”	Mean	SD	Factor 1 “Rational View”	Factor 2 “Value Related View”	Factor 3 “Societal View”
A strategy for cost savings	3.23	1.061	.764	-.143	.099
An opportunity for new revenue	3.42	1.051	.758	.090	.093
A way to impact employee satisfaction	3.16	1.074	.717	.318	-.083
Complying with laws and standards	3.47	.936	.693	.363	.013
A function of aligning values	3.58	.952	.084	.884	.071
A function of management belief	3.89	.948	.034	.721	.182
Dedication to long-run development	4.00	.856	.139	.572	.420
A method of risk management	3.00	.982	.317	.556	.089
Addressing hunger and societal welfare	3.51	1.211	.021	.149	.869
Reducing impact on the environment to preserve it for the future	4.09	.978	-.171	.238	.793
Collaboration with other groups	3.56	.886	.276	-.096	.584
Eigenvalue			3.563	1.963	1.148
Alpha			.75	.72	.70

Total N = 113 observations

Scale from 1 = Strongly disagree to 5 = Strongly agree

Source. Own data

The results of the PCA differ from those found by Rankin et al. (2011), who found a single item factor “regulatory compliance” and another factor including the “profit driven” and the “innovative sustainability” levels 2 and 3. Here, the first factor reflects compliance issues and cost and revenue, and therefore would be attributed to the levels 1 and 2 of sustainability (regulatory compliance and profit-driven sustainability). Our second factor contains three items which are included in Rankin et al.’s “Innovative” view, as well as an item reflecting an understanding of sustainability as a method for risk management. Given the items’ content we decided to label this factor as “Value-Related” sustainability view. Our third factor again deviates from the factor “organizational and societal sustainability” found by Rankin et al. (2011), since it only contains altruistic items. It is therefore called the “Societal view” Before turning to the results of the cluster analysis, the relevance of sustainability in sourcing decisions and sustainable actions which companies do already undertake are reported.

Relevance of Sustainability in Sourcing Decisions

The results of the ranking of sourcing criteria support previous findings related to the role of sustainability in the sourcing process: Table 4 shows that sustainability as a sourcing criterion mainly ranks behind price, quality and delivery reliability of suppliers. This is in line with Seuring and Mueller (2008) and Brindley and Oxborrow (2009, 2011), who found that such criteria are often used as order qualifiers, while order winners are price, quality, and other, delivery-related criteria such as availability and reliability. Nevertheless, roughly 13 percent of the respondents ranked sustainability as the most or second-most important criterion.

Table 4. Rating of sourcing criteria in percentage per rank

	Mean (SD)	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Quality	1.66 (.880)	54.12	31.76	9.41	3.53	1.18
Price	2.29 (1.242)	30.59	36.47	14.12	10.59	8.24
Reliability of supplier	3.41 (1.188)	7.06	15.29	28.24	28.24	21.18
Supply availability	3.79 (1.025)	2.35	9.41	22.35	38.82	27.06
Sustainability	3.86 (1.197)	4.71	8.24	25.88	18.82	42.35

N=85 observations

Source. Own data

Sustainable Actions: Internal Measures and Sourcing Practices

The ratings of internal and external sustainability measures in terms of usefulness were found to build four components. Two of these comprise internal measures, and two supplier related (external) measures. Three of the components were sufficiently reliable based on Cronbach’s Alpha values. Detailed results are reported in Table A-II in the appendix.

A first important finding is that all of the measures are rated as (rather) useful, with no mean lying below 3. Organic and Fair Trade purchases are rated with the lowest means of 3.3 and 3.9 among the purchasing principles. As internal measures, offering more vegetarian meals and not

using convenience products were rated “least useful”, with 3.5 and 3.6 respectively, and thus still with a positive tendency.

In the qualitative interviews indicated that there could be product specific differences in sustainability strategies. The respondents were therefore asked to rate the relevance of sustainable sourcing in different product categories, and to indicate which sustainable actions their company undertakes in food procurement in these categories (Table 5). The latter answers were transformed into adoption rates, representing the share of adopted measures over the total number of potential measures in the product category.

Table 5. Relevance of sustainability in different product categories

	Average Adoption of Sustainable Actions ¹	Relevance of Sustainability ²	Correlation-coefficients ³
Meat	47.8 % (27.333)	4.1 (.940)	.4159***
Fruit and Vegetables	46.8 % (26.346)	4.2 (.870)	.1554*
Fish	37.2 % (24.366)	4.3 (.895)	.3898***
Meat products	30.4 % (23.581)	3.6 (.921)	.3106***
Dairy Products	28.6 % (23.024)	4.0 (.887)	.3064**
Frozen Food	16.2 % (18.289)	3.5 (1.002)	.2507**
Coffee	14.2 % (16.805)	3.5 (1.076)	.2455*

*p<.10 **p<.05 ***p<.01;

¹ Share of implemented sustainable actions in total number of potential sustainability actions: Mean (Standard deviation)

² “How important is sustainability in different product groups for your company?” Scale from 1 = not relevant at all to 5 = very relevant: Mean (Standard deviation)

³ Pearson correlations between adoption rates and relevance of sustainability in the respective product category

Source. Own data

Correlation coefficients between the share of implemented actions and the general relevance of sustainability in the specific product categories support impressions from the descriptive results: The average adoption of green purchasing activities shows higher levels for product groups with higher relevance of sustainability, which are basically fresh, unprocessed products.

These results are in line with Smith (2008) who assumes that higher adoption rates could be caused by easier implementation of green strategies for unprocessed food products like meat, fish, fruit, and vegetables. Results from the expert interviews also show that fish, meat, fruit, and vegetables are more in the focus of sustainable strategies than other products. As one interviewee confirmed, “Sustainable strategies for fresh products (fish, meat, fruit and vegetables) are feasible in 90 % even for large companies of the food service industry”.

The analysis of relevance of specific sustainable procurement activities in the different product categories is documented in detail in Tables A-III and A-IV in the appendix. While animal welfare and local production seem to be important for meat, for buying fish, protection of species and sustainable-labeled fish products are relevant from participants’ perspective. Using local suppliers and buying seasonal products are, one the other hand, the main sustainability measures for fruit and vegetables (see Table A-IV).

Qualitative results support these impressions from the survey, as one interviewee stated: “Sourcing criteria are different regarding the product groups. When buying fish products, the freshness and especially the size are relevant for the protection of the species. Appropriate animal husbandry is an important criterion for meat procurement decisions, while domestic products are decisive for vegetables”. And another one stated: “While local and domestic meat, fish, fruit and vegetables are preferred in procurement decisions, prices are decisive for dairy products”.

Respondents were furthermore asked to indicate their additional willingness to pay (WTP) for sustainable products. Here, 23.3% of respondents answered that they are not willing to pay any mark-up for sustainable products. Another 47.4 % stated to be willing to pay up to 10 % more for sustainable products. 25.9 % indicated an additional WTP between 10 and 20 %, while 2.6 % would be ready to pay 20-30 % mark-ups, and one respondent indicated a willingness to pay more than 30 % for sustainable products. This rather strong reluctance to pay more leads us to investigate the drivers and especially the barriers which companies face.

Drivers and Barriers of Sustainability Management and Sustainable Sourcing

The results of the PCA on the eight potential drivers of sustainability revealed three components with Eigenvalues greater than one.⁵ Only one component – the internal drivers - had a sufficiently large Cronbach’s Alpha value of .77.⁶ Results of the PCA are reported in the appendix in Table A-V, including means and standard deviations for single items.

For participants of this study, the most important reasons to implement sustainability management in the companies were internal drivers, i.e., the engagement of the top-management (mean=3.80) and the staff (3.73), followed by consumer expectations (3.59) and moral considerations (3.56). The relevance of NGOs and other societal organizations on average is esteemed to play a less important role (2.96). A possible explanation is the smaller scale of the companies in this sample and in the sector in general, as compared, for example, to the manufacturing sector. This may reduce the public awareness of the potential impact of this sector on sustainable development (Revell and Blackburn 2007). The results, however, are not in line with Mikkola (2009), who investigated the relevance of sustainability among Finnish caterers. She found that as long as there were no regulations, this topic would not be taken into account.

Concerning the barriers to sustainable sourcing in the FSI, the PCA yielded three components with Eigenvalues greater than 1 and sufficiently large Cronbach’s Alpha values. Due to its high loadings above .5 on factors 1 and 2, the variable “Too little information of the producer” was excluded from the final analysis. Means and standard deviations as well as factor loadings are presented in Table A-VI in the Appendix.

The three factors were labelled as “availability and information problems”, “insufficient network” and “price barrier”. The items included in the latter were, on average, rated as the

⁵ The variable “Consumer expectations” had to be excluded from the factor analysis due to its low factor loading below .5.

⁶ For cluster comparisons in the next sections, we therefore used the single items of the non-reliable factors.

strongest problems. The items included in “insufficient network” were rated as less severe, although the means are slightly above 3.

These results again are consistent with the descriptive analysis of measure implementation and relevance as reported in Table A-III: The three measures relating to local sourcing yield the highest ratings in terms of relevance, while they are less frequently implemented than other measures that are easier to implement. This also supports the findings from the qualitative interviews: The problem mentioned most often about sustainable procurement strategies by the eight experts of the FSI is the availability of local and domestic food products. Especially large-scale FSI companies, which demand high quantities of products, stated to encounter this problem. Associated with problems of availability, experts meet difficulties in local logistics and procurement strategies. This includes the integration of many small suppliers in existing procurement processes. Moreover, it is problematic that locally-produced products often have higher prices, due to a smaller and thus less efficient production structures.

Customers were perceived to show a low WTP for sustainable food products and not to be interested in products’ origin, which is in line with the literature. The interviewed experts are criticizing German consumers’ mentality and attitude towards sustainable behavior vis-à-vis food products. One possible cause for this attitude is the fact that the consumers are not directly affected by the potential consequences of not buying sustainable products. Experts propose that changes in individual buying behavior are necessary in order to increase the overall offer of more sustainable products in the FSI into more sustainable products and “living sustainability principles” in the company.

Cluster Analysis on Sustainability Views

The cluster analysis was based on the three components of “sustainability views”, and yielded four clusters, which make up 31% (Cluster 1), 22% (Clusters 2 and 3 each), and 25% of the sample, respectively. In the following, the four clusters will be described based on Oneway ANOVAs (Table 6). Using the Levene test, we found homogeneity of variance for most of the variables. In these cases the Scheffé procedure was applied to identify significant differences between the clusters. For the other cases, Tamhane-T2 was applied (Tamhane 1979).

As can be seen from Table 6, Clusters 1 and 4 reveal rather high mean values, around 4, for both the Value Related and the Societal View on sustainability. They differ significantly, however, with respect to the Rational View, which reflects the economic and compliance levels of sustainability (Rankin et al. 2011). Here, only Cluster 1 shows a high mean value, while members of Cluster 4 on average rejected the items included in this factor. This difference leads us to interpret Cluster 1 as “Sustainability Strategists” (in the following, simply called Strategists), while Cluster 4 is labelled as “Sustainability Idealists” (Idealists).

Table 6. Results of the Cluster Analysis

Cluster Factor/ Item (Mean/SD)	A Sustainability Strategists	B Sustainability Rationalists	C Sustainability Laggards	D Sustainability Idealists	F-Value
Index Rational Sustainability View	4.04 (.515) ^{*(B)***(C,D)}	3.71 (.388) ^{*(A)**(C,D)}	2.61 (.494) ^{***(A,B)}	2.81 (.474) ^{***(A,B)}	59.34 ^{***}
Index Value-related Sustainability View ^T	3.96 (.519) ^{***(B)***(C)}	3.44 (.660) ^{***(A,C,D)}	2.98 (.472) ^{***(A,D)**(B)}	3.98 (.419) ^{***(B)***(C)}	22.46 ^{***}
Index Societal Sustainability View ^T	4.19 (.500) ^{***(B,C)}	2.74 (.471) ^{***(A,C,D)}	3.57 (.476) ^{***(A,B)**(D)}	4.12 (.771) ^{***(B)**(C)}	36.34 ^{***}
Cluster descriptive variables: Usefulness of sustainability measures and adoption rates					
Index Sustainability orientation	3.86 (.642) ^{***(C)}	3.56 (.656)	3.18 (.626) ^{***(A)***(D)}	3.95 (.560) ^{***(C)}	7.16 ^{***}
Index Usefulness of purchasing labelled products ^T	4.27 (.586) ^{*(B)***(C)}	3.59 (1.043) ^{*(A)}	3.46 (.770) ^{***(A)**(D)}	4.05 (.658) ^{***(C)}	6.49 ^{***}
Index Usefulness of internal measures: meal composition and packaging	4.14 (.655) ^{***(B)}	3.43 (.845) ^{***(A)}	3.74 (.729)	3.74 (.813)	3.8 ^{**}
Adoption rate ¹ Sustainability measures for <u>meat</u>	50.2% (20.9) ^{*(C)}	49.0% (28.4)	31.9% (27.3) ^{*(A)}	59.7% (28.8)	4.77 ^{**}
Adoption rate ¹ Sustainability measures for <u>fish</u> ^T	36.5% (16.0)	40.5% (27.7)	25.2% (25.6) ^{*(D)}	46.3% (26.3) ^{*(C)}	3.40 ^{**}
Adoption rate ¹ Protection of species ^T	43.9% (32.0) ^{***(C)}	34.5% (30.4)	16.5% (22.3) ^{***(A,D)}	41.5% (29.8) ^{***(C)}	4.48 ^{**}
Supplier requirements^a					
Index Sustainable process requirements	4.54 (.549) ^{***(C)*(D)}	4.15 (.726)	3.86 (.913) ^{***(A)}	4.04 (.678) ^{*(A)}	4.29 ^{**}
Index Sustainable product requirements ^T	4.7 (.502) ^{*(C)}	4.32 (.716)	4.28 (.671) ^{*(A)}	4.52 (.560)	2.63 [*]
Drivers of sustainability management^b					
Public pressure (stakeholder, NGOs)	3.55 (.685) ^{*(C)}	3.08 (.845)	2.83 (1.164) ^{*(A)}	3.00 (.949)	3.00 ^{**}
Barriers to sustainable procurement					
Index Availability and information problems	3.50 (.923) ^{*(C)}	2.89 (1.132)	2.70 (1.259) ^{*(A)}	2.81 (1.167)	2.75 ^{**}

Mean = arithmetic mean; SD = Standard deviation; *** = significance level $p = .01$; ** = $p < .05$; * = $p < .1$; Capital letters in brackets indicate significant differences between individual clusters.

Index: Unweighted average of the scores for the single items included in the factor.

¹ Adoption rates were calculated by dividing the number of adopted measures by the total number of available measures in the respective product category.

^T The Levene-Statistic indicated variances to be not homogeneous variance at least at the 10%-level of significance. Therefore, the Posthoc-test is based on Tamhane-T2 (Tamhane 1979).

^a Item: "Which requirements do your suppliers have to fulfill with respect to sustainability?" Scale from 1 = not necessary to 5 = absolutely necessary.

^b Item: "How important are the following drivers for sustainability management in your company?" Scale from 1 = does not play a role at all to 5 = plays a very important role.

Source. Own data

Clusters 2 and 3 both represent 22% of the sample and are characterized by significant differences in all cluster building variables. While members of Cluster 2 rather agree to the Rational View and the Value-related View on sustainability, and rather reject the societal view, Cluster 3 rejects the Rational View, rather agrees to the Societal View, and takes a neutral position on the Value-related View. In combination with the findings about self-assessed sustainability orientation and adoption rates of sustainability measures in procurement, Cluster 3 is labeled Cluster 3 as “Sustainability Laggards”, and Cluster 2 as “Sustainability Rationalists”:

The Laggards assess their own sustainability orientation lowest among all clusters, significantly different from Strategists and Idealists, while the Rationalists do not differ significantly from any of the clusters. The same holds for the adoption rates of sustainability measures: the Laggards, having the lowest average adoption rates, differ significantly from Strategists with respect to meat, from Idealists with respect to fish, and from both with respect to protection of species, while the Rationalist do not differ from any of the clusters, taking again a middle-position.

There are also some significant differences between the Strategists and Laggards with respect to supplier requirements for sustainable actions, drivers and barriers. For detailed information with respect to the factor analysis of the supplier requirements see Table A-VII in the appendix. Although the Strategists seem to put stronger requirements upon their suppliers regarding a sustainable process and a sustainable product itself, all clusters rather strongly agreed to the respective items with mean values around 4. Concerning drivers and barriers, Strategists seem to be most affected by availability and information problems and most driven by public pressure as compared to the Laggards.

Furthermore, the four clusters differ significantly (χ^2 -test) with respect to the stated willingness to pay a mark-up for “sustainable products”. Since only four respondents indicated a WTP for more than 20% of mark-up, these were grouped together with the 27 respondents willing to pay a mark-up of 10-20%. As can be seen from Table 7, the company types do not show strong differences between the four clusters. The different companies are almost distributed equally between the clusters. There might be a slight tendency from catering companies to settle in the cluster of Rationalists and Idealists, while full service restaurants can be found more often within the Rationalists and Laggards. Purchasing managers tend to be a little more often in the group of Rationalists and Idealists, while employees are the Rationalists. Due to the unequal distribution of the company type and position of respondent within the sample, these results are slight tendencies which need to be proved statistically by a larger sample.

Because of fewer statements of company’s revenue, the number of sites is used as a proxy (Pearson Correlation with revenue = .426**). Regional differences could not be identified.

Table 7. Comparison of clusters in terms of additional WTP for sustainable products and company characteristics

Cluster	Strategists (N=31)	Rationalists (N=23)	Laggards (N=24)	Idealists (N=26)
Willingness-to-pay¹				
No mark-up	16.1%	34.8%	29.2%	19.2%
Up to 10% mark-up	51.6%	52.2%	62.5%	26.9%
More than 10% mark-up	32.3%	13.0%	8.3%	53.8%
Company size²				
1 site	53.8%	84.2%	68.4%	75.0%
Up to 10 sites	30.8%	10.5%	21.1%	0.0%
More than 10 sites	15.4%	5.3%	10.5%	25.0%
Company type³				
Communal catering	71.0%	47.8%	60.9%	59.3%
Event catering and other catering	12.9%	39.1%	17.4%	37.0%
System gastronomy	3.2%	4.3%	4.3%	3.7%
Full service restaurants	25.8%	47.8%	47.8%	22.2%
Lodging	9.7%	17.4%	17.4%	22.2%
Position of the respondent³				
Business manager	3.0%	4.5%	9.1%	10.7%
Purchasing manager	12.1%	31.8%	18.2%	28.6%
Head chef	57.6%	45.5%	63.6%	50.0%
Department manager	24.2%	31.8%	27.3%	17.9%
Employee	15.2%	36.4%	13.6%	10.7%

Cluster size is slightly lower here, because not all respondents indicated an additional WTP and the number of sites.

¹ χ^2 -value: 17.647, $p < .05^{**}$

² χ^2 -value: 11.591, $p < .1^*$

³ Multiple answers were possible regarding the company type and position in the company; row percentages can thus be > 100 .

Conclusion

This study provides insights into the sustainability views of decision makers in FSI companies and reveals how different views on sustainability correspond to actions taken in the area of procurement. Moreover, drivers and barriers faced by companies in the food service industry concerning vertical sustainability management are investigated.

The results show that companies in the FSI are well aware of the meaning of sustainability issues, as well as of its internal and societal relevance. Sustainable procurement practices are rated as slightly less important for the companies' overall strategies. In terms of actions, resources-saving activities are most positively rated for internal sustainability. Across all product categories, local sourcing is most-often implemented as a sustainable sourcing principle which corresponds to a high rating of this measure in terms of achieving sustainability goals. Interestingly, classical B2C sustainability-related labels such as organic or fair trade are rated as less useful for sustainable sourcing decisions than the aforementioned measures. This may

indicate an underlying distrust in such labels, which was mentioned by most of the interviewees in the qualitative study.

The strong focus of FSI actors on local sourcing is not strictly in line with the findings on environmental impact, since today there are still deficiencies in short logistics chains (Mundler and Rumpus 2012). It may be assumed, based on the high rating of the driver “customer expectations”, that this trend is rather driven by customers’ positive associations with regional foods than by the wish to increase sustainability. A further explanation may be the wish to support local communities, which was stated in some qualitative interviews and has been reported for certain consumer segments for example by Schuldt and Hannahan (2013).

There are, however, some problems of availability and, more importantly, of customer willingness-to-pay, which represent major obstacles to increasing sustainable sourcing. This contradiction of consumer expectations as drivers and consumer WTP as barrier has been often discussed for food retailing (Vermeir and Verbeke 2006; Zander et al. 2013).

This research could not replicate the results of Rankin et al. (2011), neither in terms of sustainability levels nor in terms of clusters. Reasons may lie in the specific sector, but also in the different positions of the respondents compared to those in Rankin et al.’s study.

Taken together, we find two clusters comprising companies which have developed a rather comprehensive view of sustainability and also have translated this partially into measures of sustainable procurement. On the other hand, there are two clusters which represent companies rather reluctant in embracing the concept of sustainability. Broadly, one could thus distinguish Sustainability Leaders and Followers. The detailed cluster analysis shows that within the two broad groups, the views and motives do differ slightly. E.g., among the Leaders, one cluster of companies stresses the possibility of saving costs and creating competitive advantage (Strategists), while the other cluster (Idealists) explicitly rejects this view, focusing more on values and societal inclusion.

As already reflected by the lower overall importance attached to sustainability criteria in sourcing, all groups are rather reluctant towards the actual implementation of sustainable procurement strategies. Only few differences could be revealed in adoption rates of sustainable procurement measures for meat (Strategists vs. Laggards) and fish (Idealists vs. Laggards), and the perception of barriers is the same in most groups.

Implications and Future Research

The study provides implications both for FSI companies and their suppliers. There may be room for differentiation if distributors can offer specific ranges of sustainable products, potentially with price premiums up to 10 %. This applies even more strongly if they are able to establish efficient local supply chains which link producers achieving certain sustainability criteria in production to the nearest possible buyers. Only if the two conditions – sustainable production and environmentally-efficient transportation – are fulfilled, an improvement of the overall sustainability of food provision via the FSI can be achieved.

Besides the improvement of overall sustainability, suppliers may gain competitive advantages. Based on the resource dependency theory (RDT) by Pfeffer and Salancik (1978) the availability and dependency of external resources affect firms’ behavior. Consequently, suppliers are

assigned to a powerful market position and this becomes a highly relevant competitive factor. Suppliers who implement and meet the aforementioned recommendations may not only improve overall sustainability of the FSI, but may also benefit themselves by gaining competitive advantages compared to their competitors. Assuming to be the first supplier offering and supporting sustainable principles, Liebermann and Montgomery (1988) emphasized the advantage of increased performance (First-mover advantage). Further research should also address the reasons why regional or local sourcing are highly preferred by FSI decision makers, given the so-far unclear contribution to sustainability.

A theoretical approach to explain the adoption of regional and local sourcing (and sustainable procurement strategies in general) could be the theory of dynamic capabilities by Teece et al. (1997), demonstrating that the ability of companies to react to environmental change leads to competitive advantages. From a strategic point of view, regional or local sourcing may be more highly valued by consumers, meaning that these measures are expected to provide some competitive advantage. Since the clusters almost do not differ with respect to the perception of barriers, one could conclude that this hints at a potential market failure. This could indicate a need for more research into the functioning and impact of short, local or regional supply chains. In order to overcome the probably most challenging barriers regarding consumers (un)willingness to pay more for sustainable products, more research is needed to identify appropriate ways of communication and of measures to address people's awareness and effects on consumption behaviors, e.g. through nudging (Thaler and Sunstein 2008). Suppliers and companies of the FSI should work together in conducting market research for the promotion of their sustainable principles. Trying to improve supply chain transparency using communication strategies can both help to further collaborate certain sustainability measures and to reduce consumer's suspiciousness and skepticism towards the sustainability of food products.

This also means focusing on those issues which allow for win-win-situations (Porter and Kramer 2006). The low margins achieved in the FSI sector (Friddle et al. 2001), competitive pressures as well as the price orientation of a huge proportion of its customers do not allow any sacrifices by the companies and seem to leave little room for maneuver so far.

A final point and barrier may also be a lack of knowledge, rather negative attitudes or a problematic calculation of the benefit towards difficult-to-grasp trends such as "sustainability" among decision makers, which keeps them from considering more environmental issues in their sourcing choices.

Taking into account the relevance of professionalism as one reason for isomorph firm strategies (DiMaggio and Powell 1983), one could consider introducing sustainability issues more strongly in the curricula of professional education as a useful means for changing decision makers' minds and to at least overcome internal firm barriers.

Sustainability management, of course, is only one challenge that FSI companies are facing. To derive general success factors in the sector, a general approach could be to study the internal processes of learning and problem-solving which is the foundation of dynamic capabilities (Helfat et al. 2007).

References

- Backhaus, K., B. Erichson, W. Plinke, and R. Weiber. 2011. *Multivariate Analysemethoden. Eine anwendungsorientierte Einführung*. 13th edition, Springer Verlag Berlin Heidelberg..
- Baden, D. A., I. A. Harwood, and D. G. Woodward. 2011. The effects of procurement policies on ‘downstream’ corporate social responsibility activity: Content-analytic insights into the views and actions of SME owner-managers. *International Small Business Journal* 29(3):259–277.
- Baldwin, C., N. Wilberforce, and A. Kapur. 2011. Restaurant and food service life cycle assessment and development of a sustainability standard. *International Journal of Life Cycle Assessment* 16(1):40–49.
- Barney, J. 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management* 17(1):99-120.
- Boehlje, M., M. Roucan-Kane and S. Broering. 2011: Future Agribusiness Challenges: Strategic Uncertainty, Innovation and Structural Change. *International Food and Agribusiness Management Review* 14(5):53-82.
- Brindley, C. and L. Oxborrow. 2014. Aligning the sustainable supply chain to green marketing needs: A case study. *Industrial Marketing Management* 43(1):45–55.
<http://dx.doi.org/10.1016/j.indmarman.2013.08.003>.
- BE. 2013. Die Ernährungsindustrie in Zahlen 2013, CREST Verbraucherpanel Deutschland, npdgroup, Bundesvereinigung der Deutschen Ernährungsindustrie (ed.).
- CHD. 2013. GFC: Global Foodservice Classification. <http://chd-expert.com/data-management/foodservice-classification>.
- Ciliberti, F., P. Pontrandolfo and B. Scozzi 2008. Investigating corporate social responsibility in supply chains: a SME perspective. *Journal of Cleaner Production* 16(15):1579–1588.
- Coley, D., M. Howard, M. Winter. 2009. Local food, food miles and carbon emissions: A comparison of farm shop and mass distribution approaches. *Food Policy* 34(2):150-155.
- Conner, D.S., B.T. Izumi, T. Liquori, M.W. Hamm. 2012. Sustainable School Food Procurement in Large K–12 Districts: Prospects for Value Chain Partnerships. *Agricultural and Resource Economics Review* 41(1):100–113.
- Crespin-Mazet, F. and E. Dontenwill. 2012. Sustainable procurement: Building legitimacy in the supply network. *Journal of Purchasing and Supply Management* 18(4):207-217.
- Davies, T. and D.M. Konisky. 2000. Environmental Implications of the Foodservice and Food Retail Industries. Online: *Resources for the Future*. Discussion Paper 00-11.
<http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=17128>.

- DEHOGA. 2012). DEHOGA-Jahrbuch 2012. Gastronomie und Hotellerie in Deutschland. The German Hotel and Catering Association. Berlin. http://www.dehoga-bundesverband.de/fileadmin/Inhaltsbilder/Publikationen/Jahrbuecher/Jahrbuch_DEHOGA_Bundesverband_2012_01.pdf.
- DEHOGA. 2013. DEHOGA-Jahrbuch 2013. Gastronomie und Hotellerie in Deutschland. The German Hotel and Catering Association. Berlin. http://www.dehoga-bundesverband.de/fileadmin/Inhaltsbilder/Publikationen/Jahrbuecher/DEHOGA_Jahrbuch_Final_2013.pdf.
- DGE. 2004a. 21 Minuten mehr Zeit zum Essen - Ergebnisse des Ernährungsberichts 2004, Pressebericht, DGE-aktuell 14/2004, Deutsche Gesellschaft für Ernährung. <http://www.dge.de/modules.php?name=News&file=article&sid=457>.
- DiMaggio, P.J. and W.W. Powell. 1983. The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review* 48 (2):147-160.
- Elkington, J. 1994. Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development. *California Management Review* 36(2): 90-100.
- U.S. Department of Agriculture, Economic Research Service. 2012. Food Service Industry – Market Segments. <http://www.ers.usda.gov/topics/food-markets-prices/food-service-industry/market-segments.aspx>.
- Federal Statistical Office. 2010. Demografischer Wandel führt zu 50% mehr Pflegebedürftigen im Jahr 2050. Pressemitteilung vom 22.11.2010. https://www.destatis.de/DE/PresseService/Presse/Pressemitteilungen/2010/11/PD10_429_224.html.
- Fridle, C.G., S. Mangaraj, J. D. Kinsey. 2001. The food service industry: trends and changing structure in the new millennium. Working Paper 01- 02. The Retail Food Industry Center, University of Minnesota.
- GfK Panel Services. 2009. Essen und Trinken in Deutschland-Salziges vor dem Fernseher - Süßes vorm PC, GfK SE, Corporate Communications, Pressemitteilung, Nürnberg.
- Green Seal. 2013. Green Seal™ Environmental Leadership Standard for Restaurants and Food Service Operations. http://www.greenseal.org/Portals/0/Documents/Standards/GS-46/GS46_one_pager.pdf
- Handfield, R., S.V. Walton, R. Sroufe, and S.A. Melynk. 2002. Applying environmental criteria to supplier assessment: A study in the application of the Analytical Hierarchy Process. *European Journal of Operational Research* 141(1):70–87.
- Helfat, C.E., S. Finkelstein, W. Mitchell, M. Peteraf, H. Singh, D. Teece, S.G. Winter. .2007: Dynamic capabilities: Understanding strategic change in organisations. Carlton, Australia, Blackwell Publishing.

- Herzig, C. and S. Schaltegger. 2009. Wie managen deutsche Unternehmen Nachhaltigkeit? Bekanntheit und Anwendung von Methoden des Nachhaltigkeitsmanagements in den 120 grössten Unternehmen Deutschlands. Centre for Sustainability Management (CSM), Leuphana Universität Lüneburg, Berlin, Lüneburg.
- Lebensmittelzeitung. 2013. Top 30 Systemgastronomie 2013. http://www.lebensmittelzeitung.net/business/daten-fakten/rankings/Top-30-Systemgastronomie-2013_370.html
- Leiserowitz, A.A., R. W. Kates, and T. M. Parris. 2006. Sustainability Values, Attitudes, and Behaviors: A Review of Multinational and Global Trends. *Annual Review of Environment and Resources* 31: 413-444.
- Liebermann, M.B., and D.B. Montgomery. 1988. First-Mover Advantages. *Strategic Management Journal* 9:41-58.
- Marcus, A. A. and A. R. Fremeth. 2009. Green Management Matters Regardless. *Academy of Management Perspectives* 23(3):17–26.
- Mentzer Morrison, R., L. Mancino and J. Variyam. 2011. Will Calorie Labeling in Restaurants Make a Difference? *Amber Waves*. March.
- Mikkola, M. 2009. Shaping professional identity for sustainability. Evidence in Finnish public catering. *Appetite* 53(1):56-65.
- Morgan, K. and R. Sonnino. 2007. Empowering consumers: the creative procurement of school meals in Italy and the UK. *International Journal of Consumer Studies* 31(1):19–25.
- Mundler, P. and L. Rumpus. 2012. The energy efficiency of local food systems: A comparison between different modes of distribution. *Food Policy* 37(3):609–615.
- Npdgroup. 2011. Zahlen, Daten, Fakten. Die aktuelle Branchenbilanz 2011. Npdgroup Deutschland GmbH, Nürnberg. http://www.dehoga-mediathek.de/fileadmin/Mediathek/Aktuelle_Branchenbilanz_Jochen_Pinsker.pdf.
- Nunnally, J. C. 1978. Psychometric Theory. New York: McGraw-Hill.
- Otsuki, K. 2011. Sustainable partnerships for a green economy: A case study of public procurement for home-grown school feeding. *Natural Resources Forum* 35(3):213–222.
- Parfitt, J., M. Barthel and S. Macnaughton. 2010. Food waste within food supply chains: quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society* 365(1554):3065-3081.
- Peterson, H. C. 2009. Transformational supply chains and the ‘wicked problem’ of sustainability: aligning knowledge, innovation, entrepreneurship, and leadership. *Journal on Chain and Network Science* 9(2):71-82.

- Pfeffer, J. and G. R. Salancik. 1978. *The External Control of Organizations: A Resource Dependence Perspective*. New York, NY, Harper and Row.
- Porter, M.E., and M.R. Kramer. 2006. Strategy and Society. The Link between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review* 89(1):1-17.
- Rankin, A., A. W. Gray, M. D. Boehlje, and C. Alexander. 2011. Sustainability strategies in U.S. agribusiness: Understanding key Drivers, objectives, and actions. *International Food and Agribusiness Management Review* 14(4):1-20.
- Raskin, P.D., C. Electris, and R.A. Rosen. 2010. The Century Ahead: Searching for Sustainability. *Sustainability*. 2(8): 2626-2651.
- Revell, A. and R. Blackburn, 2007. The Business Case for Sustainability? An Examination of Small Firms in the UK's Construction and Restaurant Sectors. *Business Strategy and the Environment* 16:404-420.
- Rimington, M., J. C. Smith and R. Hawkins. 2006. Corporate social responsibility and sustainable food procurement. *British Food Journal* 108(10):824-837.
- Rittel, H. W. J. and M. M. Webber. 1973. Dilemmas in a General Theory of Planning. *Policy Sciences* 4(2):155-169.
- Rogge, C.B.E. and T.C. Becker. 2008. Consumer information in the food service industry vs. food retailing. Paper presented at the 12th Congress of the European Association of Agricultural Economics, August, 2008.
- Schaltegger, S., C. Herzig, O. Kleiber, T. Klinke, and J. Mueller. 2007. Nachhaltigkeitsmanagement in Unternehmen. Von der Idee zur Praxis: Managementansätze zur Umsetzung von Corporate Social Responsibility und Corporate Sustainability. Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, econsense - Forum Nachhaltige Entwicklung der Deutschen Wirtschaft e.V., Centre for Sustainability Management (CSM) der Leuphana Universität Lüneburg, Berlin, Lüneburg.
- Schuldt, J.P. and M. Hannahan. 2013. When good deeds leave a bad taste. Negative inferences from ethical food claims. *Appetite* 62 (1):76-83.
- Seuring, S. and M. Mueller. 2008. From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production* 16(15):1699-1710.
- Smith, B.G. 2008. Developing sustainable food supply chains. *Philosophical Transactions of the Society* 363(1492): 849-861.
- Tamhane, A.C. 1979. Comparison of procedures for multiple comparisons of means with unequal variances. *Journal of the American Statistical Association* 74(366):471-480.
- Thaler, R. H. and C. R. Sunstein. 2008. *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press, New Haven.

- Teece, D., G. Pisano and A. Shuen. 1997. Dynamic Capabilities and Strategic Management. *Strategic Management Journal* 18(7):509-533.
- UFS. 2013. Unilever Food Solutions. <http://www.ufs.com/?nr=1>.
- Vermeir, I. and W. Verbeke. 2006. Sustainable Food Consumption: Exploring the Consumer “Attitude – Behavioral Intention” Gap. *Journal of Agricultural and Environmental Ethics* 19(2):169-194.
- Walker, H. and S. Brammer. 2009. Sustainable procurement in the United Kingdom public sector. *Supply Chain Management – An International Journal* 14(2): 128–137.
- Walker, H., L. Di Sisto and D. McBain. 2008. Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing & Supply Management* 14 (1):69–85.
- Wognum, P. M., H. Bremmers, J. H. Trienekens, J. G. A. J van der Vorst and J. M. Bloemhof 2011. Systems for sustainability and transparency of food supply chains – Current status and challenges. *Advanced Engineering Informatics* 25 (1):65–76.
- Young, L.R. and M. Nestle. 2002. The Contribution of Expanding Portion Sizes to the US Obesity Epidemic. *American Journal of Public Health* 92(2):246-249.
- Zander, K., H. Stolz and U. Hamm. 2013. Promising ethical arguments for product differentiation in the organic food sector. A mixed methods research approach. *Appetite* 62(1): 133-142.

Appendix

Table A-I: Overview of the sections and questions in the questionnaire

Section 1: Questions regarding the general understanding of sustainability	
1. Please mention at least three words/ideas which you are spontaneously connecting with sustainability.	Open question
2. How important is sustainability for your company?	Scale from 1 = not important to 5 = very important
3. To what extent do the following statements apply to your understanding of sustainability?	Scale from 1 = does not apply at all to 5 = totally apply
4. How important are the following measures in order to improve sustainable strategies?"	Scale from 1 = not useful at all to 5 = very useful
Section 2: Questions regarding sustainability issues in the procurement management	
1. How important is sustainability for your procurement management?	Scale from 1 = not important to 5 = very important
2. Please rank the following sourcing criteria.	Rank from 1 = most important to 5 = less important
3. How important are the following measures in order to improve sustainable procurement strategies?"	Scale from 1 = non-relevant to 5 = relevant
4. How important is sustainability in different product groups for your company?	Scale from 1 = not important to 5 = very important
5. Which of the following green strategies are adopted and used in your procurement management (divided per product category)?	Binary outcome (yes/no)
6. Which requirements do your suppliers have to fulfill with respect to sustainability?	Scale from 1 = not necessary to 5 = absolutely necessary
Section 3: Questions regarding the adoption of sustainable strategies within the company	
1. How important are the following barriers for sustainability management in your company?"	Scale from 1 = does not play a role at all to 5 = plays a very important role
2. How important are the following drivers for sustainability management in your company?"	Scale from 1 = does not play a role at all to 5 = plays a very important role
3. Are you familiar with the following sustainable programs and standards?	Binary outcome (yes/no)
4. How relevant are the following traditional quality management systems in comparison to sustainable standards?	Scale from 1 = much smaller relevance to 5 = much greater relevance
Section 4: Final questions	
1. Please evaluate the level of sustainability for your company.	Scale from 1 = no sustainable orientation at all to 5 = strong sustainable orientation
2. In comparison to other companies: please evaluate the level of sustainability for your company.	Scale from 1 = less sustainable orientation to 5 = stronger sustainable orientation
3. How important will the sustainability topic be in the future for a) the food service industry and b) your company?	Scale from 1 = not important to 5 = very important
4. Please indicate your willingness to pay an additional charge for sustainable products.	1 = no additional charge, 2 = less than 10 %, 3 = 10-20%, 4 = 20-30 %, 5 = more than 30%
Section 5: General Information concerning the company	
5. Which position do you hold in your company?	Different binary outcomes (yes/no)
6. Which type of company of the FSI do you own/work for?	Different binary outcomes (yes/no)
7. How many sites does your company have?	Open question
8. Please indicate the last annual turnover of your company in Mio €.	Less than 2, less than 10, less than 50, more than 50,
9. Please indicate the number of food supplier (average per site)	Less than 5, 5 to 10, 10 to 15, more than 15

Table A-II. Results of PCA on usefulness of actions for sustainability management

Measures	Mean	SD	Factor 1 “SSCM: regional, seasonal and animal- friendly purchasing”	Factor 2 “Internal measure: resource saving and waste reduction”	Factor 3 “SSCM: Purchasing labelled products”	Factor 4 “Internal measure: meal composition and packaging”
Purchasing regional products	4.57	.618	.802	.184	.199	.161
Purchasing from local and regional suppliers	4.57	.618	.751	.066	.085	.137
Short transportation	4.54	.650	.736	.058	.004	.171
Purchasing seasonal products	4.60	.596	.718	.217	.224	-.010
Purchasing from animal-friendly husbandry	4.41	.753	.701	.198	.262	-.020
Energy saving	4.68	.655	.113	.912	.043	.115
Water saving	4.64	.758	.127	.869	.164	.032
Waste reduction	4.73	.489	.390	.771	-.064	.169
Purchasing fish with sustainability standards (e.g. MSC/QSFP)	4.37	.832	.153	.248	.794	-.091
Purchasing Fair Trade	3.93	1.044	.204	.057	.768	.375
Purchasing organic	3.31	1.133	.227	-.195	.679	.334
Caring for protection of species	4.59	.582	.349	.355	.368	-.334
Increased offer of vegetarian meals	3.53	1.097	.087	.028	-.016	.716
Minimal use of convenience	3.64	1.123	.125	.136	.089	.704
Renouncement on single packaged food items	4.25	1.022	.079	.066	.258	.602
Eigenvalue			4.967	1.978	1.498	1.274
Cronbach's Alpha			.857	.897	.737	.567

Source. Own data

Table A-III. Adopted sustainable actions

	Average Adoption of Sustainable Actions ¹	Relevance for Sustainability ²	Correlation-coefficients ³
Reduction of suppliers	43.0 % (35.484)	3.9 (1.046)	.143
Package waste avoidance	42.5 % (44.432)	4.3 (.999)	.178*
Sustainable fish products	38.1 % (32.919)	4.4 (.812)	.246**
Avoidance of convenience products	37.5 % (33.595)	3.7 (1.106)	.132*
Protection of species	35.6 % (30.675)	4.6 (.636)	.156
Short transport distances	34.5 % (29.803)	4.5 (.689)	.271***
Local producer and suppliers	33.4 % (26.768)	4.5 (.687)	.292***
Animal welfare	33.8 % (33.920)	4.4 (.789)	.255***
Local and regional products	31.6 % (28.791)	4.6 (.648)	-.037
Fair Trade products	27.4 % (35.350)	3.9 (1.056)	.348***
Seasonal products	21.6 % (22.597)	4.6 (.585)	.157*
Organic products	13.3 % (21.574)	3.3 (1.163)	.344***

*p<.10 **p<.05 ***p<.01;

¹ Share of implemented sustainable actions in total number of potential sustainability actions: Mean (Standard deviation)

² “How important are the following measures in order to improve sustainable procurement strategies?” Scale from 1 = nonrelevant to 5 = relevant: Mean (Standard deviation)

³ Correlation between adoption rates and relevance of sustainability

Source. Own data

Table A-IV. Overview of the adoption of green strategies in different product categories

Sustainable Strategy	Meat	Fish	Fruit and Vegetables	Dairy Products	Processed Meat	Coffee	Frozen Food
Reduction of Suppliers	59.2%	37.2%	47.8%	45.1%	39.8%	31.0%	38.9%
Local Suppliers	53.1%	28.3%	62.8%	33.6%	36.3%	6.2%	13.3%
Short Way of Transportation	54.0%	36.3%	47.8%	38.9%	34.5%	10.6%	19.5%
Organic Products	23.0%	7.1%	26.5%	9.7%	10.6%	8.8%	7.1%
Local Products	54.0%	29.2%	56.4%	31.9%	35.4%	6.2%	8.0%
Seasonal Products	28.3%	26.5%	65.5%	8.8%	12.4%	3.5%	6.2%
Avoidance of convenience products	53.1%	42.5%	45.1%	25.7%	31.0%	-	27.4%
Animal Welfare	55.8%	38.1%	-	27.4%	34.5%	-	13.3%
Protection of Species	49.6%	66.4%	-	24.8%	24.8%	-	12.4%
Package waste avoidance	-	-	-	42.5%	45.1%	-	-
Sustainable (certified) fish products	-	60.2%	-	-	-	-	15.9%
Fair Trade-products	-	-	22.1%	-	-	32.7%	-

Source. Own data

Table A-V. Results of PCA on drivers of sustainability management

Measures	Mean	SD	Factor 1 “Internal drivers”	Factor 2 “Market drivers” ^x	Factor 3 “Societal drivers” ^x
Efforts of employees	3.73	1.151	.860	-.010	.009
Exchange of ideas within the company	3.50	1.079	.807	.196	.233
Top Management support	3.80	1.101	.725	.241	.171
Public pressure (stakeholder, NGOs)	2.96	1.174	.029	.863	.051
Competitive pressure	3.29	1.058	.380	.711	.114
Moral considerations	3.56	1.060	.357	-.151	.805
Political regulations or initiatives	3.21	1.058	-.018	.400	.802
Consumer expectations*	3.59	1.094	-	-	-
Eigenvalue			2.891	1.218	1.001
Cronbach's Alpha			0.776	0.577	0.561

Total N = 104 observations

Scale from 1 = Strongly disagree to 5 = Strongly agree

*The item “consumer expectations” was excluded from the factor analysis due to its loading above .5 on both the first and the third factor.

^x Factors 2 and 3 were not retained for further analyses due to the too low CA values.

Source. Own data

Table A-VI. Results of PCA on barriers of actions for sustainability management

Measures	Mean	SD	Factor 1 “Availability/ information problems”	Factor 2 “Insufficient network”	Factor 3 “Price barrier”
Complicated logistics/procurement of local products	3.58	.945	.797	-.198	.201
Unavailability of sustainable products	3.45	.987	.793	-.231	.197
No guarantee of required products	3.43	1.125	.733	.181	.097
Too little product information	3.65	.967	.588	.417	-.014
Little interest of other companies in the same industry	3.34	1.034	.033	.783	-.176
Missing sustainability of producer	3.33	.984	.260	.759	-.026
Missing support of politics	3.59	1.070	.010	.674	.228
Little support of wholesaler	3.40	1.088	.456	.568	-.100
Higher prices for sustainable products	4.24	.785	.037	.015	.851
Consumers low willingness-to-pay	3.94	.988	.209	.192	.744
Financial or organizational barrier	3.92	.825	.111	-.241	.675
Too little information of the producer*	3.44	1.100	-	-	-
Eigenvalue			3.438	2.109	1.212
Cronbach's Alpha			.747	.720	.663

Total N = 103 observations

Scale from 1 = Strongly disagree to 5 = Strongly agree

*The item “Too little information of the producer” was excluded from the factor analysis due to its loading above .5 on both the first and the second factor.

Source. Own data

Table A-VII. Results of PCA on supplier requirements

Measures	Mean	SD	Factor 1 “Sustainable process requirements”	Factor 2 “Sustainable product requirements”
Use of resource saving technologies	4.16	.992	.888	-.020
Energy-efficient transport system	4.17	1.023	.880	.024
Information on the sustainability of the products	4.24	.922	.766	.311
Information on the production process (environmental pollution and social standards)	4.07	.900	.677	.281
Information on ingredients and additives	4.55	.659	.065	.893
Information on provenience of the products	4.44	.713	.184	.875
Information on sustainable measures*	4.15	.873	-	-
Information on sustainable measures of all suppliers along the chain*	4.09	.923	-	-
Eigenvalue			2.986	1.400
Cronbach's Alpha			.836	.762

Total N = 109 observations

Scale from 1 = Strongly disagree to 5 = Strongly agree

*The items “Information on sustainable measures” and “Information on sustainable measures of all suppliers along the chain” were excluded from the factor analysis due to its loading above .5 on both factors.

Source. Own data



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Development and Management of a Bio-Energy Supply Chain Through Contract Farming

Luigi Cembalo[Ⓐ], Stefano Pascucci^ᵇ, Carolina Tagliafierro^ᶜ, and Francesco Caracciolo^ᵈ

^ᵃ *Senior Researcher, Department of Agriculture, Agricultural Economics and Policy Group,
University of Naples Federico II, Via Università 96, 80055 Portici, Naples, Italy*

^ᵇ *Assistant Professor, Management Studies Group,
Wageningen University Hollandseweg 1, 6706KN Wageningen, The Netherlands*

^ᶜ *Junior Researcher, Department of Agriculture, Agricultural Economics and Policy Group,
University of Naples Federico II, Via Università 96, 80055 Portici, Naples, Italy*

^ᵈ *Junior Researcher, Department of Agriculture, Agricultural Economics and Policy Group,
University of Naples Federico II, Via Università 96, 80055 Portici, Naples, Italy*

Abstract

This paper discusses how to develop and manage integration, coordination and cooperation in bio-energy supply chains. Farmers decisions on whether or not to participate in a contract farming scheme have been investigated, particularly assessing the trade-offs between the contract attributes and their impact on the likelihood to participate. A stated preference model was implemented where respondents were asked to choose between alternative contracts with varying attribute levels to start biomass cultivation. Results show that participation is mainly influenced by minimum price guaranteed, contract length, and re-negotiation before the end of a contract.

Keywords: agricultural biomass, cooperation, Choice Modeling, Italy

[Ⓐ]Corresponding author: Tel: + 39 081 2539065

Email: L. Cembalo: cembalo@unina.it

S. Pascucci: stefano.pascucci@wur.nl

C. Tagliafierro: karola_tag@yahoo.it

F. Caracciolo: francesco.caracciolo@unina.it

Introduction

This paper considers the specific case study of contract determinants individual farmers have when engaging in a contract for promoting a bio-energy (biomass production) chain. In particular, it focuses on the issues related to farmer's decision-making process on whether to participate or not in the contract farming scheme. By assessing the likelihood of farmers' participation, the likelihood that a large number of farmers participate in a simultaneous contract is investigated as well. Such sort of cooperation is necessary in order to make the investment profitable for the bio-energy producer company, which requires specific biomass quantities throughout the year. Consequently, a group of farmers needs to agree to be part of the contract farming scheme and set up the bio-energy chain. Using a choice experiment, the farmer's decision making process is explained in terms of trade-offs between the different attributes of the contract farming scheme the farmer is willing to commit or not to it.

Contract farming literature suggests that several attributes may be involved in such decision making process, like: i) base price formula (i.e. the prevailing market price for agro-biomass); ii) a minimum quantity of biomass to be produced each year (measured in hectares invested in biomass); iii) minimum guaranteed price; iv) contract length; v) re-negotiation before the end of a contract; vi) mandatory participation to training and extension programs (Masakure and Henson 2005; Abebe et al. 2013).

Our empirical study has been conducted in the province of Avellino (Southern Italy), in an area characterized by extensive cereal production, such as wheat and barley, where marginal lands are mostly uncultivated, thus potentially available for conversion to bio-mass production and energy cropping. The characteristics and issues in the area are common to many Mediterranean internal regions, which supports the generalizability of the methodology used in this study. In particular, in the study area a public-private-partnership is already taking place to further explore the opportunity to set-up a pilot bio-energy supply chain¹. Two hundreds face-to-face questionnaires have been administered to local farmers in September-November 2013. More specifically, we implemented a stated preference model to investigate farmers' preferences about contract farming. The choice of a stated preference method was necessary because no actual contracting behaviour was available to be observed (Roe et al. 2004). In a choice experiment, based on an efficient experimental design, farmers were asked to choose between alternative contract farming schemes with varying attribute levels in order to start a biomass production. The biomass crop suggested was *Arundo Donax* (also known as *Giant Cane*). The *Arundo* was chosen because of its high biomass productive efficiency, its ability to significantly mitigate soil erosion risk (it is a multi-year crop) and its capacity to yield an income comparable to wheat. To the best of our knowledge, this is one of the few applications of this methodology to farmers' preferences towards contract farming in bio-energy supply chain (Lajili et al. 1997; Abebe et al. 2013).

¹ Promotion and Development of an bio-energy supply chain in partnership with industrial actors funded by European Regional Development Fund (PON): "Integrated agro-industrial chains with energy efficiency for the development of eco-compatible processes of energy and bio-chemical production for renewable sources for the land valorization (ENERBIOCHEM)".

Facilitating Participation in Contract Farming

Farmers' participation in bio-energy supply chains has been widely discussed (Pellerin and Taylor 2008; Altman et al. 2013). Another important aspect widely debated both in the academic and in the managerial and political context is the conflict between bio-energy production and food security (Seuring and Muller 2008; Negash and Swinnen 2013). Bio-fuels production often requires use of the most fertile and productive areas, thus creating direct competition between energy and food/feed crops (Cicia et al. 2012; Negash and Swinnen 2013). However, if energy crops, especially for bio-mass production, are located on marginal land, they can integrate and complement conventional food/feed crop production rather than conflicting with it (Caracciolo and Lombardi 2012).

Energy crop cultivation always requires the set up and management of integrated and coordinated supply chains, in order to secure the energy company the critical mass for the plant to operate efficiently. It is in the energy company's interest to design supply chain arrangements such that a large group of suppliers (farmers) has convenience to deliver their production. This is a crucial point as, while the process of designing such arrangements is complex and costly, the increasing general interest in sustainable sources of energy is an incentive for energy producers to address the issue of how to foster and manage integration and coordination along the chain (Seuring and Muller 2008).

By chain integration and coordination we mean a process of progressive dependence among different actors, that involves common investments, coordination of activities, and processes of learning and innovation (Handfield and Nichols 1999; Hugos 2003). While all chains are based on agreements between two or more actors, the bio-energy supply chain shows the peculiar feature of the simultaneous focus on integrating and coordinating the bio-energy producer (buying company) and the farmers (suppliers), and stimulating cooperation among farmers. Contract farming is often used to manage integration, coordination and cooperation because it provides flexibility in the way incentives can be set for different typologies of suppliers, thus increasing the chances of large participation (Abebe et al. 2013).

Integration through cooperation is not a new topic in the studies of sustainable use of the natural resources in bio-energy supply chain (van Dam et al. 2010; Scarlat and Dallemand 2011). However how to combine contractual aspects between the buying company and the group of suppliers remains difficult to address (Meinzen-Dick et al. 2004). The role of inter-firm collaboration and contract design results to be a priority in this respect. In particular, it is relevant to further investigate how a contract farming approach can support the development and management of bio-energy supply chains in which a group of farmers needs to (simultaneously) collaborate with an energy-producer company.

To address these issues, a contract design to foster the participation in bio-energy supply chain can move from the following principles: (i) the characteristics of the cooperation problem (i.e. property rights on resources) are well-defined; (ii) the characteristics of the group (i.e. size and heterogeneity) are controlled; (iii) the level of institutional formalization (e.g. type of participation contract) is kept as limited as possible in order to gain benefits from the flexibility ensured by the informal component of the collaborative behavior; (iv) know-how and technology

is shared and finally (v) actions of national governments and other external actors should be supportive of the cooperative process, not corrupting the mechanism towards a too individualized or formalized (bureaucratic) process (Ostrom et al. 1999). Subsequently, to successfully organize a bio-energy supply chain, it is a key element to design a participation contract that takes those principles into account but through individual farmer-based decisions.

In designing the contract, the first element to consider is the price mechanism introduced by the contract and whether a minimum price is guaranteed or not (Roe et al. 2004; Schlecht and Spiller 2012). Also, because participation in the contract farming creates mutual dependency, defining the length of the contract and whether renegotiation is an option is another important element (Roe et al. 2004; Schlecht and Spiller 2012; Abebe et al. 2013). To ensure know-how and technology sharing it is often needed to provide an extension service attached to participation decision (Abebe et al. 2013). Finally, seeking economies of scale requires the definition of a minimum volume of product to be delivered by the farmer (Schlecht and Spiller 2012).

Data and the Study Area

Moving from these considerations, we designed a choice experiment for a sample of farmers in a rural area of South Italy to assess their preferences for contract farming and predict their likelihood to participate in a bio-energy supply chain. Data were collected through the administration of a questionnaire with face-to-face interviews. The study area covered several municipalities of the Avellino province, Campania region, some 150 km east of Naples. This area well represents the typical conditions of Southern Italian internal regions. It is characterized by mild continental weather and cultivation of cereals and forage crops, sometimes associated with dairy or animal rearing activities. Bio-energy producers are increasingly interested in investing in such areas, where conditions are naturally optimal for bio-energy crops while conventional crops often bring low productivity and high risk of soil erosion.

The aim of the investigation was to investigate farmers (stated) preferences for participation in contract farming. Following established practice in choice experiment literature (Louviere et al. 2000; Hensher et al. 2005), we designed the survey questionnaire through an iterative process, taking indications from different stages of the study and taking into account the specific objectives of our research. The questionnaire was organized in three sections.

In order to collect all the information we needed, while keeping the questionnaire short, we introduced the socio-demographic questions in the first section of the questionnaire, adding some more questions on the farm structure and organization and using these questions to “warm up” the interviewee and introduce him/her to the topic of our research. The objective was to outline the type or types of entrepreneur and farm in our sample and collect information on their behavior to better interpret and understand their choices in the questionnaire choice scenarios.

In the central section of the questionnaire respondents made their choice for contract attributes which were determined through an experimental design approach. We opted for four choice sets each with two alternatives (see Table 1). Each alternative represented a contract, constructed as a combination of different levels of the selected attributes. For each choice scenario, the interviewee was asked to choose the most preferred contract or to choose none of them. The

scenarios were introduced with a detailed description of biomass cultivation, specifically the *Giant Cane*, the set-up of the bio-energy chain in the study area, the need of a contract with several farmers in order to provide the bio-energy plant with sufficient and constant raw materials. The selected attributes, that in different level combinations formed the different contract types offered in the choice tasks, were carefully described so that respondents could make an informed choice. The choice scenarios were finally introduced and the cards with the alternative contracts showed to the respondents, highlighting that they represented realistic contract types a bio-energy producer company could propose to the local farmers.

Table 1. Selected attributes and levels of proposed contracts

Attributes	Levels definition	Range
Base Price	Current market price plus or minus a flat amount for marketing premium or fees: values are randomly generated from a normal distribution	from 38€ to 51€ per tons.
Minimum guaranteed price	Presence (1) or absence (0) of a minimum price: values are randomly generated from a binomial distribution.	0 or 1.
Length	Discrete values are randomly generated from an uniform distribution in the 3-10 years interval	from 3 to 10 years
Renegotiation option	Presence (1) or absence (0) of an option to renegotiate the contract terms: values are randomly generated from a binomial distribution.	0 or 1.
Training meeting	Presence (1) or absence (0) of mandatory participation to training meetings: values are randomly generated from a binomial distribution.	0 or 1.
Minimum volume of product	Presence (1) or absence (0) of minimum volume of product to be guaranteed: values are randomly generated from a binomial distribution	0 or 1.

The face-to-face survey administration in the study case area provided 200 complete questionnaires². Based on the data collected by the first section of the questionnaire (summarized in Table 2), in our sample farm managers are mostly male (61%), aged in average 43, full time farmers and owner of the land they cultivate. The sample farms cover an area of 4,092 ha, of which 3,706 ha are cultivated. Farm size is quite variable in the sample, as it goes from a minimum of 1.5 ha to a maximum of 340 ha, however the most frequent size (sample mode) is 20 ha.

Farms are generally fragmented in parcels, varying from a minimum of 1 up to 30 parcels, with an average number of parcels per farm of six. Arable crops, mostly wheat, are clearly predominant in the sample farms (93% of the total cultivated land). Only a very small share of the land is left for olive trees, industrial crops and grapevine. Due to erosion and landslides, along with steep slope, in 30% of the sampled farms part of the arable land is now abandoned,

² Two professional interviewers with agro-technological background and a long experience of the study area have been recruited for the field survey. Interviewees have been selected from a list of farm managers who have expressed interest to local extension services to be involved in the bio-energy pilot project.

some 4% of the overall farm land under investigation. This area represents the most suitable part of the farms to be converted into energy crops.

Table 2. Farmers and farms characteristics

Description		Mean	Std.dev	Min	Max
Gender	1 if male; 0 female	61%	N.A.	0	1
Age	(year)	43.2	11.76	18	80
Farm size	Total area of sample farms (ha)	20.5	26.66	1.5	340
Total cultivated area	Total cultivated area of sample farms (ha)	18.6	23.52	1	300
Full time farmer	1 if full time; 0 otherwise	77%	N.A.	0	1
Individual farmers	1 if individual; 0 otherwise	96%	N.A.	0	1
Number of land parcels		6		1	30
Land ownership	<i>Property</i>	72%	N.A.	0	1
	<i>Rent</i>	26%	N.A.	0	1
	<i>Other</i>	2%	N.A.	0	1
Crops	<i>Arable crops (ha)</i>	16.7	21.91	0.5	280
	<i>Permanent crops (ha)</i>	0.6	1.14	0	9

Note. N.A: not applicable

Part of the survey was orientated to investigate the propensity of farm managers to change and their openness to innovation and investment. This is a crucial aspect to be considered in the assessment of the preference and propensity of those farm managers to adopt energy crops and to participate in contract farming with an energy producer company. Table 3 summarizes main results. About 70% of farm managers have invested in new equipment or new processing systems or have bought more land during the past five years. Much less (46%) have introduced some innovation in the cropping systems, techniques and organization of the farm.

Table 3. Investments and innovation in the past five years* (number of farmers and their %)

	Value	Percentage
Investments in the last 5 years:	139	70%
Machines	119	60%
New constructions	66	33%
Processing and packaging	6	3%
Marketing	11	6%
Land acquisition	83	42%
Other	1	1%
Innovations in the last 5 years:	91	46%
Cropping system changes	35	18%
Cropping techniques changes	9	5%
Organization changes	64	32%

Note. *The number of investments and innovations is greater than the number of the farms as some farms have adopted more than one.

Moreover we have investigated farm managers experience and propensity to cooperate. As showed in Table 4, cooperation is not particularly common in the sample. Although more than half of the sample (56%) is aware of the presence of some forms of cooperation in the area, only 32% of the farmer managers declared to have participated already in one of them. Cooperation is mainly experienced in marketing activities, to control production uncertainty, to secure a minimum price and the access to markets (Table 4). Farmers that participate to different forms of cooperation are generally younger (40 years-old) than the average age of the sample (43) and the size of the farm is bigger (25.58 ha) than the average size of the sample (20.46 ha). The most common form of contract they are involved with (68%) is informal and one-year long.

Table 4. Presence of forms of cooperation in the area and participation

	Value	Percentage
Forms of cooperation in the area:	111	56%
Informal contracts	66	33%
Cooperatives and trademarks	40	20%
Supply chain contracts and guaranteed minimum price	2	1%
Participation in cooperation activities:	64	32%
Cooperation on the production side *	16	8%
Cooperation on the marketing side **	48	24%

Note. * Technical assistance, supply of production inputs and raw materials, transfer of technological innovations

** Product marketing, minimum price guarantee, less uncertainty in product allocation, access to markets

Empirical Strategy

The empirical strategy we used has roots in the random utility framework (McFadden 2001) that is widely used in economics studies for analyzing consumer preferences (Cembalo et al. 2008; Verneau et al. 2014). It has been proposed for the first time by Roe et al. (2004) for contract attributes analysis.

The model assumes that when a number C of contract alternatives is showed to the h -th farmer, the utility assigned by the farmer to each c contract alternative is a linear, additive and separable function of all the t attributes that constitutes the contract:

$$(1) \quad U_c^h = f(\mathbf{z}_c) + \varepsilon_c^h$$

where \mathbf{z}_c is a T -vector of observed attributes. The chosen alternative c represents the outcome of an "expected utility" maximization exercise of the farmer. To put it differently, the choice of the contract c will provide the farmer with the highest utility; in analytical terms, $U_c^h \geq U_k^h$, with the alternative $k \in C$ and $k \neq c$.

Thus, in order to maximize his/her utility, the farmer is assumed to choose the contract alternative with the most desired set of attributes \mathbf{z}_c . The probability of the farmer choosing contract c across the set of all possible alternatives C is defined by the probability that the utility of alternative c is greater than, or equal to, the utility related to each other alternative within the set of contracts:

$$(2) \quad \Pr(U_c^h) = \Pr\{U_c^h > \max(U_k^h, \dots, U_c^h)\}$$

The random utility model considers utility U_c equal to the sum of an observable component Ωz_c , where Ω is a T -vector of unknown parameters, and a stochastic component ε_c :

$$(3) \quad U_c^h = \Omega z_c + \varepsilon_c^h.$$

The Ω parameters can be distributed in the sample according to a distribution function defined by a location (μ) and a scale (σ) parameter:

$$(4) \quad U_c^h = \Omega^h z_c + \varepsilon_c^h$$

where $\Omega^h = \Omega + v^h$, $v^h \sim N(0, \Sigma_{\Omega}^h)$ ³.

If the random term is assumed to have a type I extreme value distribution, then a logistic regression can be adopted to estimate Ω or Ω^h parameters and their weight in affecting the choice of one contract over another (McFadden 2001). Thus, estimated coefficients (Ω or Ω^h) provide an explicit indication of overall farmers preferences toward each level of the proposed contract attributes.

In our experiment, four choice tasks, each with two randomly selected alternatives, were presented to respondents. Each contract alternative represents a different combination of levels for the T attributes (Table. 5). Six attributes were selected based on a preliminary focus group with key stakeholders and include: base price, minimum guaranteed price, contract length, renegotiation option, extension service, minimum volume of product requirement.

The base price (45€) was defined reflecting current market conditions for biomass resources from agricultural residues plus or minus a fixed amount randomly generated from a normal distribution with mean €0 and standard deviation 2€ (approximated to the closest integer). The final price was reported in the card. Given the length of the economic life of the *Arundo*, the duration of the contract was established to vary between 3 and 10 years, with each value randomly chosen from a uniform distribution.

Contracts could include the presence or absence of the minimum guaranteed price for farmers (guaranteed price at which given quantities are to be purchased by the buyer) and the presence or absence of the renegotiation option (all parties could discuss future contract adjustments to changing market conditions). Contract alternatives could also differ for the presence or absence of mandatory participation to training meetings (four hours per year), provided by the buyer to keep farmers up-to-date on cultivation practices, and for the presence or absence of a minimum guaranteed product quantity by farmers for the buyer.

³ The combined error term ($v^h z_c + \varepsilon_c^h$) is correlated across alternatives, relaxing the IIA assumption.

The random nature of combining levels values populate the matrix \mathbf{z}_c characterizing the c -th contract. Matrix \mathbf{z}_c thus includes 1600 profiles of contracts (789 of them unique), submitted in 4 choice tasks to the 200 farmers. The Ω parameters can be estimated with the maximum likelihood estimator for logit model (Amemiya 1985), using maximum simulated likelihood methods (Train 2009).

Table 5. Attributes and levels of contracts

Attributes	Levels Definition	Average	Std.dev	Min	Max
Base Price	Current market price plus or minus a flat amount for marketing premium or fees: values are randomly generated from a normal distribution	44.55	1.97	38	51
Minimum guaranteed price	Presence (1) or absence (0) of a minimum price: values are randomly generated from a binomial distribution.	0.50	N.A	0	1
Length	Discrete values are randomly generated from an uniform distribution in the 3-10 years interval	6.45	2.32	3	10
Renegotiation option	Presence (1) or absence (0) of an option to renegotiate the contract terms: values are randomly generated from a binomial distribution.	0.50	N.A	0	1
Training meeting	Presence (1) or absence (0) of mandatory participation to training meetings: values are randomly generated from a binomial distribution.	0.50	N.A	0	1
Minimum volume of product	Presence (1) or absence (0) of minimum volume of product to be guaranteed: values are randomly generated from a binomial distribution	0.50	N.A	0	1

Note. N.A: not applicable

Results and Discussion

Data on farmers' responses to the choice tasks have been analyzed with fixed parameters ($v^h = 0$) and random parameters logit models. Results are reported in Table 6.

According to the fixed parameters logit (upper part of the Table), the only contract attribute farmers have not considered in their choices is the mandatory requirements for a minimum guaranteed product volume. The coefficient is indeed not statistically significant (coefficient estimate 0.11, z-value 1.18). We interpret this outcome as a tendency to avoid "locked-in" position, in which farmers are obliged to deliver to the buying company even in case of insufficient production. The model also provides statistical evidence that farmers clearly prefer

higher base price but also a shorter contract length, the presence of a minimum guaranteed price and both the presence of the renegotiation option and the training meetings.

From these results, some indications, in monetary terms, can be obtained on the trade-off farmers have made between the t -th contract attribute and the base price ($\Omega_t/\Omega_{\text{baseprice}}$, in the fifth column of Table 6). The minimum guaranteed price gains the highest price premium, estimated equal to €10.3 per ton of production. Price premium for the training meetings is valued equal to €3.2 per ton of production, while the price premium for the presence of renegotiation option is €9.3 per ton of production. Adding an extra year to the contract length is considered by farmers a price loss of €1.3 per ton of production.

The influence of the contract characteristics on the farmer's likelihood to join the contracts can be assessed calculating the cumulative distribution function of $\Pr(U_c) = \Pr\{U_c > \max(U_k, \dots, U_C)\}$ by varying the level values of matrix \mathbf{z}_c .

Farmer's likelihood to join is positively related with the base price and negatively with the contract length; the two patterns differ greatly in overall appearance (Figure 1). The presence or the absence in the contract of the minimum guaranteed price shifts the overall pattern of the previously examined relations. For example, Figure 2 shows how the curve linking base price with the probability of choosing the c -th contract is much higher when the minimum guaranteed price term is present in the contract.

Table 6. Fixed parameter and Random parameter results

Fixed parameter	Coef.	Std. Err.	z	P>z	Euros equivalent (€/tonn.)
Base Price	0.08	0.03	2.27	0.023	
Minimum guaranteed price	0.81	0.10	8.36	0.000	10.3
Contract Length	-0.10	0.03	-3.21	0.001	-1.3
Renegotiation option	0.73	0.10	7.49	0.000	9.3
Training meetings	0.25	0.10	2.65	0.008	3.2
Minimum volume of product	0.11	0.09	1.18	0.239	
Random parameter	μ	Std. Err.	z	P>z	
Base Price	0.09	1.03	-3.08	0.002	
Minimum guaranteed price	1.27	0.22	5.73	0.000	
Contract Length	-0.15	0.06	-2.73	0.006	
Renegotiation option	1.14	0.21	5.31	0.000	
Training meetings	0.42	0.15	2.83	0.005	
Minimum volume of product	0.12	0.14	0.84	0.402	
	σ	Std. Err.	z	P>z	
Base Price	1.20	0.58	-2.07	0.039	
Minimum guaranteed price	1.06	0.29	3.62	0.000	
Contract Length	0.26	0.10	2.6	0.009	
Training meetings	1.26	0.31	4.08	0.000	

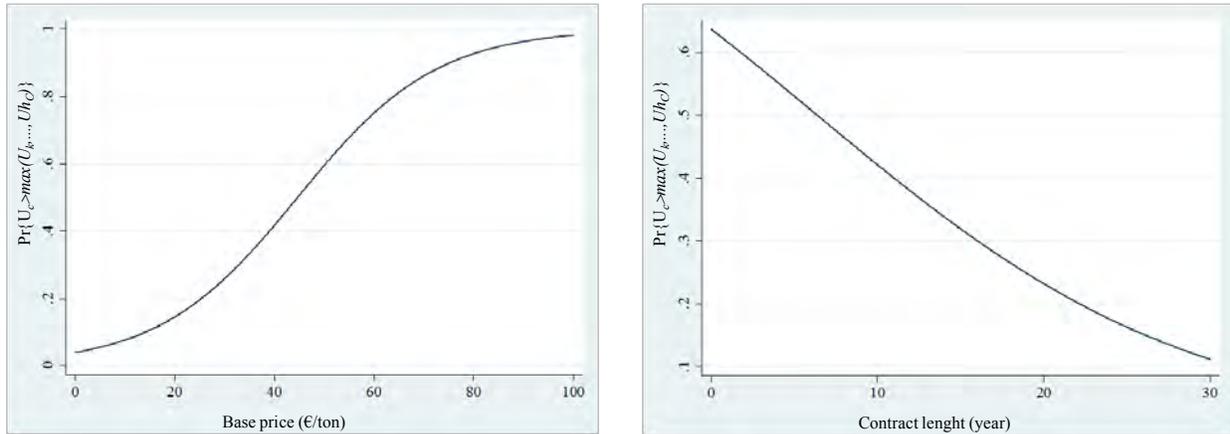


Figure 1. The influence of base price and contract length on the probability of choosing the *c*-th contract.

Note. c.d.f are calculated by maintaining constant (at the sample mean) the values of the other contract characteristics.

The data analysis with a random parameter model reveals that some of the considered attributes vary stochastically in the sample. We assume that they follow a Gaussian distribution, except the base price, which is assumed to follow a log-normal distribution that assures only strictly positive values (Figure 3). Thus, the distribution function for each of these attributes can be estimated using the position (μ) and scale (σ) parameter.



Figure 2. The influence of presence or absence of minimum guaranteed price on the probability of choosing the *c*-th contract

Note. c.d.f are calculated by maintaining constant (at the sample mean) the values of the other contract characteristics.

From Figure 3 it is evident that preference heterogeneity toward each attribute is a major characteristic in our farmers' sample. The higher be the heterogeneity of preferences, the greater will be the difficulties in establishing a consensus among farmers on a specific contract farming scheme, suggesting that "personalized" contract schemes are likely to be needed. Nevertheless, estimating the cumulative function at 0, it results that the whole sample, at varying intensity, prefers the presence of the training meetings; shorter contracts are appreciated by the 96.7 per cent of the sample, while only a negligible fraction of the population (1.1 per cent) do not like the presence of the minimum guaranteed price.

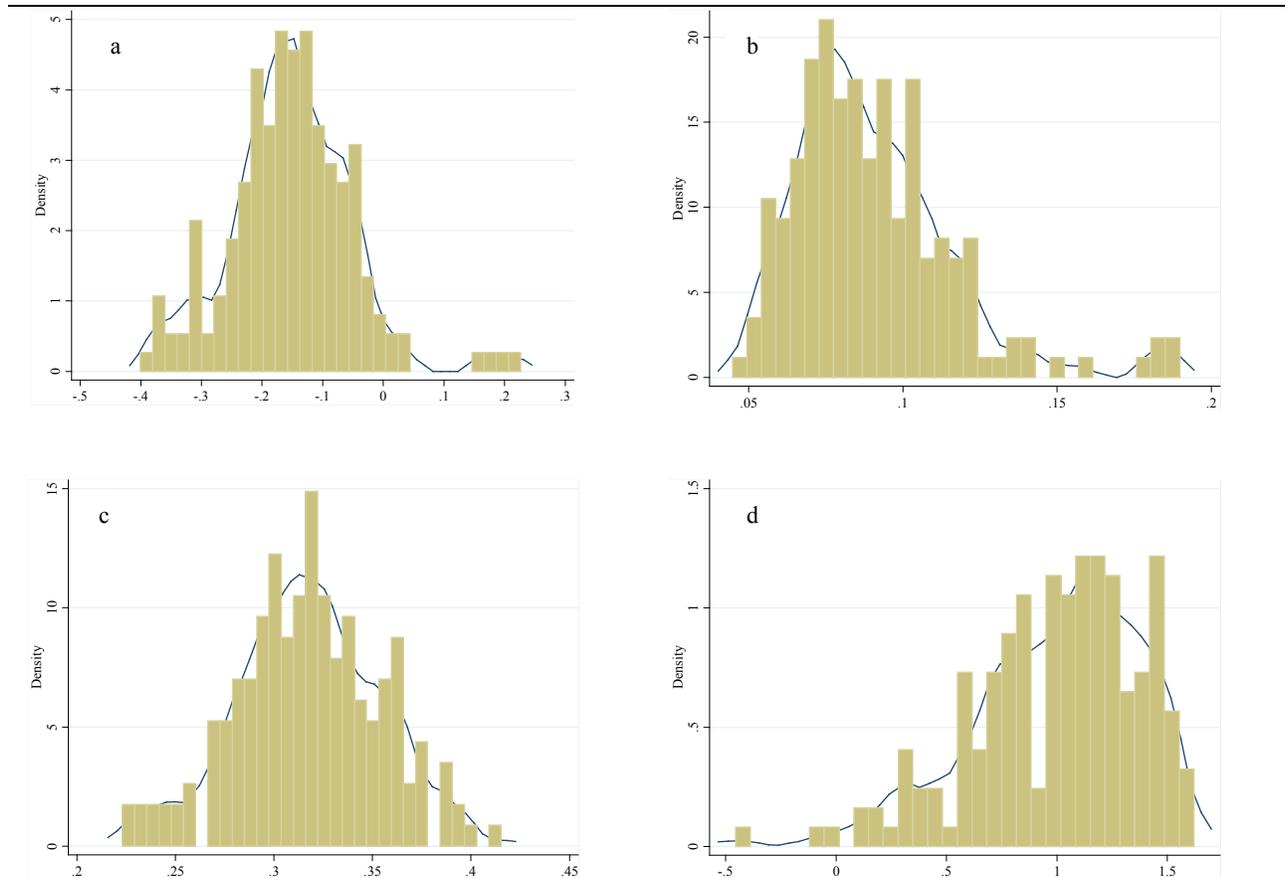


Figure 3. Heterogeneity of parameters concerning contract length (a), base price (b), training meeting (c), and minimum price guaranteed (d).

The correlation matrix of estimated parameters shows an inverse correlation between the base price and both the training meeting and minimum guaranteed price, and a positive correlation between the minimum guaranteed price and the contract length (Table 7).

Table 7. Correlation matrix of estimated parameters

	Renegotiation option	Contract length	Minimum guaranteed price	Training meetings	Base price
Renegotiation option	1.000				
Contract Length	0.041	1.000			
Minimum guaranteed price	-0.036	0.086***	1.000		
Training meetings	-0.005	-0.026	0.003	1.000	
Base Price	0.013	0.037	- 0.140***	-0.093***	1.000

After the respondents went through the contract choice scenarios, stating their choice for each of them, in the debriefing section of the questionnaire they were questioned about the motivations of such choices. Three different sets of debriefing questions were designed, depending on the respondent's choices: a) choice of no contract for all the four choice tasks; b) choice of one contract for each of the four choice tasks; c) choice of at least one contract over the four choice tasks. A 5 score-based Likert scale was used to help the respondent express the level of agreement between the provided statement and their own motivations.

Depending on the choices stated in the four choice tasks they were presented with, respondents can be grouped in three groups. 47% of respondents have chosen at least a contract over all the shown contracts. Slightly less respondents (46%) have chosen a contract alternative for each of the four choice tasks. Finally, only 8% of the sample has not chosen any of the proposed contracts over the four choice sets. The first two groups, where respondents have expressed their choice for some contract alternatives, gather most farmers that have made investments in their farm in the last five years. In particular, the group of respondents that have chosen at least a contract shows a higher propensity to investments (82%) than the sample average (70%) and more openness to participate in multiple or single contracts (43% compared to 32% sample average). Responses to the debriefing questions shed a light on the motivations of their choice in terms of contracts.

Table 8 focuses on the responses of the first group. For each statement, respondents were asked to assign a score to state the intensity of the agreement between their real motivations and the statement, from 1 ("Does not reflect at all") to 5 (Does reflect perfectly"). In the Table, the percentages are reported from the scores of respondents for each statement.

Adding up the percentage of respondents that assigned scores 4 and 5 (agreement with the statement), the most important motivation for choosing to join a bioenergy supply chain contract is the opportunity it represents to create and foster a new cooperation and collaborative environment in the area, among the local farmers (statement (d) 88% of group respondents).

Much importance in affecting the choice is assigned to the positive environmental effects of the introduction of biomass cultivation, in particular in terms of soil quality (statement (f) 79% or group respondents). Respondents trust the local farmers and their potential to make the bio-energy supply chain successful (statement (e) 47%). The motivation for not choosing some contracts is their duration, considered to be too long (statement (b) 64% of group respondents). Consistently with their responses, they are willing to convert some of their cultivated land to biomass. This amounts to 20% of their land, corresponding to 3.97 ha in average per farmer.

Table 8. Motivations for respondents that have chosen at least one contract

Statement		Does not reflect at all → Reflects perfectly				
		1	2	3	4	5
Some contracts are in favor of the bioenergy company	a	0.09	0.25	0.4	0.18	0.07
Some contracts last too long	b	0.07	0.06	0.22	0.43	0.21
Some contracts do not provide enough incentive to change cropping system	c	0.08	0.21	0.42	0.16	0.13
Support to supply chain contracts to foster cooperation among fellow farmers	d	0.01	0.05	0.05	0.28	0.6
Trust in fellow farmers to abide by contract terms	e	0.05	0.18	0.29	0.29	0.18
Environmental benefits of <i>Arundo</i> on soil	f	0.02	0.04	0.15	0.27	0.52

The second group of respondents (46%) has chosen a contract for each of the four proposed scenarios. Also for respondents of this group (Table 9) the most important reason to accept and join contracts are the benefits in terms of collaboration and cooperation they would promote in the area among the local farmers (statement (d) 80%), as well as the environmental benefits the *Giant Cane* would provide to the soil of the area (statement (e) 74%). Their choice is supported by the perception that the contracts look favorable and pose no major problem (statement (c) 61%) and by the trust in the local farmers (statement (b) 56%). Then, they consider the *Arundo* a valid alternative for the area and their farm (statement (a) 51%). However, they are likely to convert less to the biomass cultivations, 16% of their cultivated land, in average 3.3 ha per farmer.

Table 9. Motivations for respondents that have chosen one contract for each choice set

Statement		Does not reflect at all → Reflects perfectly				
		1	2	3	4	5
<i>Arundo</i> is a valid alternative for the area and the farm	a	0.04	0.07	0.36	0.29	0.22
Trust in fellow farmers to abide by contract terms	b	0.04	0.15	0.25	0.33	0.24
Favorable contracts that can be fulfilled	c	0.01	0.08	0.30	0.34	0.27
Support to supply chain contracts to foster cooperation among fellow farmers	d	0.03	0.02	0.15	0.24	0.56
Environmental benefits of <i>Arundo</i> on soil	e	0.03	0.03	0.19	0.27	0.47

The last and smallest group comprises respondents that have not chosen any of the proposed contracts from the 4 choice set. They represent only the 8% of the whole sample. It is interesting to note that farmers in this group are older (53 years-old) than the sample average and the previous two groups (42 and 43) and are less full time farmers. They own generally smaller farms (mean 11.91 ha) and have invested or innovated less than the average sample in the last five years. They show a low level of participation to any cooperation with other farmers, limited to mainly informal relationships.

The motivations for their refusal towards all the proposed contracts is mainly economic (Table 10). No contract is chosen as none is sufficiently convenient to be considered (statement (a) 75% of the group respondents). The biomass cultivation, then, the way it is proposed in the contracts, does not represent an interesting option for their farm (statement (b) 63%): they do not feel to have enough skills to start it (60% of the group respondents) and it seems too risky (60%), subsequently they would not replace with biomass any of the existing crops in their farms (50%). No proposed price is convenient enough to promote the change (statement (g), 56%) and the local farmers are not reliable to create a successful supply chain (statement (f) 56%).

Table 10. Motivations for respondents that have chosen no contract in any choice set

Statement		Does not reflect at all → Reflects perfectly				
		1	2	3	4	5
No contract is convenient	a	0.13	0.00	0.13	0.31	0.44
Biomass not a valid option for the farm	b	0.13	0.06	0.19	0.06	0.56
Contracts last too long	c	0.19	0.00	0.56	0.19	0.06
Contracts favor the bioenergy company	d	0.06	0.13	0.63	0.00	0.19
Bioenergy company could get too much power	e	0.06	0.00	0.50	0.19	0.25
Distrust in local farmers to abide by contract terms	f	0.06	0.00	0.38	0.25	0.31
No price is convenient enough for changing	g	0.13	0.00	0.31	0.06	0.50

Conclusions

Energy producer companies are increasingly focusing on bio-mass production to diversify their activities and move into the sustainable energy sector. In Italy as well as in many other countries these companies need often to deal with many small bio-mass producers and to engineer bio-energy supply chains almost from scratch. In this respect, it becomes relevant to understand the key elements that can help design effective supply chain mechanisms, in particular how to develop and manage integration, coordination and cooperation along the chain.

This is the focus of this paper. It concerns the analysis of farmers' preferences towards different contract attributes, with the aim of identifying those attributes that would promote farmers' participation in a bio-energy supply chain through cooperation. In our study area, engineering novel supply chain is particularly needed for farmers in order to support their income, diversify their production from cereals and convert marginal areas, often affected by soil erosion hazard, into productive areas.

We propose the adoption of biomass crop such as the *Arundo Donax* (also known as *Giant Cane*). It ensures high biomass productive efficiency, shows a significant ability to mitigate soil erosion risk and, based on the prominent biomass market price, can provide revenue comparable to wheat.

The analysis considers the attributes of a contract farming scheme and investigates the monetary trade-offs farmers are likely to make. In particular, six contract attributes are considered on the

base of focus group indications: base price, minimum guaranteed price, contract length, renegotiation option, extension service, minimum volume of product requirement.

Our results seem to highlight that cooperation among farmers can be enhanced by contract farming if effective contract attributes are proposed to them. Indeed, the decision of a farmer to participate in a supply chain is based on considerations regarding his/her own economic pay-off, but also on the characteristics (attributes) of the contract proposed by the buyer (i.e. the bio-energy producer company). Moreover it is needed to identify contract attributes that maximize the likelihood to cooperate. In other words, a cooperation in a bio-energy supply chain context implies that one farmer decision is not independent from what other farmers do.

Of all the considered contract attributes, only “mandatory requirements of product volume to be guaranteed to buyers” does not contribute to the choice of whether to accept the proposed contract farming scheme or not. If we consider the trade-off, in monetary terms, of the other four attributes with the base price, minimum guaranteed price and renegotiation option are valued significantly higher than contract length and training meetings. In particular, the analysis of trade-offs between contract attributes suggests that using a “minimum price guarantee” approach is an effective solution: on one hand it reduces the “cost of the contract” for the energy company and on the other hand it reduces the negative effect of a long-term contract duration. Thus by proposing a minimum price guarantee energy producer company can at the same time reduce the price offered for the bio-mass, offer longer contracts and get higher rate of farmers participation. Farmers can benefit from a less risky contractual scheme and operate investments in bio-mass production in a long-term perspective. Also the possibility to re-negotiate contract terms works in the same direction.

From a managerial point of view, our results indicate that conditions for a contract farming approach, aiming at building a bio-energy supply chain in the study area, do exist. This is not a trivial outcome since introducing contract farming schemes in this area arises complex issues, related to the combination of the individual and social dimension of the decision-making process. For instance, our results point out that it is key to take into account individual differences for contract attributes. While company managers may prefer more standardized contracts, empirical evidence seems to indicate that more “profiled” and “personalized” contract schemes need to be introduced. However, very personalized contract conditions may be risky for the buying company and costly to manage. Different conditions may lead farmers to make comparison and induce them to complain for potentially unfair treatments. Eventually, this may lead farmers to dis-trust the buying company, thus hampering motivations to act collectively.

Further research is needed in this field of inquiry. First, our study does not explore contract attributes in detail. The way the proposed attributes take form in a formal contract could make the difference. Second, we need to explore farmers’ preferences for the same attributes but in alternative arrangements, for example when a contract is offered via a producers’ organization instead of individual farmers. Third, we investigated an area in many ways representative of marginal rural areas where the opportunity costs of capitals are quite low. External validity of this study in areas with higher opportunity costs is poor. Finally, continued improvements in the experimental approaches used to gauge contract choice is warranted.

Acknowledgements

This research received grant from the European Regional Development Fund (PON): "Integrated agro-industrial chains with energy efficiency for the development of eco-compatible processes of energy and bio-chemical production for renewable sources for the land valorization (ENERBIOCHEM)".

Stefano Pascucci was kindly supported by the COMPETE research project funded by the European Union's Seventh Framework Programme (Contract No 312029).

References

- Abebe, G., K. Bijman, J. Kemp, R. Omta and O. A. Tsegaye. 2013. Contract farming configuration: Smallholders' preferences for contract design attributes. *Food Policy* 40: 14-24.
- Agrawal, A. 2001. Common property institutions and sustainable governance of resources. *World Development* 29 (10): 1649–1672.
- Altman, I., J. Bergtold, D.R. Sanders and T. G. Johnson. 2013. Market development of biomass industries. *Agribusiness* 29 (4): 486-496.
- Amemiya, T., 1985. *Advanced Econometrics*. Harvard University Press.
- Baland, J.M., and J.P. Platteau. 1996. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* Oxford University Press, New York.
- Caracciolo, F. and P. Lombardi. 2012. A new-institutional framework to explore the trade-off between agriculture, environment and landscape. *Economics and Policy of Energy and the Environment* 3:135-154.
- Cembalo, L., G. Cicia, T. Del Giudice, R. Scarpa and C. Tagliafierro. 2008. Beyond Agropiracy: The case of Italian pasta in the United States retail market. *Agribusiness* 24 (3): 403-413.
- Cicia, G., L. Cembalo, T. Del Giudice and A. Palladino. 2012. Fossil energy versus nuclear, wind, solar and agricultural biomass: Insights from an Italian national survey. *Energy Policy* 42:59-66.
- Conklin, J. 2006. *Wicked problems and social complexity*. J. Conklin (Ed.), Dialogue mapping: building shared understanding of wicked problems (Chapter 1), Wiley, New York.
- Freeman, R.E., 2010. *Strategic management: A stakeholder approach*. Cambridge University Press.
- Handfield, R.B. and E.L. Nichols. 1999. *Introduction to supply chain management*. New Jersey: Prentice - Hall.

- Hensher, D.A., J.M. Rose and W.H. Greene. 2005. *Applied Choice Analysis. A Primer*. Cambridge University Press, Cambridge.
- Hugos, M. 2003. *Essentials of supply chain management*. John Wiley and Sons.
- Lajili, K., P.J. Barry, S.T. Sonka and J.T. Mahoney. 1997. Farmers' Preferences for Crop Contracts. *Journal of Agricultural and Resource Economics* 22 (2): 264–280.
- Louviere, J.J., D.A. Hensher, and J.D. Swait. 2000. *Stated Choice Methods. Analysis and Applications*. Cambridge University Press, Cambridge.
- McFadden, D. 2001. Economic Choices. *American Economic Review* 91 (3): 351–378.
- Meinzen-Dick, R., M. Di Gregorio, and N. McCarthy. 2004. Methods for studying collective action in rural development. *Agricultural Systems* 82 (3): 197-214.
- Negash, M. and J. F. Swinnen, 2013. Biofuels and food security: Micro-evidence from Ethiopia. *Energy Policy* 61: 963-976.
- Ostrom, L., J. Burger, C.B. Field, R. Norgaard, and D. Policansky. 1999. Revisiting the Commons: Local Lessons, Global Challenges. *Science* 284 (5412): 278-282.
- Pellerin, W., and D.W. Taylor. 2008. Measuring the bio-based economy: a Canadian perspective. *Industrial Biotechnology* 4(4): 363-366.
- Rasmussen, L., and R. Meinzen-Dick. 1995. Local Organizations for Natural Resource Management: Lessons from Theoretical and Empirical Literature. *IFPRI Environment and Production Technology Division Discussion Paper 11*. International Food Policy Research Institute, Washington, DC.
- Rittel, H.W., and M.M. Webber. 1973. Dilemmas in a general theory of planning. *Policy Sciences* 4 (2): 155-169.
- Roe, B., T.L. Sporleder, and B. Belleville. 2004. Hog producer preferences for marketing contract attributes. *American Journal of Agricultural Economics* 86 (1): 115–123.
- Scarlat, N., and J.F. Dallemand. 2011. Recent developments of biofuels/bioenergy sustainability certification: A global overview. *Energy Policy* 39 (3): 1630-1646.
- Schlecht, S., and A. Spiller. 2012. A Latent Class Cluster Analysis of Farmers' Attitudes Towards Contract Design in the Dairy Industry. *Agribusiness* 28 (2): 121-134.
- Seuring, S., and M. Muller. 2008. From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production* 16 (15): 1699-1710.
- Train, K. 2009. *Discrete choice methods with simulation*. Cambridge University Press. Cambridge MA (US).

- Verneau, F., F. Caracciolo, A. Coppola, and P. Lombardi. 2014. Consumer fears and familiarity of processed food. The value of information provided by the FTNS. *Appetite* 73:140-146.
- van Dam, J., M. Juginger, and A.P.C. Faaij. 2010. From the global efforts on certification of bioenergy towards an integrated approach based on sustainable land use planning. *Renewable and Sustainable Energy Reviews* 14 (9):



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Agricultural Supply Management and Antitrust in the United States System of Agribusiness

Yuliya Bolotova

*Assistant Professor of Agribusiness, School of Agricultural, Forest, and Environmental Sciences
236 McAdams Hall, Clemson University, Clemson, South Carolina, USA*

Abstract

During the last decade organizations of agricultural producers in the U.S. used a supply management practice, which included some form of production restrictions. The purpose of using it is to control the level of supply in order to ensure a fair level of returns to agricultural producers. A practice of using production restrictions has recently raised a lot of concerns among industry participants, lawyers and antitrust law enforcers in the U.S. The plaintiffs in a number of recent and on-going private antitrust lawsuits allege that agricultural production restrictions violate the Sherman Antitrust Act (1890). The article identifies and analyzes key legal and economic issues relevant to the nature and performance of agricultural supply management programs in the United States.

Keywords: agricultural production restrictions, antitrust, cartels, dairy industry, market power, potato industry, supply management.

^①Corresponding author: Tel: +1.864. 656.4079

Email: Y. Bolotova: yuliyab@clemson.edu

Introduction

The organizations of agricultural producers in the United States (i.e. agricultural cooperatives, associations, federations, etc.) have used a variety of supply management strategies/programs affecting production and marketing of agricultural products. These strategies vary from affecting the quantity of agricultural commodities produced to managing marketed product shipment patterns. The joint (collective) activities of individual agricultural producers implemented through their organizations are possible due to the Capper-Volstead Act (1922). This Act provides a *limited* antitrust exemption from the Sherman Antitrust Act (1890), which in general prohibits the joint activities of competitors aiming to restrict the amount of output and/or to increase/fix the level of output price.

During the last decade organizations of agricultural producers in a number of industries in the United States (dairy, potatoes, eggs, mushrooms) used a supply management practice, which included some form of production restrictions (limitations). The purpose of using it is to control the level of supply with the purpose of obtaining a fair level of returns to agricultural producers. In the modern agribusiness environment, this practice allows agricultural producers to mitigate the adverse effects of a number of market forces affecting their profitability, such as over-supply of agricultural commodities, increasing agricultural input and output price volatility, and increasing exposure to the volatility of international agricultural commodity markets and to increased competition from these markets. The “supply management programs” typically include a number of programs, some of them affect production and some of them affect agricultural product marketing.

For example, the U.S. dairy industry developed and implemented a herd retirement program used to remove the entire milking herds of selected dairy farmers from the production. The export assistance program was used to divert cheese and butter to export markets. The U.S. potato industry developed and implemented a potato acreage management program used to control the number of fresh potato acres planted. In addition, the potato industry implemented the potato flow control program affected the fresh potato product shipment throughout the marketing year. Both the dairy and potato industry supply management programs were funded through the assessments from participating producers.

The organizations of agricultural producers (cooperatives) played the key role in developing and implementing the supply management programs in dairy and potato industries. They designed the programs and developed the detailed guidelines on their implementation. From the perspective of agricultural producers and their organizations, the desirable economic effects of this type of programs are higher and less volatile prices received by agricultural producers. The economic effects of these supply management programs were noticed on the national level (USDA Rural Development Rural Cooperatives: March/April 2005).

A practice of using production restrictions as an element of agricultural supply management by the organizations of agricultural producers has recently raised a lot of concerns among industry participants, lawyers and antitrust law enforcers in the United States (Varney 2010, Frackman and O'Rourke 2011, Hibner 2011, Manning and Welle 2012). The plaintiffs (direct and indirect

buyers) in a number of recent and on-going private antitrust lawsuits allege that agricultural production restrictions violate the Sherman Antitrust Act (1890)¹.

The issue to be decided during these legal proceedings is whether production restrictions are protected by the Capper-Volstead Act. The outcomes of these litigations will have important implications for the design of supply management practices as well as related production, marketing and pricing strategies of the organizations of agricultural producers and individual agricultural producers in all agricultural commodity markets. Furthermore, the antitrust enforcement agencies, U.S. Department of Justice and U.S. Federal Trade Commission, rely on the case law in their antitrust enforcement efforts.

The objective of this research is to identify and analyze the key legal and economic issues relevant to the nature and performance of agricultural supply management programs, with a particular focus on agricultural production restrictions (limitations). The analyzed agricultural supply management programs are private industry-funded and administered programs, which involve no government participation. Very little research can be found which analyses the current nature, design, performance and market effects of supply management programs in agricultural markets or examines relevant competition and antitrust law issues. This analysis aims to provide useful information for agricultural and agribusiness decision-makers, policy-makers, agricultural and antitrust law practitioners and research scholars working in this area.

The article is organized as follows. First, an overview of the economics of joint conduct of agricultural producers through their organizations and its legal foundation, the Capper-Volstead Act (1922), is presented. Second, the most recent experience of implementing supply management programs by the organizations of agricultural producers in the U.S. dairy and potato industries is described. The economic forces leading to the idea of supply management in these industries, the design of the supply management programs and the available empirical evidence on their market effects are discussed. The dairy and potato industries are selected for the analysis because information on their supply management programs is available from public sources. Third, the current debate on the legal status of agricultural supply management practices and production restrictions is presented. The article concludes with a discussion of business and policy implications of the uncertainty currently surrounding the legal status of agricultural supply management practices (production restrictions).

The Economics of Agricultural Supply Management and its Legal Foundation

Legal Foundation for the Joint Conduct of Agricultural Producers

The joint activities of agricultural producers implemented through their organizations can be characterized as cartel agreements. A cartel is a group of firms, otherwise competitors, who join together for the purpose of controlling the amount of output supplied to the market and/or market price². The joint activities of competitors aiming to restrict output and/or to control market price

¹ A number of the most recent antitrust lawsuits is listed in References section of the manuscript.

² Cartels can be either private or public. In the latter case, a government participates in organizing and monitoring cartel activities or the government can be a part of the cartel agreement. Cartels can be either legal or illegal

are illegal *per se* under the U.S. antitrust law. Section 1 of the Sherman Antitrust Act (1890) prohibits contracts, combinations and conspiracies in restraint of trade. Price-fixing and output control agreements are considered to be the most damaging to market practices, because their typical market effects are a decrease in output quantity supplied to the market, an increase in price paid by consumers and a deadweight loss.

Many joint activities of agricultural producers, which might affect output prices and quantities, would potentially be subject to Section 1 of the Sherman Act, because agricultural producers are competitors. The Capper-Volstead Act (1922) provides a *limited* antitrust immunity to the joint activities of agricultural producers implemented through their organizations³. Section 1 defines in general terms the scope of activities protected by the Act⁴. In particular, “*persons engaged in the production of agricultural products...may act together in associations... in collectively processing, preparing for market, handling and marketing ...such products*”. These associations are allowed to form marketing agencies in common and to make necessary contracts and agreements to achieve their objectives.

Section 2 of the Capper-Volstead Act is concerned with potential market power that may result from activities allowed by Section 1. The concerned conduct is monopolization and restraint of trade that lead to unduly enhanced prices. Section 2 authorizes the Secretary of Agriculture to issue a cease and desist order, if he has a reason to believe that an organization of agricultural producers monopolizes and restraints trade to such extent that the price of agricultural commodity is unduly enhanced. Section 2 has virtually never been enforced.

The case law performs the major role in interpreting the Capper-Volstead Act. While the existing case law in general provides a well-developed guidance on how to interpret the purpose and scope of the Act, there is some uncertainty relating to the scope of conduct (activities) immune. Given that a potential range of activities of the organizations of agricultural producers that may be protected by the Capper-Volstead Act is very broad, the alleged practices (conduct) are subject to interpretation by courts on a case-by-case basis.

Price-fixing practices of the organizations of agricultural producers, a type of activities considered to be illegal *per se* in other industries, fall within the Capper-Volstead Act protection. Some of the actions on withholding already produced volume of agricultural commodities from the market might be immune. Acquiring large market shares by growth in membership and forming associations of cooperatives are legal. However, gaining market power by using

depending on the antitrust law regime in a particular country. For a comprehensive survey of cartels operating in different periods of history, the nature of their practices and the market effects of these practices, see Connor (2007) and Bolotova et al. (2007).

³ The Congressional intent in passing the Capper-Volstead Act was to equalize the market position of agricultural producers with the market position of the middlemen. In particular, the objective was to give agricultural producers additional market power so they could compete effectively in the market place and could earn additional income by capturing the middlemen returns. Some of the desired market effects of the Capper-Volstead Act were higher prices received by agricultural producers and lower food prices paid by final consumers. For a comprehensive discussion of the Capper-Volstead Act see Jesse et al. (1982) and USDA Rural Business Cooperative Service (2002).

⁴ Section 1 also sets criterions that have to be met for the organizations of agricultural producers to be protected by the Act.

predatory means, exclusionary practices, boycotts and similar conduct are not exempt by the Capper-Volstead Act⁵.

The legal status of various supply management practices, including production restrictions (production limitations or production control), is currently the most controversial issue on the proper interpretation of the scope of activities protected by the Capper-Volstead Act. First, Section 1 does not explicitly mention “supply management” and/or “production restrictions”. Second, there is no well-developed case law interpreting the legal status of various supply management practices. Plaintiffs (direct and indirect buyers) in a number of recent and on-going private antitrust lawsuits challenge the legal status of agricultural supply management practices, and in particular, the legal status of production restrictions, which will be discussed later in the article in greater details.

*The Economics of Joint Conduct of Agricultural Producers:
Agricultural Output Control Practices: Supply Management and Production Restrictions*

Agricultural markets are traditionally characterized as markets with perfectly competitive structures. There are many agricultural producers, and each of them produces the amount of output which is small relative to the total industry output. Agricultural producers are price-takers, who individually do not have any control over the market price. However, in light of the entire industry, the total amount of agricultural output supplied to the market each year/season is pre-determined, and market price is a function of the output quantity. In other words, agricultural producers representing the entire industry face inverse demand. Given this nature of demand, agricultural producers representing a single industry, as a group, could attempt to control the output quantity produced and supplied to the market each year, and consequently they can affect to some extent the level of output price that they receive.

The joint production and marketing decisions, corresponding conduct of agricultural producers, and market effects of this conduct could be analyzed using the profit-maximization models of firms with the seller market power (oligopoly and monopoly)⁶. The most traditional economic model used in applied antitrust analysis is the one based on the assumptions of a linear inverse demand and a constant marginal cost. Figure 1 depicts the profit-maximizing price-quantity combinations corresponding to a perfectly competitive and a monopolistic scenarios, two extremes within which the seller market power is analyzed⁷.

The Lerner Index of market power (L) measures the degree of the seller market power, which reflects the firms' (industry) ability to increase output price relative to marginal cost. $L = (P -$

⁵ See USDA Rural Business Cooperative Service (2002) for a comprehensive analysis of the activities protected by the Capper-Volstead Act and related case law.

⁶ There is a variety of these models, which differ in terms of complexity and key assumptions (linear or non-linear demand, assumptions on the marginal cost curve, static or dynamic, etc.). Standard microeconomics and industrial organization text-books discuss these models and related economics concepts; for example, see Besanko and Braeutigam (2002) and Carlton and Perloff (2004). A discussion of selected economic models and concepts for the purpose of antitrust analysis is presented in Carlton and Perloff (2004) and Hovenkamp (1994).

⁷ Under monopoly, marginal revenue (MR) curve is twice as steep as inverse demand curve (D). The monopoly profit is maximized at $MR=MC$.

$MC)/P$, where P is output price and MC is marginal cost. The Lerner Index of market power is equal to 0 under perfect competition, and it is equal to 37.7% under monopoly (in the market scenarios depicted in Figure 1). The oligopoly Lerner Index would be greater than 0 but smaller than 37.7%.

The organizations of agricultural producers implementing supply management practices, in particular, production restrictions, act as cartels or oligopolies, who have market power over the output price. The supply management (production restrictions), if effectively implemented, can help increase the output price level relative to marginal cost. As a result, the seller market power (i.e. the Lerner Index or mark-up) increases in comparison with the market scenario without the supply management (production restrictions). The antitrust law enforcers are concerned with the effects that the output control practices have on the level of market price. An output reduction leads to two adverse market effects: an increase in the market price imposed on consumers (buyers) and a dead-weight loss (Figure 1).

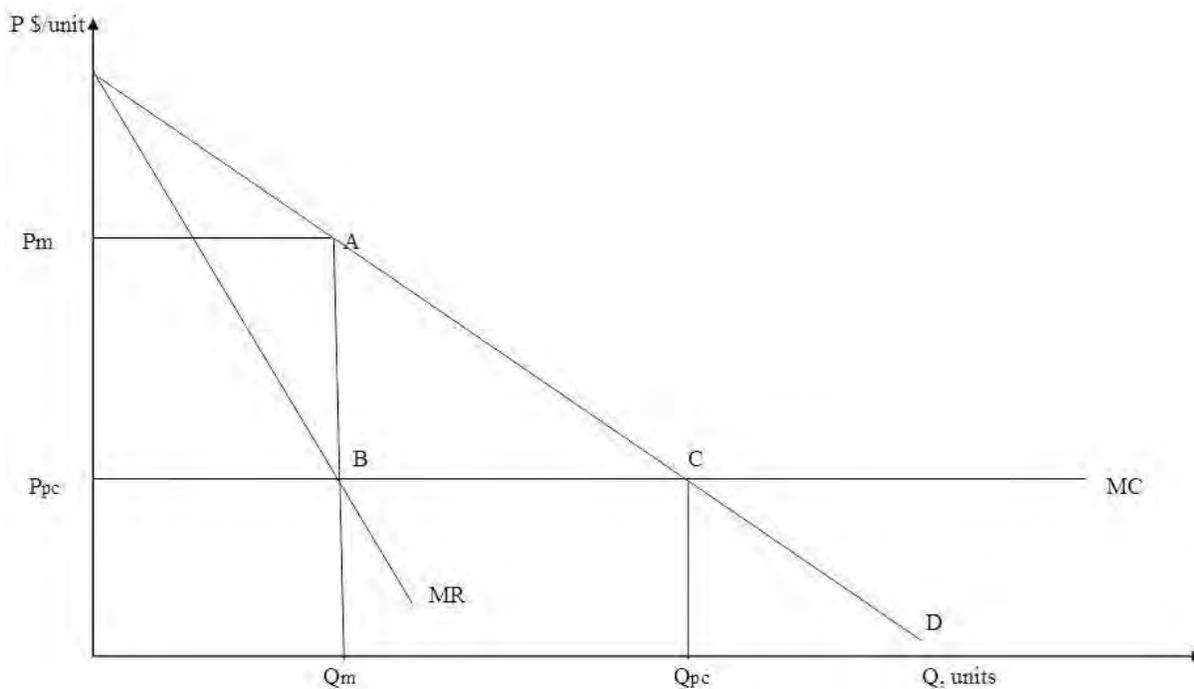


Figure 1. Perfectly Competitive (Q_{pc} ; P_{pc}) and Monopoly (Q_m ; P_m) Equilibriums.

Note. Triangle ABC is a deadweight loss due to monopoly market power. Rectangle $P_{pc}P_mAB$ is a monopoly overcharge. Trapezoid $P_{pc}P_mAC$ is a reduction in the consumer surplus due to monopoly power.

The market price increase due to the exercise of market power (in this article, due to the joint conduct of competitors) is also referred to as overcharge or damage. The actual imposed price increase is affected by a number of factors that can be identified using the Lerner Index formulas from more comprehensive models explaining the profit-maximizing behavior of firms with the seller market power. Table 1 presents formulas for Lerner Index corresponding to a perfectly competitive market and markets with the seller market power: oligopoly, monopoly or cartel with a competitive fringe, and monopoly.

Table 1. Lerner Index in market structures with the seller market power.

Market Structure	Profit-Maximizing First Order Condition MR=MC	Lerner Index: $L = \frac{P - MC}{P}$
Perfect competition (N =many)	$P = MC$	$L = 0$
Oligopoly (N =few)	$P \times (1 + \frac{\theta_i}{\epsilon_{Q,P}}) = MC_i$	<p><i>For a single firm</i></p> $L_i = \frac{P - MC_i}{P} = - \frac{\theta_i}{\epsilon_{Q,P}}$ <p><i>For the industry</i></p> $L = \sum_{i=1}^N s_i \times \frac{s_i}{\epsilon_{Q,P}} = \frac{1}{\epsilon_{Q,P}} \times \sum_{i=1}^N s_i^2 = \frac{HHI}{\epsilon_{Q,P}}$
Monopoly/Cartel with competitive fringe ($N=1$ +fringe)		$L = - \frac{1}{\frac{Q}{Q_{cartel}} \times \epsilon_{Q,P} + \frac{Q_{fringe}}{Q_{cartel}} \times \epsilon_f}$
Monopoly ($N=1$)	$P \times (1 + \frac{1}{\epsilon_{Q,P}}) = MC$	$L = \frac{P - MC}{P} = - \frac{1}{\epsilon_{Q,P}}$

HHI is Herfindahl–Hirschman Index: $HHI = \sum_{i=1}^N s_i^2$. N is the number of firms in the industry.

$\epsilon_{Q,P}$ is the industry demand elasticity: $\epsilon_{Q,P} = \frac{dQ}{dP} \times \frac{Q}{P}$. ϵ_f is the elasticity of competitive

fringe supply: $\epsilon_f = \frac{dQ_f}{dP} \times \frac{P}{Q_f}$.

An analysis of these formulas indicates that the Lerner Index (output price increase) can be generally related to: (1) the number of market (cartel) participants (-), (2) the market share of a group of firms with market power (cartel) (+), (3) the size inequality among market (cartel) participants (-), (4) the industry demand elasticity (-), and (5) the industry competitive fringe⁸ supply elasticity (-), if the competitive fringe firms are present in the industry. The plus and minus signs in the parentheses indicate either a positive or negative relationship of the factor to the Lerner Index magnitude⁹.

⁸ In the case of agricultural cooperatives and in the context of this article, non-members represent competitive fringe. Some of them may choose to comply with the programs of the cooperatives (without being formal members), and some of them may undermine the effectiveness of the programs by either producing more or selling at a lower price.

⁹ For a more detailed discussion of factors influencing the magnitude of cartel overcharges see Bolotova (2006) and Bolotova (2009).

The results of this analysis are in line with hypotheses (predictions) of the theory of oligopoly (Stigler 1964), which has traditionally been used to analyze cartels, their conduct and market effects of this conduct. According to this theory, factors contributing to cartel success (i.e. ability to impose a price increase) can be classified in two groups. The first group includes market structural characteristics that facilitate effective collusion: the homogeneity of product and purchasing commitments, a high level of market concentration, a small number of sellers, inelastic demand and high barriers to entry.

Based on the theory predictions, classic cartels are typically formed in oligopolistic markets with a relatively small number of firms. Theoretically, oligopolists joining cartel can manage to act as a single monopolist to achieve a monopolistic price level. However, the mere presence of market structural characteristics is not sufficient for cartel success. The costs of organizing and enforcing cartel agreements represent the major obstacle in achieving the monopoly price level.

Consequently, the second group of factors contributing to cartel success includes factors relating to developing an effective cartel agreement and its enforcement mechanism (policy). This represents a real challenge for cartel participants and involves substantial costs. Each cartel member seeks to maximize his own profit and always has incentives to deviate from the agreement (it is often referred to as an opportunistic behavior or a cheating problem). Furthermore, cartels have to deal with non-members, who create a free-riding problem and can destroy the cartel efforts.

The main differences between the organizations of agricultural producers implementing supply management (production control) and classic cartels are the type of market structure, including the number of participants and barriers to entry, and legal status. As compared to classic cartels, which are organized in industries with oligopolistic market structures, where there is a relatively small number of firms and high barriers to entry, the organizations of agricultural producers are organized in industries with perfectly competitive structures, where there are many firms (agricultural producers) and relatively low barriers to entry.

The type of market structure is a major determinant affecting the success of the implementation of output control strategy and the ability to increase market price. As the number of cartel participants increases, the degree of their seller market power (i.e. price increase) decreases. Furthermore, a large number of agricultural producers makes it more difficult to develop and especially to effectively enforce the output control strategy. Despite the fact that some agricultural cooperatives have large market shares, which theoretically contributes to cartel success, a large membership represents a real challenge in developing and enforcing their agreements (programs).

In agricultural industries, large market shares of the organizations of agricultural producers are not likely to be reflected in a significant degree of market power, as compared to other industries. Assuming that agricultural producers can legally implement some form of agricultural supply (output) control, they are much less likely to be effective in imposing a sustainable price increase, in terms of both the magnitude and duration. A large number of agricultural producers, low barriers to entry, a presence of producers-non-members, and the size inequality among agricultural producers would make achieving a sustainable price increase more difficult. This

may suggest that the size of damage (overcharge) from agricultural supply control is likely to be lower than the damage imposed by classic cartels using a similar output control strategy, though acting illegally.

Supply Management in the United States Dairy and Potato Industries

This section discusses supply management programs implemented in the U.S. dairy and potato industries in the 2000s. The focus of this discussion is on economic forces leading to the decision of agricultural producers to implement supply management programs, the design of supply management programs and their enforcement procedures. Available empirical evidence on the market (price) effects of these programs is also discussed.

U.S. Dairy Industry and Cooperatives Working Together (CWT) Supply Management Program

The U.S. dairy industry implemented two government-sponsored voluntary supply management programs in the 1980s to address the over-supply problem and increasing volatility of milk prices: Milk Diversion Program (1984) and Dairy Termination Program (1986 and 1987). The U.S. Congress authorized these programs, and they were funded partially through the dairy producer assessments and partially through the government funds¹⁰.

The supply management program developed and implemented during the period of 2003-2010 was the first *private*, industry-funded and administered program. There was no government participation involved, and the participation of dairy producers was voluntarily. The program was initiated by the National Milk Producers Federation (NMPF), a trade association of dairy cooperatives. It was implemented through the Cooperatives Working Together (CWT), which encompassed dairy producers and their cooperatives throughout the country. Participating dairy producers marketed on average 70% of the national milk supply.

The objective of the CWT supply management program was to balance milk supply with milk demand and to stabilize the level of prices received by dairy farmers in order to obtain a satisfactory level of farm-level milk price¹¹. The CWT supply management program was developed in response to a number of economic forces adversely affecting the dairy farm profitability: over-supply of raw milk; increasing over time volatility of milk prices received by dairy farmers; an increasing level and volatility of agricultural input prices, in particular, feed prices; a substantial decrease in the government milk price support; and increasing exposure of domestic dairy industry to fluctuations taking place in international dairy markets.

The CWT supply management included a herd retirement program, a dairy export assistance program and a milk production reduction incentives program. The herd retirement program was the major of these three programs. The purpose of this program was to remove from production

¹⁰ Gale (1990), Dixon et al. (1991) and Brown et al. (2010) discuss the nature of these programs and their economic effects. A general conclusion is that these programs were more likely to have some short-term positive effects and no long-term effects.

¹¹ The nature and design of the CWT supply management program are discussed in Parkinson (2008), Siebert and Lyford (2009), Brown et al. (2010) and McCay (2011).

the entire milking herds of selected dairy farmers. The dairy export assistance program allocated subsidies to participating dairy cooperatives on exports of butter and cheese. The milk production reduction program was implemented once at the very beginning; there was a lack of support from dairy producers for this program.

During the period of 2003-2009, CWT held 9 herd retirement rounds, during which entire herds of selected number of dairy farms were removed from the production. To make a decision on whether to conduct a herd retirement round and the scale of the round, the CWT used the guidelines that included a number of economic indicators characterizing the industry conditions, such as the all-milk price¹², milk production cost, milk-feed price ratio, and cow numbers, among others.

During each herd retirement round, participating dairy producers had to submit their bids on how much money they were willing to accept in order to slaughter their entire milking herds. The CWT selected the bids that they were willing to accept. The producers of accepted bids were required to slaughter their entire herds during 15 days after the audit process of their production was completed. The CWT supply management program was funded through the assessments of participating dairy producers. Approximately 90% of the funds was allocated to the herd retirement program. The originally introduced in July 2003 assessment was \$0.05/cwt¹³; it increased to \$0.10/cwt in July 2006.

The available empirical evidence on the market (price) effects of the CWT supply management program includes estimated milk price increases. According to Brown (2009), the estimated all-milk price increase due to CWT program ranges from \$0.22/cwt in 2004 to \$1.54/cwt in 2009, with the average of \$0.67/cwt increase (2004-2008). The largest share of the magnitude of these price increases are due to the herd retirement program. For example, while in 2008 CWT increased all-milk price by \$0.87/cwt, the herd retirement program contributed \$0.78/cwt, and the export assistance program added \$0.09/cwt to the reported price increase.

The estimated all-milk price increases due to the herd retirement program reported by McCay (2011: Table 9) depend on the assumption on the elasticity of milk demand. Under the assumption of the demand elasticity equal to -0.1, the estimated short-run returns are in the range of \$0.21/cwt (2009, 4th quarter) to \$0.62/cwt (2009, 2nd quarter). If the demand elasticity is assumed to be -0.8, the estimated short-run returns are in the range of \$0.03/cwt (2003, 4th quarter; 2008, 3rd quarter; 2009, 4th quarter) to \$0.08/cwt (2009, 2nd quarter). As milk demand becomes less elastic, the price increase effect becomes stronger.

¹² In the United States, the Federal and State Milk Marketing Orders set the minimum prices that the first-level handlers (milk processors) have to pay to dairy farmers for raw milk (regulated pricing). This system uses classified milk pricing and pooling principles. Raw milk is priced according to its use defined by four milk classes (FMMOs). Class I milk is milk used in manufacturing of fluid (beverage) milk products (whole milk, reduced-fat milk, etc.). Class II, III and IV milk is used in manufactured dairy products (ice-cream, cheese, butter, etc.); this milk is often referred to as manufacturing milk. The receipts from milk processors are pooled within the orders and distributed among farmers based on the milk utilization rate in each milk class. Dairy farmers within the same Order receive the same "all-milk" price. The overview of FMMOs milk pricing is presented in Manchester (1983), Manchester and Blayney (1997, 2001 and 2004) and Brown et al. (2010).

¹³ "Cwt" is one hundredweight (100 pounds).

The milk price increases due to the herd retirement program reported in Parkinson (2008: Table 4) depend on the assumptions on the demand elasticities for manufacturing milk and fluid milk and the ratio of these two uses of milk. Assuming the average demand elasticities for manufacturing milk and fluid milk are -0.29 and -0.14 respectively, and the ratio of milk going in these two uses is 2:1 (consequently, the weighted average elasticity is -0.24), the estimated average nation-wide milk price increase is \$0.36/cwt (a 2.63% price increase). If the weighted average demand elasticity for milk ranges from -0.17 to -0.31, the estimated milk price increase ranges from \$0.51/cwt (a 3.71% price increase) to \$0.28/cwt (a 2.03% price increase).

The reviewed studies emphasized that the CWT herd retirement program was likely to have a stronger short-run positive effect than a long-run effect. Some of the problems in effective implementation of the program include the following. First, the nature of animal reproduction process and improvements in genetics mitigate the effective impact of the supply reduction on market price. Second, a “free-riding” problem represents a great challenge and is difficult to address. There are dairy producers who benefit from higher milk prices without participating in the program by paying assessments. Furthermore, these producers have incentives to expand their herds in response to favorable (increasing) milk prices.

U.S. Potato Industry and United Potato Growers of America (UPGA) Potato Supply Management

The U.S. potato industry followed the dairy industry experience. A potato supply management program was developed and implemented in order to mitigate a similar to the dairy industry economic conditions adversely affecting the profitability of potato growers. This program was a private, industry-funded and administered program and involved no government participation. The idea of potato supply management originated in Idaho, the leading potato producing state in the country. The United Fresh Potato Growers of Idaho (UFPGI), a marketing cooperative of fresh potato growers, was organized in the fall of 2004, and the first potato supply management program was implemented in the spring of 2005.

Originally the UFPGI represented 85% of fresh potato growers in Idaho. Shortly, processing and seed potato growers joined the cooperative. A national level cooperative, the United Potato Growers of America (UPGA), was organized in March 2005. UPGA originally represented 70% of fresh Russet potato growers in the country. The UPGA became a coordinating mechanism for a newly created system of regional cooperatives of potato growers with similar objectives, which were joined by Canadian potato growers.

The objective of the potato supply management program was to stabilize the potato supply in order to provide a fair level of returns to potato growers. The program was expected to help mitigate the adverse effects of the over-supply of fresh potatoes, a low level and high volatility of fresh potato prices received by potato growers, increasing level and volatility of potato production costs, and increasing competition from Canadian potatoes. The combination of these economic forces adversely affected the profitability of potato producers and caused frequent financial situations when the returns received by potato growers did not cover their potato production costs.

The potato supply management program was originally developed to control fresh potato supply (production and marketing). The potato acreage management program was used to control the number of fresh potato acres planted. The potato flow control program and exchange of marketing information were used to effectively manage the shipments of fresh potatoes throughout the marketing year. The potato supply management program was funded through the assessments of participating growers.

To implement the potato acreage management program, a system of base acres was introduced. The base acres for each grower were those acres where potatoes were planted during the period of 2003-2004. Each base acre was originally assessed at \$50. During the first year of the program implementation, the cooperative members were required to decrease the planted area by 15% relative to the base year (i.e. 2004). If a grower chose not to reduce the planted area or to reduce it by less than 15%, he was assessed a pro-rated percentage of \$50. The assessment fund was used to buy acres elsewhere in Idaho. If a grower decided to expand relative to the base year, he was assessed \$100 per acre. Field audit was conducted to monitor a proper implementation of the acreage management program.

The potato flow control program and exchange of marketing information were used to coordinate quantity of potatoes supplied to the market throughout the year. A variety of marketing information (capacity, stocks, prices, demand and supply trends, etc.) was discussed during conference calls that took place once a week at the national level. The results of the discussion were summarized in a price advisory used as a recommended pricing strategy for the coming week. Other marketing activities included the removal of excess potatoes from the market by diverting them to charities, food banks and humanitarian services.

The empirical evidence available for the first few years of the potato supply management program implementation may suggest that the program was effective. Bolotova (2009), using data for all Idaho potatoes (fresh, processing, seed), reported an increase in the Lerner Index of market power from 0.4% in 2004 to 11.3% in 2005 (the first year of the program implementation). A successful implementation of the potato supply management may have contributed to the observed increase in the Idaho potato industry Lerner Index. It should be noted that the major focus of the supply management program was originally on fresh potato market. Taking into account the evidence of the over-supply of fresh potatoes and the fact that fresh potato prices were below the potato production cost in 2004 and a few preceding years, the Lerner Index of Idaho fresh potato market alone was likely to be much lower than the presented number for the entire industry (fresh, processing and seed potatoes).

Bolotova et al. (2008) reports fresh potato price changes (increases) between a period without the supply management (the pre-coop period) and a period encompassing the first few years of the program implementation (the coop period). An empirical analysis based on monthly fresh potato prices received by potato growers for all potato varieties indicates that the Idaho fresh potato prices increased from \$3.89/cwt in the pre-coop period to \$6.63/cwt in the coop period. While this reflects a 70% increase in Idaho fresh potato price, potato production costs' increase was in the range of 10% to 16%. The U.S. fresh potato prices increased from \$7.78/cwt to \$10.19/cwt or by 31%.

These price increases should be interpreted by evaluating the level of potato price relative to the potato production cost and relative to the U.S. average potato price during the pre-coop and coop periods reported in Bolotova et al. (2008: Table 5). First, the average Idaho potato price was \$3.89/cwt during the pre-coop period, and it was below the minimum level of potato production costs, which ranged from \$4.63/cwt to \$5.23/cwt during the same period. During the coop period, the average Idaho potato price was \$6.63/cwt, which was above the maximum level of potato production costs, which ranged from \$5.17/cwt to \$5.96/cwt during the same period. In addition, the average Idaho potato price during the coop period, \$6.63/cwt, was far below the average U.S. potato price during the coop period, \$10.19/cwt, and was also lower than the U.S. average potato price during the pre-coop period, \$7.78/cwt.

An empirical analysis utilizing a more disaggregated data, Idaho weekly shipping point prices for Russet Burbank between the pre-coop and coop periods, suggests that fresh potato price increases were in the range of 47%-71% for US No1 non-size A potatoes, 14%-52% for US No 1 size A potatoes and 34%-72% for US No 2 potatoes (Bolotova et al. 2010: Table 3) . The Russet Burbank potato production and packing costs increased by 16%-20% (Bolotova et al. 2010: Table 2). Finally, Bolotova et al (2008 and 2010) report empirical evidence reflecting a reduced fresh potato price volatility during the first years of the program implementation.

Current Debate on the Legal Status of Agricultural Supply Management Practices and Production Restrictions

Currently the legal status of agricultural supply management practices of the organizations of agricultural producers, in particular, the legal status of various forms of production restrictions, represents a very controversial issue. Possible consequences of this legal uncertainty for agricultural producers and their organizations are substantial civil penalties under federal and state antitrust laws. Under federal antitrust law, direct buyers are entitled to recover treble damages (i.e. three times the overcharge). Under the state antitrust and similar statutes, indirect buyers are entitled to recover from a single to three times the overcharge, depending on a particular state jurisdiction.

Until very recently, the existing case law was not clear on whether and which exactly supply management and production control practices were protected by the Capper-Volstead Act. A general perception of the industry participants was that this type of activities was immune. In terms of economics, the market effects of supply (production) control are similar to the market effects of price-fixing. There is a well-developed case law establishing that the organizations of agricultural producers can fix output prices, as this is an element of marketing activities that Section 1 of the Capper-Volstead Act aims to protect.

A number of recent publications of government officials from the U.S. Department of Justice Antitrust Division and a number of on-going federal and state private antitrust litigations indicate that the uncertainty surrounding the legal status of agricultural supply management practices remains. This situation represents a great challenge for agricultural community because it affects production, marketing and pricing decisions and strategies of individual agricultural producers and of their organizations.

A set of arguments for holding production (supply) restrictions both outside and within the Capper-Volstead Act immunity are discussed by Christine Varney, a former Assistant Attorney General of the U.S. Department of Justice Antitrust Division (2010). This issue is evaluated by analyzing the language of Section 1 of the Capper-Volstead Act, existing decisions/recommendations of the government agencies (Federal Trade Commission, Department of Justice and Department of Agriculture) and the relevant case law. The summary of the analysis is presented below¹⁴.

A number of reasons favoring the point of view that agricultural production restrictions are not immune by the Capper-Volstead Act are the following. First, the explicit list of activities included in Section 1 does not include words “production” or “supply”. This list encompasses a range of marketing (post-production) activities. It reads that agricultural producers “may act together in collective processing, preparing for market, handling and marketing”. One might argue that all these activities are post-production type, and therefore they do not include joint production activities.

Second, any antitrust exemption is to be interpreted very narrowly, as guided by the U.S. Supreme Court. Third, a similar to the Capper-Volstead Act statute, the Fisherman’s Collective Marketing Act (FCMA), which regulates fishermen activities, defines the scope of protected activities by explicitly including words “catching” and “production”. The Capper-Volstead Act does not include similar words. Finally, the legislative history of the Capper-Volstead Act may suggest that Congress did not intend to include production (supply) restrictions in the scope of protected activities. An approach that both antitrust enforcement agencies, Federal Trade Commission and Department of Justice, have taken is that the Capper-Volstead Act does not protect production restrictions.

A number of reasons favoring the point of view that agricultural production (supply) restrictions are within the scope of the Capper-Volstead Act are the following. First, it can be argued that the scope of activities listed in the Act does encompass the whole range of activities from pre-planting through harvest, processing to sales. One might argue that effective marketing (i.e. preparing for market and marketing) includes the decision on how much to produce in the first place. Second, withholding already available agricultural output from the market might be considered as part of marketing. This may include donating this part of output to charities and/or destroying it. Actually, allowing withholding already available output, but not allowing production restrictions, may be more wasteful and inefficient from the societal perspective.

Third, the Act’s legislative history may be used to argue that production restrictions were immune. In particular, Congress intended to treat the organizations of agricultural producers as single corporations. This implies that an organization of agricultural producers, as a single corporation, can decide on how much to produce. Fourth, some limited case law may be used to argue that supply (production) restrictions are protected by the Act. For example, in *Alexander vs. National Farmers Organizations* (1982), the court held that the cooperative could withhold the members’ output in order to obtain a higher price. One may further interpret this legal

¹⁴ Also see Ondeck and Clair (2009), Frackman and O’Rourke (2011), Hibner (2011) and Manning and Welle (2012).

opinion as the one suggesting that agricultural cooperatives can limit their production. Finally, there are opinions indicating that, if the Fisherman Collective Marketing Act allows controlling production, the Capper-Volstead Act should protect this activity as well, although the language of the latter is somewhat different, as mentioned earlier.

The case law influences the antitrust enforcement efforts of antitrust enforcement agencies. In particular, as indicated by Varney (2010), the outcomes of current litigations were important for the enforcement efforts of the Department of Justice. In December 2011, a U.S. district court for the first time in history addressed the issue of planting restrictions in a lawsuit against a group of cooperatives of potato growers, including the United Potato Growers of Idaho and United Potato Growers of America (*In Re: Fresh and Process Potatoes Antitrust Litigation*).

After conducting a very comprehensive analysis, the court concludes that production restrictions (acreage limitations) are not protected by the Capper-Volstead Act. First, by having analyzed the existing case law, the court indicates that there are no legal opinions that explicitly approve a pre-production output limitation as opposed to a post-production marketing decision. Furthermore, there are no legal opinions suggesting that the Capper-Volstead Act immunizes cooperatives who decide to collectively reduce production in order to increase market prices. Second, by analyzing the plain language of the Capper-Volstead Act, the court concludes that it does not include reducing acreage for planting.

Third, the opinion reiterates that the government agencies responsible for antitrust law enforcement in their own opinions have not approved production restrictions. Fourth, in response to the defendants' (i.e. the cooperatives) argument that production restrictions are similar to price-fixing, and it is well-established that the latter is immune by the Capper-Volstead Act, the Judge concludes that these are not the same. This is because an individual freedom to produce more during the periods of higher prices acts as a safe-guard against the Capper-Volstead Act abuse. Finally, the Act's legislative history is used to conclude that Congress did not indicate a strong intent to give farmers opportunity to limit their production. The Judge clarifies that agricultural supply control is possible under Agricultural Marketing Agreement Act (1937).

Discussion and Implications of the Analysis Results

Agricultural producers and their organizations involved in developing and implementation of the private industry-funded and administered supply management programs in the U.S. had a legitimate objective: to address the over-supply problem and increasing output price volatility in order to achieve a fair level of returns. Due to the nature of agricultural production, the over-supply of agricultural commodities has been a common problem in agricultural markets. It becomes a more challenging problem to deal with in the modern agribusiness environment.

First, during recent decades, the level of various forms of domestic government support of agricultural producers has been decreasing, mostly due to international trade liberalization and WTO rules imposing the limits on the amount of domestic support. There is a considerably higher degree of exposure of domestic agricultural commodity markets to conditions of international commodity markets and to increased competition from these markets. This situation contributes to increasing volatility of agricultural input and output prices.

Second, agricultural producers are affected by increasing concentration and consolidation that have been taking place in agricultural input markets as well as in food processing, distribution and retailing. An increase in market power observed in these segments of the food supply chain leads to higher agricultural input prices (due to the seller market power of agricultural input suppliers) paid by agricultural producers and to lower agricultural commodity prices (due to the buyer market power of buyers of agricultural commodities) received by agricultural producers.

Third, some of the economic effects of the over-supply of agricultural commodities have a direct adverse effect on the profitability of agricultural producers and also involve losses for the society. The over-supply of agricultural commodities causes a wasteful use of resources used in agricultural production. From the agricultural producers' perspective, this increases their agricultural production costs. At the same time, the excessive volume of agricultural commodities in the market place causes prices received by agricultural producers to decline further. An increase in agricultural production costs and a decrease in revenue decreases the farm profitability.

The reviewed empirical evidence on the economic (price) effects of the private industry-administered and funded supply management programs in the U.S. dairy and potato industries implemented during the 2000s suggests that these programs may be a workable mechanism to be used to address the over-supply problem and may provide some noticeable returns to agricultural producers in terms of a higher level of prices and a lower price volatility (i.e. reduced price risk).

However, direct and indirect buyers of agricultural commodities (and food products manufactured from these commodities) affected by the supply management programs have challenged the legal status of the supply management practices and in particular of agricultural production restrictions in a number of recent and on-going antitrust litigations. The current uncertainty surrounding the legal status of various agricultural supply management practices implemented by the organizations of agricultural producers in the U.S have significant implications for production, marketing and pricing decisions of individual agricultural producers and their organizations.

This situation poses a number of legal, economic and business issues that deserve further analysis and discussions among industry participants, policy-makers, lawyers and researchers. Some of the issues to be evaluated in the future are discussed below.

Implications for Industry Decision-Makers and Law Practitioners

- 1. It is important to distinguish between supply management practices implemented at the pre-production, production and post-production stages.*

Various supply management practices at the post-production stage are more likely to be protected by the Capper-Volstead Act, because they are likely to be characterized as “marketing” activities described in Section 1. It is “safer” to use only those agricultural supply management practices that are known to be immune.

One of the challenges is that there is a very limited case law interpreting supply management practices, which creates uncertainty on how a particular practice will be interpreted in the future, should a legal dispute arise. An analysis presented in *Alexander vs. National Farmers Organizations (1982)*¹⁵ may suggest that the organizations of agricultural producers may withhold already produced agricultural output of their members in order to obtain a higher price for this output. This type of “post-production” supply management is more likely to be interpreted as “preparing for market and marketing” in light of Section 1 of Capper-Volstead Act.

2. *Evaluating and developing alternative to agricultural supply management (including production restrictions) practices deserve consideration.*

here is a well-developed case law establishing that price-fixing (price-setting) activities of the organizations of agricultural producers are protected by the Capper-Volstead Act, because they are elements of marketing.

For example, in *Treasure Valley (1974)* the joint bargaining activities of two cooperatives of potato growers with two potato processors involving negotiations of both price and non-price terms in potato processing contracts were found to be within the scope of the Capper-Volstead Act. Furthermore, *Northern California Supermarkets (1976)* clarifies that an organization of agricultural producers can fix prices without being directly involved in the process of marketing, sales or other activities mentioned in Section 1. This legal opinion confirms that price-fixing by the organizations of agricultural producers is a legitimate Capper-Volstead Act activity.

The issue for some of the organizations of agricultural producers to evaluate is whether some form of price-fixing may be a viable alternative to agricultural supply management and in particular to production restrictions at the pre-production and production stages.

3. *It is important to re-evaluate the role and functions that the organizations of agricultural producers may perform for the joint benefits of their members in the modern agribusiness environment.*

Some of these organizations may be purely bargaining organizations, which would represent agricultural producers in the contract negotiation processes with buyers of agricultural commodities (processors, distributors and retailers) (cases analyzed in *Treasure Valley (1974)* and *Northern California Supermarkets (1976)*).

Additionally, some of the organizations of agricultural producers may be actually involved in various marketing activities, including some form of supply management and exchange of marketing information (the U.S. dairy and potato industry experience discussed in the article). The specific market structural characteristics and the nature of contractual relations (selling/buying practices) between agricultural producers and buyers of agricultural commodities

¹⁵ USDA Rural Business-Cooperative Service (2002) presents a comprehensive analysis of the case law discussed in this section.

(processors, distributors and retailers) would define the role and functions that the organizations of agricultural producers should perform.

4. *In order to be legally involved in the activities protected by the Capper-Volstead Act, it is imperative for the organizations of agricultural producers (cooperatives, associations, federations, agencies, etc.) to comply with the requirements to the organizational structure specified in Section 1 of the Capper-Volstead Act, and all agreements and contracts of these organizations with other entities must comply within the requirements of this section*¹⁶.

First, all members of the organization have to be agricultural producers and have to be *actually* involved in agricultural production. A presence of one member, who is not involved in agricultural production, removes the Capper-Volstead Act protection for the whole organization and its activities.

For example, in *Case-Swayne (1967)*, U.S. Supreme Court interprets “a person engaged in agricultural production” (Section 1 of the Capper-Volstead Act) very narrowly. This caused Sunkist, an organization of citrus fruit producers, to fall outside the Capper-Volstead Act protection. Approximately 15% of Sunkist’s members handling approximately 13% of its volume were packing houses, who operated for profit and did not grow citrus fruits. Their relationships with growers were through marketing contracts and not through membership agreements.

In *National Broiler (1978)*, U.S. Supreme Court revisits the definition of agricultural producers (i.e. farmers) in the case of a large vertically integrated cooperative of entities involved in broiler production. This legal opinion reiterated a very narrow definition of agricultural producers for the purpose of Section 1 of the Capper-Volstead Act, by restricting it to persons who were *actually* involved in growing broilers. The Court declined to extend this definition to the members of cooperative who were involved in other but growing activities (i.e. processing, feed supply) and rejected the idea that these entities participated in actual production through risk involvement.

The most recent legal opinion addressing the definition of agricultural producer in light of the Capper-Volstead Act, *Re: Mushroom (2008)*, reiterates that this definition is to cover only producers directly engaged in agricultural production. The presence of one member who was a non-producer, but who participated in the decision-making process of a mushroom cooperative, removed the antitrust immunity from this organization.

Second, being involved in combinations and contracts with non-exempt entities removes the antitrust protection, and these agreements are potentially subject to Section 1 of the Sherman Act. According to *Borden (1939)*, the organizations of agricultural producers are subject to

¹⁶ Associations of agricultural producers have to operate for the mutual benefits of their members and have to conform to one of the following: (a) no member is allowed more than one vote or (b) the association does not pay dividends in excess of 8 per cent per annum. In addition, the volume of products from non-members handled through the association cannot exceed the volume of products from its members.

Sherman Act, if they enter into combinations with non-exempt entities with the purpose of restraining trade and monopolization.

5. *Government-sponsored (public) supply management programs are alternatives to private industry-funded and administered programs.*

These public programs are possible under Agricultural Marketing Agreement Act (1937). However, this alternative is not likely to be feasible for a number of reasons. First, this would be considered to be a measure of domestic agricultural support under the WTO rules. Second, the U.S. dairy industry experience with Milk Diversion Program (1984) and Dairy Termination Program (1986 and 1987) may suggest that this type of programs is likely to provide only some short-term positive effects.

Implications for Researchers and Policy Decision-Makers

6. *There is a need for a comparative analysis of the actual market (price) effects of the output control and price-fixing practices of the organizations of agricultural producers.*

It may be hypothesized that the market (price) effects of price-fixing, which is protected by the Capper-Volstead Act, may be stronger (more harmful to the market) than the market (price) effects of agricultural supply management at the pre-production and production stages. In other words, from antitrust law perspective, the former is more damaging to the market than the latter.

In the case of production restrictions, there is a great deal of production and price uncertainty that would affect (and likely to reduce) the effective impact of output reduction on the market price. First, there is a certain time lag between the moment when the supply control (production restrictions) is implemented and the moment when the market price adjustment takes place. Second, there is uncertainty pertaining to agricultural production process. In particular, increasing over time crop yield and livestock productivity (due to the improvement in genetics and agricultural management practices) would mitigate the effect of the supply reduction on the output price over a longer time horizon. Third, given that there are many agricultural producers in the industry, there will be always non-members, which are likely to expand their production at the expense of participating members, which would drive the market price down.

On the other hand, a pure price fixing at the farm-gate, which is an element of marketing activities typically protected by the Capper-Volstead Act, has an immediate effect on market price. One may hypothesize whether a practice which market effects may be more damaging is permitted, and a practice which market effects may be (hypothetically) less damaging is prohibited. A rigorous empirical analysis of the market effects of various supply management and price-fixing practices in different agricultural markets is required to test this hypothesis.

7. *A related policy question is whether agricultural supply management practices, and in particular production restrictions, are viable means to deal with the over-supply problem and help balance supply with demand.*

The results of a comprehensive analysis of the economic effects of the private supply management programs (and of their key elements) implemented in the U.S. during the period of 2002-2009 would help answer this question.

8. *Under the presumption that the private industry supply management, including production control, is not protected by the Capper-Volstead Act, could a legitimate price-fixing practice help effectively deal with the over-supply problem?*

A comparative analysis of the economic effects of price-fixing and supply management in a particular industry setting should be conducted to answer this question.

Conclusion

During recent years the nature of competition process in agricultural and food industries in the United States attracted increased attention of policy decision-makers, industry participants and antitrust law practitioners (U.S. Department of Justice Antitrust Division and U.S. Department of Agriculture Initiative 2009-2010, Oudeck and Clair 2009). A considerable number of questions have been raised about the Capper-Volstead Act in general and its role in the modern agribusiness environment. The increased attention to various practices used by the organizations of agricultural producers, including agricultural supply management, tends to stem from the fact that many agricultural cooperatives today have large market shares. It is often presumed that large market shares are reflected in market power and higher prices paid by buyers and final consumers.

The analysis presented in this article, by comparing agricultural cooperatives with classic cartels (typically organized in markets with oligopolistic market structures where there are “few” firms), indicates that the price effects of production restrictions used by agricultural cooperatives are likely to be much weaker than the price effects of output control strategies implemented by classic cartels. Furthermore, a large membership of agricultural cooperatives and presence of non-members would always present challenges in effective enforcement of various supply management practices and their actual effects on market prices.

Finally, the issue of the legal status and market effects of the joint activities of agricultural producers is relevant for the overall international community. Many countries have similar to the Capper-Volstead Act laws. These laws typically provide a very limited antitrust immunity. During the recent decade many countries have strengthened their antitrust laws, and consequently the systems of penalties for antitrust violations. The effective joint efforts of domestic antitrust authorities have been also observed at the international level (International Competition Network).

In the past, agricultural producers in many countries benefited from a variety of income and price support government-administered programs as well as from substantial international trade barriers protecting their domestic markets. In a modern global market environment, with a constantly decreasing degree of domestic government support and trade barriers, many agricultural producers are more frequently and severely affected by agricultural over-supply. Individual agricultural producers and, more importantly, their organizations in the near future

will have to consider new supply management and pricing practices, which can help them remain profitable and preserve viable agricultural production.

References

- Besanko, D., and R.R. Braeutigam. 2002. *Microeconomics: An integrated approach*. Hoboken, NJ: Wiley.
- Bolotova, Y. 2009. Does the Potato Supply Management Program Work? A Case of the Idaho Potato Industry. Selected Paper, 7th Annual International Industrial Organization Conference; Boston, MA; April 03-05, 2009.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1175202
- Bolotova, Y. 2009. Cartel Overcharges: An Empirical Analysis. *Journal of Economic Behavior and Organization* 70: 321-341.
- Bolotova, Y. 2006. Three Essays on the Effectiveness of Overt Collusion: Cartel Overcharges, Cartel Stability, and Cartel Success. Ph.D. Dissertation. Department of Agricultural Economics, Purdue University, West Lafayette, Indiana.
- Bolotova, Y., J.M. Connor and D.J. Miller. 2007. Factors Influencing the Magnitude of Cartel Overcharges: An Empirical Analysis of Food Industry Cartels. *Agribusiness: An International Journal* 23: 17-33.
- Bolotova, Y., C.S. McIntosh, K. Muthusamy and P.E. Patterson. 2008. The Impact of Coordination of Production and Marketing Strategies on Price Behavior: Evidence from the Idaho Potato Industry. *International Food and Agribusiness Management Review* 11: 1-29.
- Bolotova, Y., C.S. McIntosh, P.E. Patterson and K. Muthusamy. 2010. Is Stabilization of Potato Price Effective? Empirical Evidence from the Idaho Russet Burbank Potato Market. *Agribusiness: An International Journal* 26: 177-201.
- Brown, S. 2009. The Economics Effects of the CWT Program. Power-point presentation. University of Missouri, College of Agriculture, Food and Natural Resources.
<http://www.agweb.com/assets/import/files/ScottBrownCWTONovember2009.pdf>
- Brown, S., B. Cropp, B.W. Gould, and E. Jesse. 2010. Dairy Policy Issues for the 2012 Farm Bill. Dairy Policy Analysis Alliance. The University of Missouri Food and Agricultural Policy Research Institute (FAPRI) and the University of Wisconsin-Madison Department of Agricultural and Applied Economics. http://www.fapri.missouri.edu/outreach/publications/2010/Dairy_Policy_Issues_April2010.pdf
- Carlton, D. and J. Perloff. 2004. *Modern industrial organization*. Prentice Hall.
- Connor, J.M. 2007. Price-fixing overcharges: Legal and economic evidence. In *Research in Law and Economics* vol. 22, edited by J.B. Kirkwood, 59-153. Elsevier, Oxford, Amsterdam and San Diego.

- Dixon, B.L., D. Susanto, and C.R. Berry. 1991. Supply Impact of the Milk Diversion and Dairy Termination Programs. *American Journal of Agricultural Economics* 73: 633-640.
- Frackman, A.J., and K.R. O'Rourke (O'Melveny & Myers LLP). 2011. The Capper-Volstead Act Exemption and Supply Restraints in Agricultural Antitrust Actions. Presented to New York State Bar Association, Antitrust Section Executive Committee, New York, N.Y.
http://www.nysba.org/Sections/Antitrust_Law/Resources/Resource_PDFs/Capper_Volstead_Act_presentation.html
- Gale Jr, F.H. 1990. Econometric Analysis of Farmer Participation in the Dairy Termination Program in North Carolina and Virginia. *Southern Journal of Agricultural Economics*: 123-132.
- Guenther, J. 2012. The Development of United Potato Growers Cooperatives. *Journal of Cooperatives* 26: 1-16. <http://acc.k-state.edu/ncera210/jocpdfs/v26/Guenther.pdf>
- Hardesty, S. 2007. United Potato Growers of America: Revisiting the Power of Producer Collaboration. Power-point presentation. Agricultural and Resource Economics, University of California-Davis.
- Hardesty, S. 2008. Enhancing Producer Returns: the United Potato Growers Association. University of California-Davis, Department of Agricultural and Resource Economics and Giannini Foundation of Agricultural Economics. http://giannini.ucop.edu/media/are-update/files/articles/v11n3_4.pdf
- Hibner, D.T. (Sheppard, Mullin, Richter & Hampton LLP - Los Angeles Office). 2011. Allegations of Conspiracy to Limit Crop Production: Ripe for Analysis Under Capper-Volstead. http://www.martindale.com/antitrust-trade-regulation-law/article_Sheppard-Mullin-Richter-Hampton-LLP_1400560.htm
- Hovenkamp, H. 1994. Federal antitrust policy: The law of competition and its practice. Hornbook series, Thomson West.
- International Competition Network. <http://www.internationalcompetitionnetwork.org/>
- Jesse, E.V., A.C. Johnson, Jr., B.W. Marion, and A.C. Manchester. 1982. Interpreting and Enforcing Section 2 of the Capper-Volstead Act. *American Journal of Agricultural Economics* 64:431-443.
- Manchester, A.C., and D.P. Blayney. 2001. Milk Pricing in the United States. Agriculture Information Bulletin No. 761, Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture.
<http://www.ers.usda.gov/publications/aib761/aib761fm.pdf>
- Manning, B.D., and Welle, A. (Robins Kaplan Miller & Ciresi LLP). 2012. Cooperative Production Limits: A 4-Course Antitrust Meal.
<http://www.rkmc.com/~media/PDFs/Cooperative%20Production%20Limits%20A%204%20Course%20Antitrust%20Meal.pdf>

- McCay C.J. 2011. Effect of Cooperatives Working Together herd retirements on the U.S. dairy herd size. Departmental Honors Thesis, Department of Agricultural Economics, Purdue University. http://www.agecon.purdue.edu/undergrad/counseling/pdf_files/CarissaMcCayThesis.pdf
- McGary, S.D., and G.H. Zobell. 2012. Fresh Potato Price Volatility and Efforts of a Potato Growers Association to Reduce the Volatility through Production Controls. Selected Paper, 22nd International Food and Agribusiness Management Association Symposium, Shanghai, China. www.ifama.org/files/conf/2012/723.pdf
- Ondeck, C.E., and K. Clair 2009. Justice Department and Private Plaintiffs Take Aim At Capper-Volstead Act's Protections for Agriculture. BNA 97 ATRR 512.
- Parkinson, S.N. 2008. A critical analysis of the Cooperatives Working Together program. All Graduate Theses and Dissertations Paper 166, Utah State University. <http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1156&context=etd>
- Siebert, J., and Lyford, C. 2009. U.S. Dairy Industry Supply Control: Managing the Cooperatives Working Together Program. *Review of Agricultural Economics* 31: 999-1013.
- Stigler, G.J. 1964. A Theory of Oligopoly. *The Journal of Political Economy* 72: 44-61.
- Varney, C.A., a former Assistant Attorney General of the Antitrust Division at U.S. Department of Justice. 2010. The Capper-Volstead Act, Agricultural Cooperatives, and Antitrust Immunity. *The Antitrust Source*: 1-8. http://www.americanbar.org/content/dam/aba/publishing/antitrust_source/Dec10_FullSource.authcheckdam.pdf
- U.S. Department of Agriculture Rural Business-Cooperative Service. 2002. Antitrust Status of Farmer Cooperatives: The Story of the Capper-Volstead Act. Cooperative Information Report 59. <http://www.rurdev.usda.gov/rbs/pub/cir59.pdf>
- U.S. Department of Agriculture Rural Development. Rural Cooperatives. March/April 2005. <http://www.rurdev.usda.gov/supportdocuments/CoopMag-mar05.pdf>
- U.S. Department of Justice Antitrust Division and U.S. Department of Agriculture Initiative "Agriculture and Antitrust Enforcement Issues in Our 21st Century Economy". 2009-2010. <http://www.justice.gov/atr/public/workshops/ag2010/>

Laws and Legal Decisions

1. *Capper-Volstead Act (1922)*: 7 U.S.C. §291- §292.
2. *Sherman Act (1890)*: 15 U.S.C §1-2.
3. *Agricultural Marketing Agreement Act (1937)*: 7 U.S.C. §601, 602, 608a-608e, 610, 612, 614, 624, 627, 671-674.
4. *In Re: Mushroom Direct Purchase Antitrust Litigation* 621 F.Supp.2d 274 (2008).
5. *In Re: Fresh and Process Potatoes Antitrust Litigation No. 4:10-MD-2186-BLW (D.Id.)*.

6. *In Re: Processed Egg Products Antitrust Litigation MDL No. 2002, 08-md-02002 (E.D.Pa.)*.
7. *Stephen L. LaFrance Holding Inc. v. National Milk Producers Federation No. 2:12-cv-00070 (E.D.Pa.)*.
8. *Edwards v. National Milk Producers Federation No. 3:11-cv-04766 (N.D.Cal.)*.
9. *Alexander vs. National Farmers Organizations 687 F.2d 1173 (1982)*.
10. *National Broiler Marketing Association v. United States 436 U.S. 816, 98 S.Ct. 2122 (1978)*.
11. *Northern California Supermarkets v. Central California Lettuce Producers Cooperative 413 F.Supp. 984 (1976)*.
12. *Treasure Valley Potato Bargaining Association v. Ore-Ida Foods, Inc. and J.R. Simplot Company 497 F.2d 203 (1974)*.
13. *Case-Swayne Company v. Sunkist Growers 389 U.S. 384, 88 S.Ct. 528 (1968)*.
14. *United States v. Borden Co. et al. 308 U.S. 188, 60 S.Ct. 182 (1939)*.



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Determinants of Agro-Dealers' Participation in the Loan Market in Nigeria

Aderibigbe S. Olomola

*Professor, Senior Economist/Consultant, International Food Policy Research Institute (IFPRI)
Nigeria Strategy Support Programme, Abuja, Nigeria*

Abstract

Agro-dealership financing deserves policy attention if agro-dealers are to contribute to the success of the ongoing agricultural transformation in Nigeria. Thus, this study seeks to (i) examine the issues influencing the decisions of agro-dealers to participate in the loan market, (ii) analyze the demand for business loan by the agro-dealers and (iii) articulate policy measures for sustainable financing of agro-input business enterprises in Nigeria. The study employed primary data collected through structured questionnaires from 300 agro-dealers and used a Tobit type-II model for the analysis. The results show that interest rate, debt, value of asset, membership of trading association and source of credit are major determinants of loan demand. Agro-dealers need to organize themselves into input trading associations to enhance their creditworthiness and unleash the inherent social capital and information advantages for improved agro-dealership financing. Moreover, diversification of product coverage by agro-dealers and a value-chain approach that links internal financing in the form of trade credit within the agro-input sector with external financing from the commercial banks are strongly recommended.

Keywords: agro-dealers, business loan, demand, policy, Nigeria

^①Corresponding author: Tel: + 234-803-613-2535 9
Email: A. S. Olomola: as_olomola@yahoo.com

Introduction

Despite the efforts of the Nigerian government to transform the agricultural sector, modern inputs (such as fertilizers, improved seeds and agro-chemicals) that are critical to the attainment of the desired productivity increases and output targets under the ongoing agricultural transformation agenda (ATA) are not available in the right quantity, quality and price. Although the agricultural sector has been recording positive growth rates in recent times, the input distribution system has been in a parlous state. The inputs at the disposal of an average farmer remain grossly inadequate and are anything but modern – being of low quality and sub-optimal productivity. The agricultural transformation agenda (ATA) introduced in 2011 seeks to tackle the inefficiencies in the distribution of key inputs making them more readily available and affordable. In this regard the private sector agro-input business enterprises (agro-dealers) are assigned a critical role especially in the implementation of the growth enhancement support (GES) scheme which took off in 2012. They are involved in the procurement, distribution and delivery of inputs (fertilizers, improved seeds and agro-chemicals) to small-scale farmers. Under the scheme farmers are to benefit directly from an innovative electronic system of delivering subsidized inputs in which the subsidy payments are delivered directly to the beneficiaries through mobile phones.

A major policy stance underpinning the implementation of the GES was the withdrawal of the Federal government from the procurement and distribution of fertilizers and improved seeds in 2011. This is in a bid to decontaminate the input distribution system and promote effective service delivery. The commercial banks, fertilizer importers and major distributors, seed companies and agro-dealers are the key private sector groups that are to be relied upon for the successful implementation of the GES. The banking sector was expected to finance the participation of the agro-dealers in the procurement and delivery of inputs to farmers under the GES. The commercial banks were however, not forthcoming with the supply of the required loans during the first year of GES implementation in 2012. Many of the agro-dealers who could not obtain credit from other sources and who could not self-finance their investments failed to deliver the required inputs and many farmers did not use the modern inputs during the 2012 production season as expected. This type of disappointment created by agro-dealers should provoke a research investigation into the nature of their participation in the loan market with a view to articulating a sustainable financing mechanism for their business. Over the years, there have been attempts to develop agro-dealership, however, the level of organization and investment attained is far from being adequate for agro-dealers to cope with the large market they need to serve as far as distribution of inputs is concerned (IFDC 2012). The weaknesses in their financial capacity came to the limelight when many of them could not ordinarily provide the financial backing for their role in the distribution of inputs under the GES scheme. They are not also adequately equipped, organized or buoyant to a level where they can access adequate loan facilities from the commercial banks.

The foregoing raises the question as to which aspects of agro-dealership financing need to be transformed for effective input distribution in the country. What are the main sources of finance for the operations of agro-dealers and how reliable are they? What variables influence their decisions to borrow? For those who borrow, what factors determine their demand for credit? What sort of financial mechanisms will enable them to discharge their responsibilities in a

sustainable fashion? Some of these questions appear to be quite simple. However, they have been unasked and unanswered in the annals of agro-input business operations in Nigeria. Yet they are to be resolved in order to engender a viable architecture of agro-dealership financing and agricultural transformation in the country. This is particularly important in view of the limited research attention often devoted to agribusiness financial needs not only in Nigeria but also in many African countries.

In Africa, the literature on loan demand and the constraints confronting entrepreneurs in accessing loans from the financial system often places emphasis on small and medium-scale enterprises (SMEs) that have nothing to do with agriculture (Marziku 2012; Okurut et al. 2005; Ahiawodzi and Sackey 2013). Besides, studies that are related to agriculture often focus directly on small-scale farmers (Absanto and Aikaruwa 2013). In Nigeria in particular, recent studies in this regard consider how small-scale farmers are credit rationed by formal and semi-formal lenders (Eneji et al. (2013) and the factors influencing their access to credit (Sanusi and Adedeji 2010). Employing a probit model, the latter found that the level of education, membership of cooperative, contact with extension agent and present of collateral security positively and significantly determine the likelihood of farmers access to formal credit, while farming experience negatively determine the probabilities of farmers having access to formal credit. By and large, the agro-input business enterprises that are in dire need of debt capital have received little research attention (if any) in terms of determining the factors influencing their demand for loan and the articulation of appropriate financing mechanisms to support their business operations. This is not totally surprising however, since their role in the input market has just become more pronounced following the disengagement of the government from the procurement and distribution of agri-inputs in 2012. There is therefore, a great lacuna to be filled by this study. Thus, objectives of this study are to (i) examine the issues influencing the decisions of agro-dealers to participate in the loan market, (ii) analyze the demand for business loan by the agro-dealers and (iii) articulate policy measures for sustainable financing of agro-input business enterprises in Nigeria.

Theoretical Framework

The financial system in Nigeria, has witnessed a lot of policy incentives to ensure that actors in the agricultural value chains have access to credit to finance their operations. In this regard, the commercial banks, microfinance banks and Bank of Agriculture are being encouraged to increase the supply of credit to the agricultural sector. The analysis of credit participation by agro-dealers is one way of assessing how demand-responsive the activities of the lenders have been. To begin with, there is need to distinguish between credit access and participation in view of the tendency for analysts to use the terms interchangeable. Conceptually, access to credit differs from credit participation. According to Doan et al. (2010), access to credit means given the availability of credit, households are both able to borrow and can satisfy lending criteria established by lenders; regardless of whether they borrow or not. On the other hand, credit participation means that households have chosen to borrow and have already borrowed. A household that has participated in borrowing activities has, of course, access to particular credit resources, whereas a household having access to credit may choose whether or not to participate in borrowing activities. Thus, the borrowing decision and the factors influencing the choice to borrow in particular cannot be ignored in understanding credit participation. Indeed, credit

participation is more related to potential borrowers' choice (demand for credit), whereas credit access is more from the supply-side and related to potential lenders' choice (Diagne 1999).

In ascertaining the determinants of agro-dealers' participation in the loan market we consider the factors influencing their decision to borrow as well as the factors influencing their demand for business loan. As an entrepreneur, the agro-dealer is taking a decision to borrow to finance working capital requirements of procuring agricultural inputs which will later be sold to generate earnings that will enable him repay the loan at the end of the input procurement season. The lending rates from the various types of banks will affect the demand for credit. In general, and depending on the scale of operation of the firm, financing of investment in agrodealership can come from both internal and external sources. It can be assumed that in making an investment decision the enterprise faces a financing constraint which can be specified as follows (a la Vera 2002).

$$(1) I + \Delta B^* = CF + \Delta CR$$

According to Vera (2002) firms are equating total uses of funds for investment with total sources of funds. Thus, they must decide on the magnitude of their investment outlays in real assets, I , and on the magnitude of their investment in external financial assets, ΔB^* . Firms finance these decisions from cash flow, CF and variations in bank loans, ΔCR . Behaviorally, there is a possibility that firms could finance investment with increases in credit demand. It is also possible to associate changes in the financing composition of the corporations, whereby an increase in the cash flow, CF , would be associated with a reduction of credit demand, ΔCR . To operationalize the financing constraint under these behavioral assumptions, Vera (2002) theorized that demand for external financial assets, ΔB^* , will depend on two elements: (a) the expected return on those assets, r^* , and (b) the financing gap of the firm, $I - CF$, which is the difference between the required resources for the investment, I , and the portion available from internal financing, CF .

$$(2) \Delta B^* = \Delta B^*(r^*, I - CF)$$

$$\text{Where } \frac{\partial \Delta B^*}{\partial r^*} > 0 \text{ and } \frac{\partial \Delta B^*}{\partial (I - CF)} < 0$$

On the one hand, equation (2) indicates that an improvement in the expected return on foreign financial assets lead firms to acquire financial claims against non-residents. On the other hand, to the extent that the investment/internal financing gap becomes wider, part of it could be financed by liquidating positions in foreign currency, which explains the inverse relation between ΔB^* and $(I - CF)$. Further assumptions made by the author leading to the credit demand function are indeed very relevant and will be adapted in this study. For example, the author assumes that real credit demand depends directly on three factors: (a) the cost of credit, r_L , (b) the financing gap, and (c) variations in the real position of external assets, ΔB^* . In other words,

$$(3) \Delta CR = \Delta CR(r_L, I - CF, \Delta B^*)$$

The real investment function is an endogenous variable in the model (which makes the financing gap likewise partially endogenous). Real investment is assumed as determined by: (a) the level

of output, Q ; (b) the cost of capital (given by the interest rate, r_L); (c) the corporate cash flow, CF ; (d) the risk status of the economy, σ , and (e) the return on competing assets, in this case the foreign financial assets, r^* .

$$(4) I = I(Q, r_L, CF, \square, r^*)$$

The model is closed by making explicit the determinants of the return on external financial assets, r^* . Indeed, r^* will be determined endogenously as the sum of the foreign currency return on external assets, i^* , and the expected exchange rate depreciation, \hat{e}^e . The resulting representations are:

$$(5) r^* = i^* + \hat{e}^e$$

$$(6) \hat{e}^e = \varphi(\bar{q} - q)$$

If the interest rate on external financial assets, i^* and the equilibrium real exchange rate are taken as given, then (5) and (6) imply that the return on external assets is a function of the behavior of the real exchange rate. A real exchange rate appreciation (relative to its long-term value), for instance, will generate expectations of depreciation of the nominal exchange rate and consequently, an increase in the return on the external financial assets will be expected as well.

Substituting (5) into (2) and (4), and then (2) and (4) into (3), will result in a reduced form credit demand function as follows:

$$(7) \Delta CR = \Delta CR(r_L, Q, CF, q, \square)$$

In theory, equation (7) is a function of five exogenous variables: the interest rate on loans, the level of economic activity, the corporate cash flow, the real exchange rate, and the index of macroeconomic risk. The signs of the partial derivatives for the interest rate on loans, the macroeconomic risk and the level of activity are evident; not, however, when evaluating the impacts of the cash flow variable and of the real exchange rate. An increase in corporate cash flow reduces the financing gap and consequently credit demand. However, it may also increase investment and the financing gap (increasing credit demand). The sign then will depend much on how sensitive is the investment function to changes in CF .

In his theoretical formulation, Vera takes a macroeconomic perspective in which time series data were used from 1986 to 1990 in the case of credit demand in Venezuela. In the Nigerian credit market with a cross-section data reflecting the demand for credit by firms in a particular sub-sector, modifications are required in the characterization of their participation in the credit market. In the neoclassical world of perfect competition with perfect information and zero transactions costs, the borrower gets the amount of money he desires to finance his business operations. However, with the imperfections in the credit market some borrowers are liquidity constrained because they are unable to obtain the same amount of credit they could receive if information were perfect and markets complete. This occurs because of market failure brought about by asymmetric information. There are two aspects of information asymmetry – adverse

selection and moral hazards. Adverse selection is an *ex ante* concept which explains how a lender's information on borrowers concerning the viability of an enterprise will be incomplete. The borrower with better information on his business concerning its high risk nature is prepared to borrow money at higher interest rate compared with a borrower whose business is less risky but not prepared to borrow money at a high interest rates. The lending institution will select the riskier business and this will marginalize some businesses in the credit market and affect the credit institutions' capital base. Due to this, the level of investible funds will be reduced; this will affect the performance of the whole economy.

As regards moral hazards, there is the tendency for borrowers to hide their true motives for request for funds (Stiglitz and Weiss (1981). In an *ex post* sense, this implies that the loans can be misapplied. For instance the loans can be diverted to speculative or consumption activities. If the investment gains are positive, the borrowers will settle their indebtedness and this will reduce lenders' risk. On the contrary, if the above does not happen, the investor will bear the full cost of the risk. Due to this phenomenon, there is the tendency for lending institutions to reduce the amount of loanable funds and they may even raise the interest rates to make up for the losses. According to the authors higher interest rates induce firms to undertake projects with lower probability of success but higher payoffs when they succeed (leading to the problem of moral hazard). Since the bank is not able to control all actions of borrowers due to imperfect and costly information, it will formulate the terms of the loan contract to induce borrowers to take actions in the interest of the bank and to attract low risk borrowers. The result is an equilibrium rate of interests at which the demand for credit exceeds the supply. Theoretically, raising interest rates or collateral in the face of excess demand is not always profitable to lenders and banks will deny loans to certain borrowers; since at higher interest rates, the expected return from a loan would start decreasing after a point due to higher defaults (Kundid and Ercegovac 2011).

Another dimension of the market imperfections is the fact that as borrowers embark on high risky projects lenders are apt to incur higher assessment and monitoring costs which in turn can lead to higher interest rate and thus impose an unbearable repayment burden on borrowers (Williamson 1987). Thus, the bank assumes that increasing the interest rate it charges borrowers may adversely affect the riskiness of the borrowers' projects or that increasing the interest rate can erode the ability to repay debt (Wolfson 1996). Thus, in the presence of information asymmetries in the market for loans and costly monitoring, banks would not use interest rates alone to equate demand and supply, but would ration credit. In the light of the foregoing, the literature is replete with situations in which lenders utilize non-price mechanisms to ration loans based on the attribute of the entrepreneurs and the characteristics of enterprises (Beck 2006; Han 2008; Muravyev et al. 2009).

Hence, in determining the participation of agro-dealer enterprises in the credit market, it is important to consider the some supply factors which banks will assess in evaluating borrowers' credit worthiness. In addition to interest rate therefore, we include a number of variables in the credit demand function which reflects the attributes of the entrepreneurs and characteristics of the agro-dealer enterprises. It was hypothesized that factors such as age, geographical location, membership of trading associations, savings, customer outreach and level of indebtedness (representing borrowing experience or credit history) have significant effects on their borrowing decisions. With regard to loan demand the hypothesis was that interest rate, savings, value of

asset, region, membership of trading association and source of loan are significant determinants. The demand function can therefore, be specified implicitly as follows.

$$(8) CR = CR (IR, S, V, REGION, LSOURCE)$$

Where IR is the interest rate, S is savings, V is value of assets REGION is geographical location and LSOURCE is source of loan. We expect an inverse relationship between CR and S and a positive relationship between CR and V. REGION is a dummy variable with a value of unity for borrowers in the northern part of the country and zero for those in the south. LSOURCE is also a dummy variable with a value of unity if the formal lender is a bank and zero otherwise.

Data and Methodology

The study employed primary data collected between February and June, 2013 through well-structured questionnaires from a cross-section of agro-dealers in all the six geo-political zones of the country. The six states covered are Sokoto (North-West), Bauchi (North-East), Benue (North-Central), Ogun (South-West), Ebonyi (South-East) and Cross River (South-South). Lists of agro-dealers were obtained from the relevant agro-dealer registration units of the Ministry of Agriculture and Natural Resources and the Agricultural Development Project (ADP) in each of the states. A random sample of 50 agro-dealers was selected to give a total of 300 agro-dealers included in the study. The data were collected by trained enumerators. The questionnaire was designed to elicit information on key areas of agro-dealership such as business activities, operational costs and main constraints, sale of agro-inputs, sources of finance, demand for loan as well as the socio-economic characteristics of the agro-dealers. The selected agro-dealer enterprises were traced to a total of 100 towns across the states included in the study. The proportion of each state in the total population of the six states was used as weights in subsequent analysis to ensure representativeness of the sample. This procedure of determining the actual borrowing status of the respondents circumvents the bottleneck often faced by analysts using survey data and who are not able to obtain the actual amount of loan obtained by households due to the difficulties surrounding the release of such data by lenders. And this is the advantage of a rigorous data collection exercise of this nature in which the borrowers and lenders have to authenticate the loan data. The loan data in respect of the respondents are obtained from them and crosschecked against the figures obtained from the lenders during the survey.

Econometric Model

The analysis of demand for business loan encompasses the participation in the loan market and the factors that prompt agro-dealers to decide to borrow from the formal sources. Aside from the determinants of loan demand, such factors are crucial in understanding the functioning of the loan market and interpreting the prospects of relying on it by agro-dealers for business financing. This implies that in addition to estimating a loan demand model a choice model that describes whether or not an agro-dealer decides to borrow needs to be estimated since the decision to borrow will affect the outcome of participation (amount of loan obtained) in the loan market.

Let D^* be the loan demand of an agro-dealer based on his own valuation of his credit need and D be the market demand based on lenders' assessment of his creditworthiness. An agro-dealer

participates in the loan market if $D > D^*$ otherwise he is not considered a participant in the loan market. In the sample there is observation on D for those who participate in the market while there is no observation on D for the non-participants. For agro-dealers not in the loan market, all that is known is that $D^* \geq D$. In other words, the sample is incidentally censored and yet the need often arises to use the sample data to estimate the coefficients in a regression model explaining both D^* and D . This challenge underscores the need to model the sample selection process explicitly. A Tobit type-II model is employed to address the inherent selectivity bias. It is associated with data whose values of the regress and are not available for some observations although values of regressors are available for all the observations (Gujarati 1995; Wiboonpongse et al. 2006). The dependent variable has zero values for a substantial part of the survey data but is positive for the rest of the data. The model can be specified as follows.

$$(1) \text{ Regression equation: } d_i^* = x_i\beta_i + \varepsilon_{1i}$$

Where x_i is a vector of exogenous variables and d_i^* the value of loan obtained by the i^{th} agro-dealer. To characterize the borrowing status of the agro-dealer in terms of whether the person borrows or not, a second equation which is a binary choice model is specified as follows.

$$(2) \text{ Selection model: } b_i^* = z_i\gamma_i + \varepsilon_{2i}$$

$$(3) d_i = d_i^*, b_i = 1 \quad \text{if } b_i^* > 0$$

$$(4) d_i \text{ not observed, } b_i = 0 \quad \text{if } b_i^* \leq 0$$

where b_i^* is a latent endogenous variable and z_i is a vector of exogenous variables determining whether an agro-dealer will borrow or not. If b_i^* is greater than a threshold value of zero, then b_i , the observed dummy variable = 1 and otherwise $b_i = 0$. The regression equation observes value d_i (value of loan) only for $b_i = 1$ (i.e for the borrowers). The distribution assumption for the unobserved errors ($\varepsilon_{1i}, \varepsilon_{2i}$) is a bivariate normal with expectation zero, variances σ_1^2 and σ_2^2 and covariance σ_{12} . The signs and magnitude of the estimated coefficients may differ across equations (1) and (2).

The model is estimated in accordance with the Heckman (1979) two-step procedure. The estimation is based on the following regression.

$$(5) d_i = x_i\beta_i + \sigma_{12} \lambda_i(z_i\hat{\gamma}_i) + v_i$$

where $\lambda_i = \frac{\phi(z_i\gamma_i)}{\Phi(z_i\gamma_i)}$ is the Heckman's lambda otherwise known as the inverse Mills' ratio, $\phi(\cdot)$ is the standard normal density function while $\Phi(\cdot)$ is the standard cumulative distribution function. The estimation task is to use the observed variables (d , x , b , z) to estimate the regression coefficients β that are applicable to the sample of agro-dealers whose values of d equal both 1 and 0. The contents of the λ_i term are estimated by a first-step maximum likelihood probit model regression of b_i on z_i . The second step is to estimate the regression model using ordinary least squares with the estimated bias term (inverse Mills' ratio) as an explanatory variable. A positive coefficient on the inverse Mill's ratio suggests that unobservables in the

probit equation that increase the probability of participating in the loan market also increase the amount of loan obtained (Heckman 1979; Halkos 2007; Pastrapa 2009).

The predictors included in the probit model are indicated as follows.

$$b_i = \gamma_0 + \gamma_1 \text{AGE} + \gamma_2 \text{DEBT} + \gamma_3 \text{SAVINGS} + \gamma_4 \text{CUSTOMER} + \gamma_5 \text{REGION} + \gamma_6 \text{ASSOC} + \varepsilon_{1i}$$

The estimating equation for loan demand has the following variables.

$$d_i = \beta_0 + \beta_1 \text{IR} + \beta_2 \text{SAVINGS} + \beta_3 \text{ASSET} + \beta_4 \text{REGION} + \beta_5 \text{LSOURCE} + \varepsilon_{2i}$$

Where d_i is value of loan and b_i is a dummy variable with a value of unity if agro-dealer is a borrower and zero otherwise. AGE is the age of the agro-dealer in years, DEBT is the amount owed and SAVINGS amount saved before loan application, CUSTOMER refers to the number of farmers patronizing the agro-dealer while REGION is a dummy variable for geographical location with a value of unity if agro-dealer operates in the northern part of the country and zero otherwise. The variable ASSOC is also a dummy with a value of unity if agro-dealer belongs to at least one agro-dealer association and zero otherwise while LSOURCE refers to source of formal loan with a value of unity if source is a bank and zero otherwise. The variable IR refers to interest rate while ASSET is the value of key physical assets owned by the agro-dealer.

Empirical Results

Opportunities and Constraints on Agro-dealership

The economic liberalization policies of government over the last one decade have created some opportunities within the private sector to permit entrepreneurs play an active role in the agricultural input distribution system. These opportunities should be recognized even in the presence of legendary constraints that seem to have stymied rapid development in the system. The identified opportunities include (i) availability of private sector companies with experience in importation and marketing of agricultural inputs, (ii) growing private sector capacity for imports and marketing of agricultural inputs, (iii) rapidly developing retail outlets for agro-inputs, (iv) policy emphasis on agro-dealers' services under the on-going agricultural transformation agenda (ATA). These opportunities need to be reinforced and at the same time the overwhelming constraints militating against the development of the agro-dealer sector need to be diagnosed and tackled.

Specifically, the financial constraints facing agro-dealers will have to be addressed to enable them participate effectively in the input market in accordance with the targets set for the ATA. To enhance their overall performance in carrying out their operations, it will also be necessary to relax the operational, logistic and marketing constraints. We found that the problem of inadequate skills needed for financial management, business planning, marketing, and forecasting of demand and supply is more severe in the north than south and among the female agro-dealers than their male counterparts implying that varying intensity of remedial measures will apply in different geographical domains taking due cognizance of gender disparities in skill

gaps. With regard to input marketing, the main marketing problems are inadequate number of input suppliers, irregular input supply, poor quality of inputs supplied, high prices charged by input suppliers and low customer demand for some inputs. Moreover, there are policy-related hurdles to be surmounted in ensuring effective agro-dealership. These include the weak regulatory framework for the control of product quality and for preventing anti-competitive behavior of importers and major distributors. The availability of adulterated products in the market frustrates the business of genuine dealers in view of the tendency to lose customers and face reduction in turnover. Similar effects have also been experienced on account of the inability of government to effectively monitor and enforce existing regulations thereby resulting in the sale of expired chemicals by some unscrupulous agro-dealers.

Some Features of Agro-dealers' Business Operations

The agro-dealer sector in Nigeria remains largely informal as evidenced by the fact that only about 38 percent of the agro-dealers' businesses are officially registered as business enterprises. This characteristic of the agro-dealer sector shows that it is still largely underdeveloped. The sector will require substantial upgrading if it is to be in a position to effectively perform the role assigned to it under the current agricultural transformation agenda.

Gender and regional differentiations are clearly reflected in the pattern of agro-dealership in Nigeria. We found that the proportion of agro-dealers selling all the three inputs is far higher in the south than north just as it is much higher among women than men. Areas and dealers with such diversity of business operation are likely to better address cash-flow problems and expand market share than situations where the focus is only on one product. The dominance of women in various combinations of agro-dealership is remarkable. There are regional and inter-regional gaps to be filled as well as gender and trans-gender gaps to be addressed to ensure that an increasingly higher number of agro-dealers are empowered to attain a viable business registration status in no distant future. This finding makes it imperative for policy makers to ensure that any policy incentive for the development of agro-dealership in the country gives due recognition to the participation of women irrespective of their scale of operation. Moreover, the proportion of agro-dealers that do not belong to any association is lower in the north than south whereas the proportion that belongs to more than two associations is higher in the south than north. In general therefore, membership of agro-dealer associations is relatively higher in the north than south whereas the diversity of membership is more prevalent in the south than north indicating the tendency of southern agro-dealers to have greater combination of inputs which they sell to farmers than it is the case in the north. This finding is of significant policy relevance as it points to the need to nuance the design of training programmes for agro-dealers across the regions and to redefine the curriculum to address the inherent product diversity among them.

Besides, the results show that the diversity of coverage of input to be sold to farmers diminishes with increases in the scale of operation. In the case of fertilizer, specialization increases with scale of operation (Figure 1). The proportion of agro-dealers at the micro-scale level selling only fertilizers is about 35 percent; it increases to 50 percent at the small-scale level, 62 percent at the medium-scale level and 80 percent at the large-scale level; implying that the large-scale operators are far more interested in selling fertilizers than other inputs.

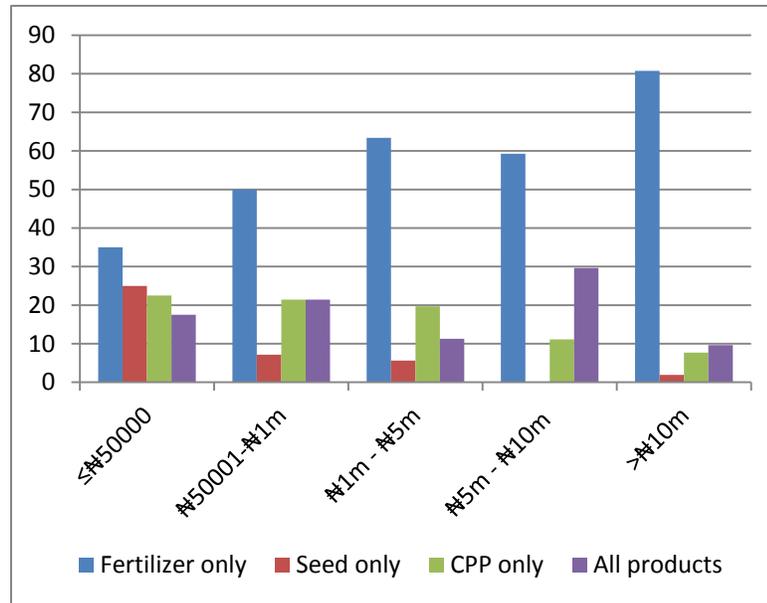


Figure 1. Dealership Status and Turnover of Agro-dealers

Factors Influencing Agro-dealers Borrowing Decision

The level of participation of agro-dealers in the formal loan market is still below expectation. Out of the sample of agro-dealers included in this study only 30 percent are borrowers; the remaining 70 percent are non-borrowers. As shown in Figure 2, there seems to be no perceptible difference between the level of participation of male and female agro-dealers. Even on regional basis, we found only a slight increase in the proportion of borrowers in the north compared to their counterparts in the south.

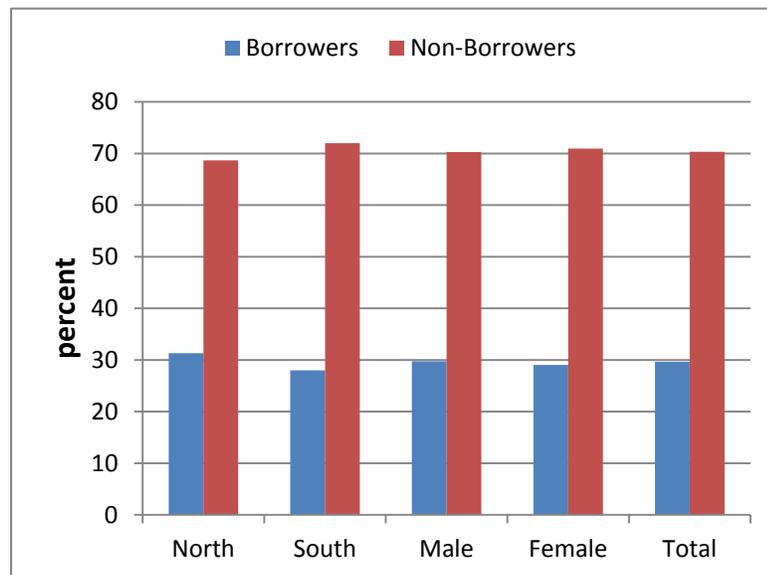


Figure 2. Borrowing Status of Agro-dealers by Region and Gender

The reasons for limited flow of external funds into the agricultural input supply chain are not far-fetched. More often than not, the banks have always been at the receiving end of the blames. On the demand side, there is need to examine the decisions of the agro-dealers and ascertain the factors that influence their decisions and whether some elements of these factors also determine their demand for loans. An in-depth analysis of these issues prompted the estimation of the probit model. The results are presented and discussed in this section.

As shown in Table 1 the significant predictors of participation in the loan market are age, debt, customer outreach, membership of associations and asset value. The marginal effects of these variables are shown in Table 2. The variables seem to have no significant effects are agro-dealers' business experience, educational attainment and location (region). The results show that the probability to participate in the loan market is higher among agro-dealers that belong to trading associations than their counterparts who are not affiliated to any of such associations. There is also a higher probability among the older agro-dealers to decide to borrow compared to the younger ones. On the one hand, agro-dealers with higher asset value and larger customer outreach may decide not to borrow while on the other hand, those whose level of indebtedness is higher (that is, borrowers with better borrowing experience) are likely to decide to participate in the loan market. The change in probability of participation is indeed extremely slim with regard to debt and asset value compared to the observed changes in the case of age, membership of association and customer outreach. This is evident in the marginal effects which are far more perceptible in the case of the three latter set of variables than the former set. For instance, an additional year of age is apt to raise the probability of being in the loan market by 5.3 percentage points. Also, if an agro-dealer belongs to a trading association, the probability of participating in the loan market is apt to increase by about 21.9 percentage points. Moreover, a marginal increase in customer outreach may reduce the borrowing probability by 0.04 percentage points.

Table 1. Probit Model of Agro-dealers' Borrowing Decision
Dependent Variable: Agro-dealers' Borrowing Status (Dummy)

Variable	Coefficient	S.E.	P[Z >z]
Age (years)	0.161***	0.046	0.000
Value of assets (₦)	-8.72e-07**	4.07e-07	0.032
Agro-dealership experience (years)	-0.035	0.064	0.579
Educational attainment (years)	0.064	0.059	0.288
Debt (₦)	1.20e-05***	2.62e-06	0.000
Membership of association	0.940**	0.500	0.060
Region (North/South)	-0.051	0.217	0.815
Customer outreach (no.)	- 0.0011**	0.0005	0.041
Constant	-2.736***	0.598	0.000

Log likelihood = -150.11

LR chi2(8) = 64.60

Prob > chi2 = 0.000

Pseudo R2 = 0.18

Number of obs = 300

Table 2. Marginal Effects of the Variables in the Probit Model

Variable	Coefficient	S.E.	P[Z >z]
Age (years)	0.053***	0.015	0.000
Value of assets (₦)	-2.88e-07**	0.000	0.033
Agro-dealership experience (years)	-0.011	0.021	0.580
Educational attainment (years)	0.021	0.019	0.288
Debt (₦)	3.97e-06***	0.000	0.000
Membership of association	0.219***	0.069	0.002
Region (North/South)	-0.017	0.071	0.815
Customer outreach (no.)	-0.0004**	0.0002	0.040

Source. Author's computation

Note. ***significant at one percent level

**significant at five percent level

*significant at ten percent level

Determinants of Demand for Business Loan by Agro-dealers

The agro-dealers obtained loans from banks and non-bank sources in 2012 from three types of banks. They are commercial banks, microfinance banks and Bank of Agriculture. As mentioned earlier, the non-banks refer to the on-lending schemes of various state governments. About 84 percent of the agro-dealers obtained loans from banks while 16 percent obtained loans from the non-bank sources. Female agro-dealers rely solely on banks unlike their male counterparts that have access to both sources. The fact that females are not observed to have access to non-bank sources stems from the limited number of female agro-dealers that are participating in the loan market. Out of the borrowers in the sample, only 10 percent are females. The problem seems more of a general lack of access rather than deliberate exclusion from the on-lending schemes. Moreover, demand for loan from non-bank sources in the south is below national average compared to the situation in the north. This finding could be due to the variation of the implementation mechanisms of the on-lending schemes and more importantly to the fact that some states in the south did not even bother to seize the opportunity offered by the terms of the CACS and simply prefer not to borrow the amount (up to ₦1.0 billion) meant for on-lending.

The determinants of demand for loan are examined on the basis of the Tobit type-II model earlier specified. The results of the two-step Heckman sample selection correction analytical procedure are presented in Table 3. The adjusted standard error for the demand equation regression is given by σ ($\hat{\sigma} = 1.0703$) and the correlation coefficient between the (unobserved) factors that determine selection into the loan market and the (unobserved) factors that determine demand for loan is given by ρ ($\hat{\rho} = 0.7970$). The statistic labeled ' λ ' which is the estimated non-selection hazard or inverse Mills' ratio ($\lambda = \sigma \times \rho$) is positive and statistically significant. This suggests that the error terms in the selection (probit) and demand (regression) equations are positively correlated as expected (the real basis for the selection bias). Evidently the (unobserved) factors that make participation in the loan market more likely, have a tendency to be strongly associated with higher loan demand. Fitting the loan demand model through a direct application of OLS to the sample would mean that the selectivity bias is ignored and would have resulted in biased and inconsistent estimates. It is not in all cases that an empirical

analysis of this nature will justify the application of type-II Tobit model; much depends on the nature of the data and the relevance of the predictors. In a similar analysis (Wiboonpongse et al. 2006), the coefficient of the lambda statistic was not found to be significant and the null hypothesis that there is no correlation between the error terms in the selection probit and demand equations could not be rejected. The significance of *lambda* and other test statistics as well as the estimated coefficients as shown in Table 3, is an indication that the estimation of a Heckman selection model in this study is justified.

Table 3. Results of Heckman Selection Correction Model of Loan Demand by Agro-dealers in Nigeria

Dependent Variable: Amount of Formal Loan Obtained(Semi-log specification)

<i>Estimated Demand Model</i>	Coefficient	S.E.	P> t
Interest rate (%)	-0.148**	0.073	0.042
Age (years)	0.118	0.077	0.125
Value of assets (₦)	1.89e-06**	1.14e-06	0.098
Agro-dealership experience (years)	-0.030	0.083	0.716
Debt (₦)	6.95e-06***	3.08e-06	0.024
Membership of association	1.004	0.928	0.279
Credit source	1.386***	0.250	0.000
Constant	7.448***	1.668	0.000
<i>Estimated Selection Model</i>			
Age (years)	0.157***	0.046	0.001
Value of assets (₦)	-9.02e-07**	4.13e-07	0.029
Agro-dealership experience (years)	-0.058	0.066	0.381
Educational attainment (years)	0.052	0.059	0.372
Debt (₦)	1.23e-05***	2.66e-06	0.000
Membership of association	0.945**	0.508	0.059
Region (North/South)	-0.022	0.217	0.917
Customer outreach (no.)	-0.0012**	0.0005	0.030
Constant	-2.657***	0.599	0.000
<i>Mills</i>			
Lambda	0.853*	0.508	0.094
Rho	0.7970		
Sigma	1.0703		
Wald chi2(7)	= 46.65	Prob > chi2	= 0.0000

Source. Author's computation

Note. ***significant at one percent level

**significant at five percent level

*significant at ten percent level

The results show that four out of the seven variables included in the regression equation are significant determinants of demand for loan. The variables are interest rate, debt, value of asset, and source of credit. The coefficients of age, business experience and membership of association are not statistically significant even though age and membership of association have significant influence on the decision to participate in the loan market. The coefficients of elasticity of the

variables in the demand model are presented in Table 4. As expected the coefficient of interest rate is negative and statistically significant. The results show that an increase in the rate of interest by one percent is associated with a reduction of 0.05 percent in the value of loan. A change from non-bank to commercial bank sources is associated with an increase of 0.11percent in the value of loan. Also, if the amount of debt increases by one percent it is likely to be associated with 0.01percent increase in the demand for loan. The implications of these findings for improved financing of agro-dealership are quite succinct. The financing from commercial bank sources should be strengthened since it is apt to provide better access to a higher value of loan than non-bank sources. Moreover, the role of membership of input trading association in enhancing the creditworthiness of agro-dealers is very crucial. This should be vigorously promoted in the country to unleash the inherent social capital and information advantages for improved agro-dealership financing.

Table 4. Elasticity Coefficients of the Variables in the Heckman Selection Correction Model

Variable	Coefficient	S.E.	P[Z >z]
Interest rate (%)	-0.052**	0.025	0.043
Age (years)	0.089	0.062	0.151
Value of assets (₦)	0.021*	0.012	0.085
Agro-dealership experience (years)	-0.006	0.016	0.718
Debt (₦)	0.012**	0.005	0.043
Membership of association	0.093	0.089	0.295
Credit source	0.114***	0.023	0.000

Source. Author's computation

Note. ***significant at one percent level

**significant at five percent level

*significant at ten percent level

Policy Recommendations and Conclusions

This study sought to examine the constraints and opportunities for agro-dealership financing in Nigeria, analyze the business operations of agro-dealers and ascertain the factors influencing their participation in the loan market especially their borrowing decisions and determinants of loan demand. This is with a view to proffering policy measures for improved agro-dealership financing for effective input distribution under the agricultural transformation agenda in the country. In this regard this section presents the policy recommendations and round off with some concluding remarks.

Policy Recommendations

It is important to stress that the essence of a review of the role of agro-dealers in the implementation of GES scheme is to provide evidence-based information for policy decision making with regard to agro-dealership financing in the overall interest of the stakeholders in the agricultural sector. To my mind, an overhauling of agro-dealership financing is warranted on the strength of the findings of this study. The strategy of moral suasion adopted by the Federal Government to convince the banking sector about the need for improved financing of agro-dealership is desirable and should continue unabated. Financing from commercial bank sources should be strengthened since it is apt to provide the agro-dealers better access to a higher value

of loan than non-bank sources. The following financing mechanisms and complementary measures are recommended for sustainable agro-dealership financing in the country.

Value Chain Financing

Agro-dealers procure inputs from three main sources namely; importers, input distributors and retail market. Majority of the agro-dealers (68 percent) purchase their inputs from distributors, 22 percent purchase from importers while only 12 percent purchase from the retail market. To augment the financing from the banking sector, key participants in the agro-input supply chain

can provide some form of financing. The approach being suggested here will involve the participation of commercial banks, importers, major input distributors, large-scale agro-dealers, microfinance banks, bank of agriculture as well as small and medium-scale agro-dealers. The federal government is expected to play a facilitating role by providing incentives in the form of loan guarantees to reduce the risk associated with lending by commercial banks. This can be achieved through the instrumentality of NIRSAL – the Nigerian incentive-based risk sharing system for agricultural lending currently being implemented in the country. In this value chain financing approach not all the players in the input distribution network will have to approach banks for loans. The commercial banks will lend directly to importers and major distributors who are expected to provide financial support to large-scale agro-dealers in the form of trade credit. The large-scale agro-dealers in turn will provide trade credit to agro-dealers (SMEs) who are in need of financial support. The latter can also obtain loan directly from microfinance banks and the bank of agriculture. To strengthen effective demand from farmers and to expand agro-dealers turnover, financial support can also be extended from the large-scale agro-dealers to the farmers. The farmers can also benefit directly from loans specially packaged by bank of agriculture (BOA) to finance the purchase of modern inputs by farmers and thus complete the cycle of financial support key actors in this value chain financing approach (Figure 5).

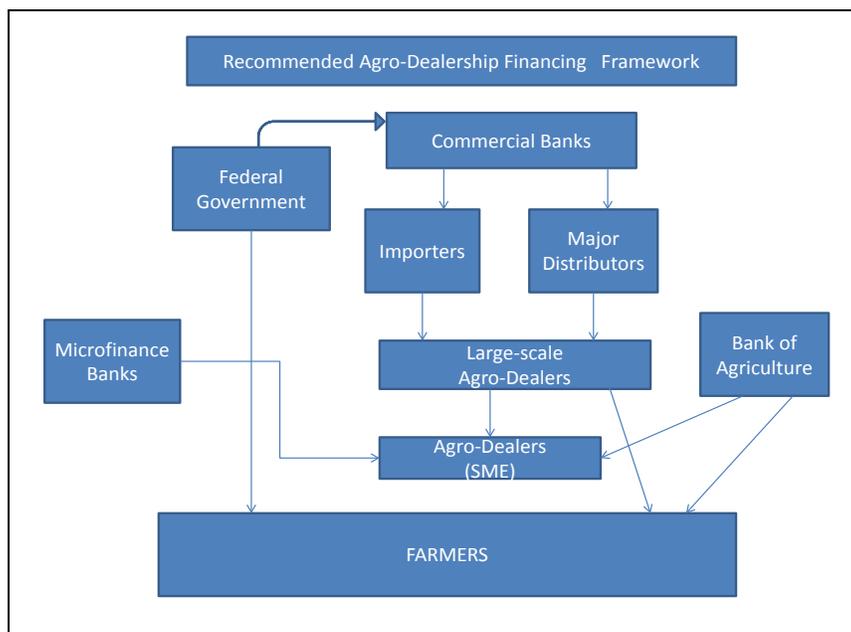


Figure 5. Recommended Agro Dealership Financing Framework

Build Human Capital for Improved Agro-dealership

As attempts are being made to modernize the distribution of agricultural inputs there is need to develop the variety of skills required for effective performance of the distribution system. Business, financial management and technical skills of key players such as importers, wholesalers and retailers have to be developed by implementing training programs in different parts of the country. Such programs can be financed through public-private-partnership (PPP) arrangements involving the FMARD, commercial banks, development partners and specialized NGOs. The technical training should cover all inputs rather than focusing only on fertilizer. There is need also to build human capital in the public sector to provide the regulatory framework and strengthen the enforcement of extant rules regarding standard and quality control.

Support the Development of Agro-input Trading Associations

The role of membership of input trading association in enhancing the creditworthiness of agro-dealers is very crucial. This should be vigorously promoted in the country to unleash the inherent social capital and information advantages for improved agro-dealership financing.

Curbing Agro-dealers' Black Market

Effective monitoring of business operations of agro-dealers involved in the GES scheme is crucial to prevent undue segmentation of the input market to the disadvantage of small-scale farmers. Essentially, there is need to ensure that the inputs are redeemed in the true sense of it rather than being allowed to be re-allocated, repurchased or repossessed in any way by any agent in the process of delivery to farmers. One way of sanitizing the market is to ensure that the farmers registered are genuine farmers. Second is to ensure that GESS participating farmers are not only eligible but also have effective demand for the inputs.

Sustainability of Government Support for Input Market Transformation

Three policy actions are required to address the issue of sustainability of current reforms involving agro-dealers and the general private-sector orientation of input procurement and distribution. Currently the GES is an incentive not only to the farmers but also to the importers, distributors and suppliers.

First, is a legislation to uphold recent reforms in the input sector in general and fertilizer, in particular. In this regard actions have reached an advanced stage to prepare a new fertilizer law that will effectively liberalize the fertilizer sector, facilitating private sector involvement and investment, and providing for regulatory oversight. When passed into law, the new bill being crafted (the Fertilizer Quality Control Bill) will repeal the National Fertilizer Board Act and the Fertilizer (Control) Act and will provide for a capacity to monitor the importation, manufacture and distribution of fertilizer and related products and quality control and assurance for fertilizer products. The existing Federal Department of Fertilizer (under FMARD) is expected to be the implementing agency. It is expected that the National Assembly will expedite action to pass the bill before the end of 2013 so that the implementation of the various provisions can start in earnest.

Second, is the need to put in place an exit strategy for the financial support before it spawns an unbearable fiscal impact. In this connection, FMARD needs to intensify efforts to expand the network of agro-dealers. If the participation of private entrepreneurs is increased then the input distribution market is apt to be far more competitive than it is currently the case and thus curb undue escalation of prices. This is important because there are farmers whose need for inputs will be far higher than the quantity covered by the GES scheme. Hence, creating healthy competition in the input market through substantial increase in the number of dealers and suppliers will prevail on agro-dealers to keep input prices at competitive levels so as not to adversely affect the demand by small-scale farmers.

Third, is for the Federal and state governments to create incentives for increased domestic production of fertilizers and crop protection chemicals and facilitate private sector involvement in the production of certified seeds. For instance, the Federal Government through the Nigeria chapter of the West Africa Agricultural Productivity Programme (WAAPP) has designed strategies to support the upstream segment of the input supply chain of prioritized crops under the ATA. Under the program, public agencies (including universities and research institutes) and commercial firms are being mobilized and funded to increase the production of breeder and foundation seeds.

Conclusions

The ongoing agricultural transformation agenda in the country has huge potential to create a considerable expansion in the quantity of modern inputs required by farmers and thus opening up a large window of demand for loan to finance the necessary transactions. The equity capital of agro-dealers and finance from informal sources are grossly inadequate to bridge the financing gaps that have emerged since the total liberalization of the input market in 2011. In the light of the foregoing, it is important to stress that the liberalization of the input procurement and distribution market and assignment of a crucial role to agro-dealers in the input supply chain, require the assurance of external flow of funds for proper functioning of the supply chain. Finance must flow from the banking sector which is expected to be catalyzed through the instrumentality of the Nigerian Incentive-based Risk Sharing for Agricultural Lending (NIRSAL) and from the importers, distributors and suppliers of inputs in the form of value chain financing. However, to have a better functioning of the input market and improved service delivery by agro-dealers, finance-related policies will not suffice. Finance will not be a substitute for missing input markets nor will it be the panacea for the critical infrastructural deficits, social insecurity and low effective demand by agro-dealers' customers which may on the long run have adverse effect on profitability. Thus, skill gaps in financial management, business planning and inventory management need to be bridged.

Furthermore, diversification of product coverage by agro-dealers is likely to enhance their credit rating. However, it is important to stress that efforts to ensure greater diversification of product coverage will need to be cognizant of the regional and gender variations in the existing pattern of agro-dealership as revealed by this study. In the same vein efforts aimed at expanding the scale of operation of agro-dealers in terms of financial incentives and skill development will need to be far more inclusive than hitherto has been the case especially to level the playing field for female agro-dealers. Finally, the low effective demand is symptomatic of a sector-related

conundrum in terms of the possibility of the agro-dealers turnover being adversely affected by limited purchasing power of farmers. This implies that efforts aimed at improving the input distribution system may not yield the desired outcome unless there is a simultaneous transformation of the output marketing system to enhance farmers' access to remunerative output markets and to stabilize their income. Policy actions in these areas should therefore, be expedited and evidence-based support to nurture the process is a strongly recommended area of further research.

Acknowledgements

This paper emanates from a research project on agricultural financing in Nigeria funded by the International Food Policy Research Institute (IFPRI). The author deeply appreciates IFPRI's contribution in this regard. The views expressed in this paper are those of the author. Publication does not imply endorsement by IFPRI nor any of its Programs of any of the views expressed.

References

- Absanto, G. and D. Aikaruwa. 2013. Credit Rationing and Loan Repayment Performance: The Case Study of Victoria Savings and Credit Cooperative Society, *Global Advanced Research Journal of Management and Business Studies* 2(6):328-341
- Ahiawodzi, A. K. and F. G. Sackey. 2013. Determinants of Credit Rationing to the Private Sector in Ghana. *African Journal of Business Management* 7(38):3864-3874
- Beck T. 2007. Financing constraints of SMEs in developing countries: Evidence, determinants and solutions. *Journal of International Money and Finance* 31(2): 401-441.
- Diagne, Aliou. 1999. "Determinants of Household Access to and Participation in Formal and Informal Credit Markets in Malawi." Food Consumption and Nutrition Division Discussion Paper No. 67, International Food Policy Research Institute, Washington, D.C.
- Eneji, M. A., R. Umejiakwu, O. Sylvannus and I. Gwacham-Anisiobi. 2013. The Demand for Credit, Credit Rationing and the Role of Microfinance- Evidence from Poor Rural Communities in Cross River state. *Science Journal of Economics* 13.doi:10.7237/sje/139.
- Gujarati, D. N. 1995. Basic Econometrics, 3rd Edition, McGraw-Hill, Inc. USA.
- Halkos, G. 2007. Econometrics. *Theory and Practice: Instructions in using Eviews, Minitab, SPSS and Excel*. Athina: V. Gkiourdas.
- Han, L. 2008. Bricks Vs Clicks: Entrepreneurial online banking behaviour and relationship banking. *International Journal of Entrepreneurial Behaviors & Research* 14 (1):17-60.

- Heckman, J. 1979. Sample Selection Bias as a Specification Error. *Econometrica* 47(1): 153-161.
- IFDC. 2012. Nigeria Agro-Dealer Support (NADS) Project Summary. International Fertilizer Development Centre (IFDC), Abuja. Nigeria
- Kundid, A. and R. Ercegovac. 2011. Credit rationing in financial distress: Croatia SMEs' finance approach. *International Journal of Law and Management* 53 (1):62-84.
- Maziku, Martha. 2012. "Credit Rationing for Small and Medium Scale Enterprises in the Commercial Bank Loan Market", Paper Presented at REPOA (Research for Poverty Alleviation) 17th Annual Research Workshop. Salaam, Tanzania, March 28-29.
- Muravyev, A., T. Oleksandr and D. Schäfer. 2009. Entrepreneurs' Gender and Financial Constraints: Evidence from International Data. *Journal of Comparative Economics* 37 (2): 270-286.
- Okurut, F. N., A. Schoombee and S. Van der Berg. 2005. Credit Demand and Credit Rationing in the Informal Financial Sector in Uganda. *South African Journal of Economics* 73(3):481-497.
- Pastrapa, E. 2009. "Estimating the Determinants of Loan Demand: The Case of Greek Households." Department of Home Economics and Ecology, Harokopio University, Athens, Greece.
- Sanusi, W. A. and I. A. Adedeji. 2010. A Probit Analysis of Accessibility of Small-Scale Farmers to Formal Source of Credit in Ogbomosho Zone, Oyo State, Nigeria. *Agricultural Tropica et Subtropica* 43 (1):
- Stiglitz, J. E. and A. Weiss. 1981. Credit Rationing in Markets With Imperfect Information, *American Economic Review* 71(3):393-410.
- Vera, L. V. 2002. The Demand for Bank Loans in Venezuela: A Multivariate Cointegration Analysis. University of Oxford, St Antony's College, Oxford OX2 6JF, United Kingdom. (mimeo).
- Wiboonpongse, A., S. Sriboonchitta and Y. Chaovanapoonphol. 2006. "The Demand for Loans for Major Rice in the Upper North of Thailand." Contributed Paper Prepared for Presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia; August 12-18.
- Williamson, S. 1987. Costly monitoring, loan contracts, and equilibrium credit rationing. *Journal of Monetary Economics* 18:159-179.
- Wolfson, M.H. 1996. A Post Keynesian theory of credit rationing. *Journal of Post Keynesian Economics* 18: 443-470.



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Risk Communication and Market Effects during Foodborne Illnesses: A Comparative Case Study of Bacterial Outbreaks in the U.S. and in Germany

Vera Bitsch[Ⓐ], Nevena Koković^ᵇ and Meike Rombach^ᶜ

^ᵃ*Professor, Chair of Economics of Horticulture and Landscaping,
Technische Universitaet Muenchen, Alte Akademie 16, 85354 Freising, Germany*

^ᵇ*Research Associate, Chair Group Economics of Horticulture and Landscaping,
Technische Universitaet Muenchen, Alte Akademie 16, 85354 Freising, Germany*

^ᶜ*Research Associate, Chair Group Economics of Horticulture and Landscaping,
Technische Universitaet Muenchen, Alte Akademie 16, 85354 Freising, Germany*

Abstract

The study analyzes two cases of E. coli outbreaks related to fresh produce, in the U.S. in 2006, and in Germany in 2011. The case analysis built on previous research how media coverage of foodborne illnesses influenced consumers' risk perception. Reports by national newspapers and other targeted media, and official press releases and reports were compared. Market data and consumer purchasing behavior before and after the outbreak were analyzed for vegetables involved. Results show that media coverage and releases by governmental authorities affected consumer purchasing behavior in both cases. Furthermore, consumers seem to trust in official advisories, in both countries.

Keywords: consumer purchasing behavior, enterohemorrhagic E. coli (EHEC), food safety, fresh produce, fruit and vegetable production, media analysis, qualitative content analysis, risk event, shiga toxin-producing E. coli (STEC).

[Ⓐ]Corresponding author: Tel: + 49.8161.71.2532
Email: V. Bitsch: bitsch@tum.de

Introduction

Worldwide, food safety and consumer trust are frequently at the center of media attention. Foodborne illnesses such as the Bovine Spongiform Encephalopathy (BSE) in 1996, several outbreaks of foot-and-mouth disease after 2000, and the European horse meat issue in 2013 affect entire food supply chains. In addition, outbreaks of foodborne illnesses, many of them caused by bacteria, happen in developed as well as in emerging countries. Many smaller outbreaks go unnoticed. Larger outbreaks trigger public attention, since they show public health vulnerability, and impose high costs on society (Tauxe et al. 2010). Also, media influence the perception of foodborne illnesses by selectively publishing information (Shan et al. 2013), and contributing to increased risk perception of consumers (Chen 2008; Swinnen et al. 2005).

In the past two decades, an increasing number of foodborne illnesses have been associated with the consumption of fresh fruits and vegetables (Calvin 2007; Klonsky 2006). Painter et al. (2013) attribute 46% of foodborne illnesses in the U.S. to fresh produce. A change in eating habits, such as the consumption of raw or lightly processed fruits and vegetables, contributes to the occurrence of outbreaks (Parker et al. 2012). *Escherichia coli* (*E. coli*) is among the pathogens that cause the majority of foodborne illnesses (Calvin 2007).

The study focusses on two cases of *E. coli* outbreaks linked to fresh vegetables, in the U.S. and in Germany. In 2006, 205 people in 26 U.S. states were infected by a Shiga toxin-producing strain of *E. coli* (STEC), later attributed to contaminated spinach. Five years later, in 2011, an STEC outbreak in Germany infected 3,842 consumers and led to 53 deaths, attributed to fenugreek sprouts. Both cases stand out with regard to the number of illnesses and deaths, public attention, and market and industry response, compared to other recent foodborne illness outbreaks linked to fresh produce (Calvin 2007; Saggau 2012).

Both outbreaks also caused substantial economic and reputational damages to vegetable producers, retailers, and governmental authorities. In the U.S., estimated costs to the industry were \$200 million. Many spinach growers ploughed under their fields or stopped planting new produce due to the decrease in demand. Retailers and foodservice buyers cut back orders, or even removed spinach from their assortment for a period (Arnade et al. 2008, 5-6). In the European Union (EU), including Germany, estimated losses to the vegetable sector were over \$1,000 million (1€ = 1.3920 US\$, European Central Bank 2011). To mitigate damages, the EU supported farmers in 22 member states with over \$300 million (European Commission, EC 2011). In both countries, regulations require the recall of all produce identified as cause of an outbreak. Each recall results in high costs to retailers and suppliers, followed by reputational damage, and at times product liability litigation (Onyango et al. 2007; Pouliot and Sumner, 2013). In both cases, outbreaks also had consequences for international trade. Mexico and Canada refused spinach shipments from the U.S. during the outbreak, and Russia banned imports of German fresh produce (EC 2011; Maysenhalder et al. 2007).

The 2006 outbreak raised questions about food safety standards of the entire supply chain in the U.S. (Pouliot and Sumner 2013). Before, producers applied good agricultural practices (GAPs), or other commodity-specific food safety standards on a voluntary basis. In their study of regulatory frameworks regarding food safety, Goldsmith et al. (2003) pointed out how numerous

system failures had occurred in the U.S., without leading to timely reform. Similarly, Labrecque and Charlebois (2006), after comparing the BSE cases 1996 in Britain and 2003 in Canada, claimed that the Canadian beef industry and government failed to learn from the British case. They argued that the Canadian and the U.S. food safety systems were unable to change legislation due to conflicting interests. The 2006 STEC outbreak, triggered the introduction of several additional voluntary food safety programs, such as California Leafy Green Products Handler Marketing Agreement in 2007. In addition, in 2011, the U. S. government legislated the Food Safety Modernization Act with the objective to develop standards required for the safe production and harvest of raw fruits and vegetables (Calvin 2013).

In Germany, comparable food safety standards were already established before the 2011 outbreak (Gay and Schneider 2007; Gawron and Theuvsen 2009). The European food safety framework is based on governmental regulation (Goldsmith et al. 2003). In addition to standards prescribed by law, private standards serve to increase food safety levels. In Europe, more than 300 certification schemes are in use, about 40 in Germany (Gawron and Theuvsen 2009). Market integration in the EU imposes a common approach to food safety, which requires each country to comply with EU regulation (Labrecque and Charlebois 2006). Despite stringent regulatory standards and a wide range of comprehensive certification schemes, the outbreak still occurred.

Considering the consequences of the two outbreaks, including personal tragedy and death, the study analyzes official press releases, media coverage of the outbreaks, and market reactions in the aftermath. The objective of the analysis is to highlight the commonalities and differences between the media reporting and the consumer reactions in the U.S., a country with emphasis on self-reliance and risk taking, and a legal approach to system failures, and a European country, namely Germany with an emphasis on state-reliance and the precautionary principle (see also Goldsmith et al. 2003). Specifically, the study examines the risk communication of governmental authorities and reporting of different media outlets during both outbreaks. Another objective is to explore consumer reactions to the information released by governmental authorities and media. Despite the use of market data and model-based prior studies for the assessment of market developments, the methodological approach is an explorative, qualitative case comparison.

Literature Review

Earlier studies show a strong relationship between media reporting on food safety issues, consumer perception of risks, trust in food safety, and, in the context of foodborne illnesses, consumers' purchasing behavior. Rowe et al. (2000) researched the link between the nature of newspaper reports and consumers' risk perception. They used three approaches to explain media impact on consumer behavior. The agenda-setting theory proposes that consumer opinion is not directly influenced by the media coverage. Instead the media lead to emphasizing the events. The quantity-of-coverage theory outlines that public opinion is impacted in a negative direction, independent of the nature of the risk reporting itself. The cultivation theory states that media exposure increases consumers' fears of hazardous situations relative to the degree of exposure. The frequency of repeated information increases consumers' risk perception.

De Jonge et al. (2007) measured general consumer confidence in food safety according to two distinct dimensions, optimism and pessimism. Optimism is related to a higher level of

confidence in the safety of specific products, and pessimism to a lower level. When foodborne illnesses occur, consumer optimism decreases, and pessimism increases. However, other factors, such as age, gender, and personality characteristics also influence consumers' risk perception. De Jonge et al. (2010) showed a relationship between newspaper coverage and consumer trust in food safety, depending on the recency of the media coverage. When Dutch newspaper articles from national and daily newspapers had published more recently about food contamination, consumer confidence with respect to food safety was weaker than in cases when some time had passed. It can be concluded that over time, when the release of information decreases, the effects of newspaper coverage on consumer confidence wane. In addition to the amount and novelty of information, factors such as the context in which messages are presented, disagreement between actors in the risk debate, dramatization of risk information, and framing of the message impact consumer reactions. Contrary, Verbeke (2005) found that the provision of a high amount of information can result in consumers' information overload, leading to confusion and the so-called boredom effect (see also Thøgersen 2006).

De Jonge et al. (2010) identified four determinants of consumer confidence in food safety. These are trust in regulators and actors in the supply chain, perceived safety of product groups, consumer recall of food safety incidents, and individual differences. Grunert (2002) considers consumer trust in regulators, producers, and distributors an important driver of consumer confidence in food safety. If consumers perceive producers and distributors as honest and professional, trust in food products is higher. Similarly, Berg (2004) pointed out that important factors in consumer trust in governmental authorities, producers, and distributors are consumers' perception of their expertise and honesty. De Jonge et al. (2010) added that consumers often compensate lack of knowledge regarding food products and food safety with trust in actors responsible for the management of hazards in the supply chain.

Another important aspect in analyzing consumers' risk perception is how media outlets facilitate the communication of important information to the wider community. Rutsaert et al. (2013) concluded that an accurate, fact-based, and timely message represents a potent tool in managing food-related hazards. Moreover, accurate and fact-based communication practices can bring together the knowledge of scientific experts, health practitioners, experts in industry markets, policy makers, and consumers. However, previously shaped information by journalists influence communication practices and can also lead to a number of pitfalls regarding information accuracy, source credibility, and trust. As a result, media reporting also can be the source of unwarranted panic and hysteria. Saghaian and Reed (2007) emphasize the role of media reporting, since consumers learn from previous outbreaks, leading to stronger reactions in future outbreaks. In creating a discourse of reality, media depends to a large extent on the information provided by government officials (Shan et al., 2013). Therefore, governmental authorities play a substantial role in providing objective information to all actors potentially affected by a foodborne illness (Saggau 2012). In addition to the findings discussed above, Nucci et al. (2009) emphasized the power of journalists in structuring the media agenda. Since knowledge about foodborne illnesses comes from specialists in science, medicine, or technology, journalists have a crucial role in shaping the information released, and transmitting it to the wider community.

Several studies analyzed the effects of consumers' risk perception on their consumption. Swinnen et al. (2005) argued that if a food product is perceived as particularly risky, consumers

tend to turn to substitute goods, and temporarily or even permanently avoid the affected food product (see also Saghaian and Reed 2007; Chen 2008). Media and other sources play an essential role in the process of food avoidance (Richards and Patterson 1999; McCluskey et al. 2005; Zhang et al. 2010). While negative information release has instantaneous effects on consumers' risk perception, and therefore leads to consumption losses, positive information on the outbreak status (e.g., identification of actual source, or declaration of the end of an outbreak) have a delayed influence on consumption (Liu et al. 1998; McKenzie and Thomsen 2001). Several studies confirmed that negative information on food safety leads to a decrease in demand in the short term (see Verbeke 2005). In addition, McKenzie and Thomsen (2001) observed a negative impact on price development in case of recalls due to food contamination.

The previous studies showed how media reporting influenced consumers' risk perception during outbreaks of foodborne illnesses. The recency of media coverage contributed to lack of consumer trust in food safety. Also, depending on the information provided by government officials, selective media releases shaped the public perception of food safety. Once a food product was perceived as risky, consumers tended to either temporarily substitute or permanently avoid the affected food product, which led to negative price development. Accordingly, the case study will analyze reporting of media outlets and of governmental authorities. Furthermore, the study will focus on the market situation in both countries before and after the outbreaks, and compare market developments and consumption patterns with the media coverage.

Methods

The study follows a qualitative research approach and is of an explorative nature. Qualitative research approaches are applied for different research purposes, such as description and interpretation of new or not well-researched topics, theory development, evaluation, policy advice and action research, and in research that is oriented towards future issues. Qualitative approaches also serve to add new perspectives to well researched topics, and qualify or correct existing theories (Bitsch 2005; Bitsch and Hogberg 2005). Case studies are particularly suitable for analyzing contemporary events (Westgren and Zering 1998; Kennedy and Luzar 1999). Since the 1990s, case study research has seen a renaissance in agribusiness research, and has been more widely used (e.g., Sterns et al. 1998; Mugera and Bitsch 2005; Bitsch and Yakura 2007).

The STEC outbreaks 2006 in the U.S. and 2011 in Germany were both linked to fresh produce, and, as discussed in the introduction, had a substantial toll in human suffering, as well as negative economic impacts on the vegetable sectors in the U.S. and the EU. Both outbreaks happened relatively recent, were large in scope and subject to extensive media coverage. In both cases, media reporting contributed to unwarranted panic and hysteria of consumers (Rutsaert et al. 2013), and as a consequence led to decreased retail orders and farm production.

To establish the basic timeline of events and to better understand the relationship between the reporting of the governmental authorities and the media reporting, the study examined press releases, advisories, and reports by governmental authorities, namely the U.S. Food and Drug Administration (FDA) and the Federal Institute for Risk Assessment (FIRA) in Germany. Institutions were chosen based on their duty to report to the public, and to inform about the process of outbreaks and ongoing hazardous situations. FDA and FIRA released information

during the entire period of the outbreak. FDA and FIRA web sites were used as sources of press releases, advisories, and official reports; these were compared to the selected media outlets.

To allow the cross country comparison, comparable media outlets needed to be determined for both countries. For the U.S., *USA Today*, an elite national newspaper (An and Gower 2009) was chosen to analyze media reporting on the outbreak. For Germany, *Die Welt* was selected as a comparable media outlet. *Die Welt* is a German national newspaper covering diverse fields of the economy, similar to *USA Today*. Media targeted at producers and production-related communities may report on outbreak events differently than national newspapers targeting the general public. Therefore, *The Sacramento Bee*, a local newspaper published in the region of California, where the source of the STEC was detected, was chosen in the U.S. for comparison. Because similar newspapers do not exist in Germany, *Gabot.de*, an online portal targeted at horticultural producers, was deemed sufficiently comparable.

The date frame of reporting in the U.S. started with *The Sacramento Bee*, September 16, 2006 until September 2, 2007. *USA Today* started to release information regarding the outbreak two days later, September 18, 2006, and ended on September 21, 2007. The majority of articles were released in 2006. Differently, the German reporting date frame started with the national newspaper, *Die Welt*, on May 21, 2011 and ended on May 3, 2013. The case analysis includes articles released in 2011, because afterwards only follow-up reports were published. *Gabot.de* started reporting four days later, on May 25, 2011, and ended reporting on September 20, 2011. Archives of the selected media outlets, accessible online, served as sources of relevant articles. Articles were selected based on their titles. Keywords used for the article search were *E. coli*, respectively, EHEC (in Germany, STEC are referred to as enterohemorrhagic *E. coli* or EHEC). The search was then narrowed to the years of the outbreak and the period afterwards; in the U.S., the articles retained covered 2006-7 and in Germany, 2011.

All articles were examined using qualitative content analysis. As the first step of the analysis, chain actors (i.e., consumers, farmers, retailers, and governmental authorities), and their concerns were identified. In order to explore the context and relationships among chain actors, four researchers read the relevant articles and coded the content. During the initial open coding process and discussion among the researchers, five categories, process, politics, source, value chain, and medicine, were established. The category process refers to the process of the outbreak and covers information concerning cases of illness and death, as well as the spread of the disease. The category politics includes reports on governmental institutions, and administrative bodies, such as FDA and FIRA. The category source addresses the origin of the outbreak and suspected sources. The category value chain comprises all actors in the chain from production to retail, including payments and support for farmers, litigation, and trade activities. The category medicine comprises information related to health issues and results by medical research organizations, such as new forms of therapy against STEC. To understand to what extent media reporting and official governmental reporting influenced each other, for each day of the outbreak, official press releases, and in the German case FIRA's timeline of the outbreak, were contrasted with the categories found in the media reporting.

U. S. market data on spinach and related produce served to describe how the outbreak impacted consumer purchasing. Because the U. S. Department of Agriculture (USDA) does not collect

comprehensive data on bagged spinach and salads (see Calvin, 2007), previous studies based on scanner data served as data sources (Arnade et al. 2010; Calvin 2007). For Germany, weekly, monthly, and annual market data on household purchasing, and retail prices of cucumbers were analyzed (provided by Behr, Agricultural Market Information Inc., AMI, 2013). The analysis focuses on cucumbers, because cucumbers were most affected during the outbreak. Cucumbers were among the vegetables, such as tomatoes and lettuce that had been falsely accused to be the source of the STEC outbreak before fenugreek sprouts were identified. Market data on fenugreek (or other) sprouts are not currently collected on such a differentiated level. Accordingly, a direct comparison of primary market data for the U.S. and for Germany was not possible.

Results and Discussion

The result section consists of three parts. The first part presents U. S. media reporting, and market development during the 2006 STEC outbreak. The second part focuses on the German case. Finally, both countries are compared in the third part.

U.S. Media Reporting and Market Developments

In the U.S., *USA Today* (Figure 1) and *The Sacramento Bee* (Figure 2) released 80 articles (39 and 41, respectively) during the reporting period. The highest number of articles appeared during the first three weeks of the outbreak, weeks 37, 38, and 39 of 2006. During that period, *USA Today* released 15 articles and *The Sacramento Bee* released 17 articles. Articles focused on the categories politics, source and value chain. Relatively little attention went to the categories process and medicine. Since governmental authorities reported on the state of the outbreak and advised the public, the categories policy and source also appeared more frequently in the media.

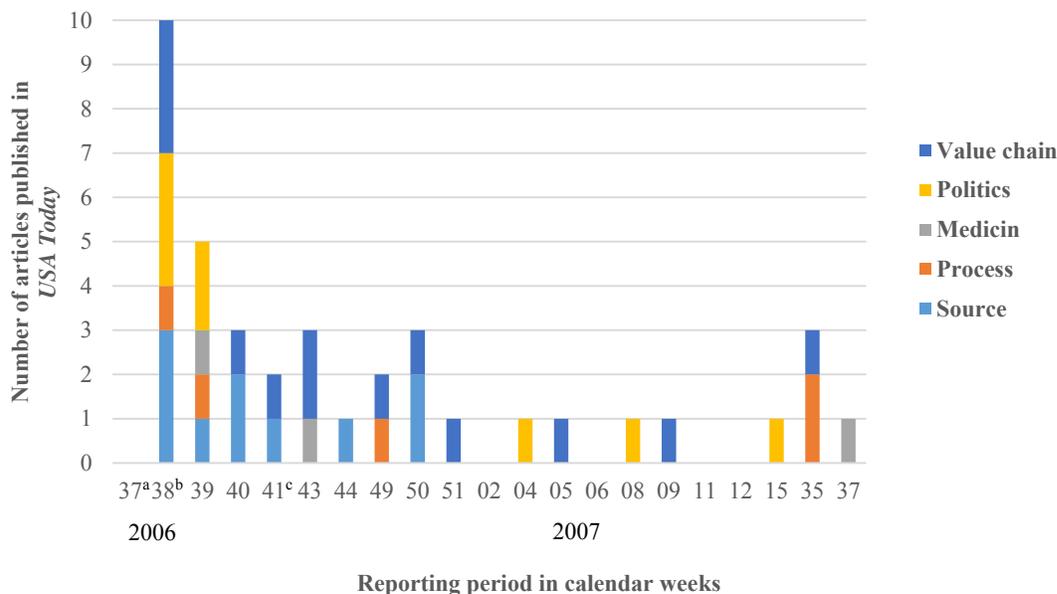


Figure 1. *USA Today* reporting on STEC outbreak in 2006

^aW37: Outbreak occurred, ^bW38: First recalls, ^cW41: Source found

In calendar week 41, the source of the outbreak was identified. In weeks 40 and 41 the number of articles decreased in both outlets, and the focus of reporting changed. *USA Today* focused on the categories value chain and source; *The Sacramento Bee* focused on the categories source, value chain and politics. The additional focus on politics of *The Sacramento Bee* is explained by its audience including producers affected by the STEC outbreak and their communities.

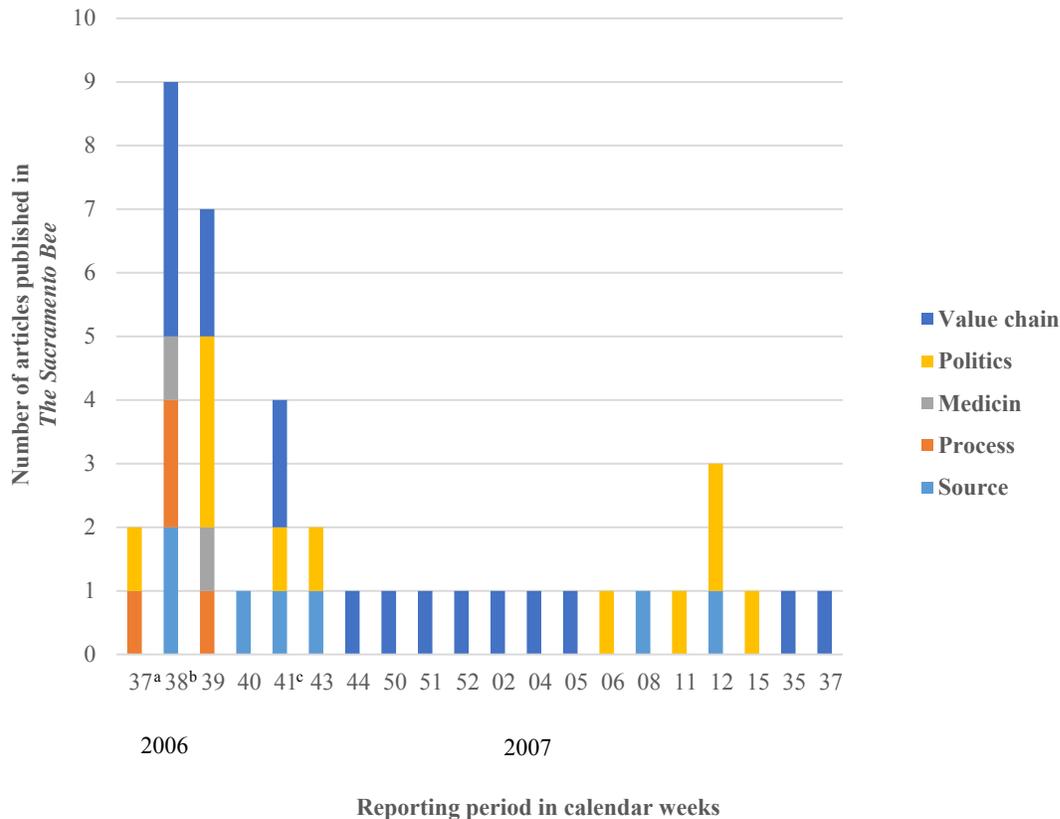


Figure 2. *The Sacramento Bee* reporting on STEC outbreak in 2006

^aW37: Outbreak occurred, ^bW38: First recalls, ^cW41: Source found

From calendar week 44 in 2006 to week 05 in 2007 differences in reporting appear. *USA Today* released articles on the value chain, the source of the outbreak, politics, and process. *The Sacramento Bee* released articles on the value chain, only. The focus on the value chain and the source is likely due to a second STEC outbreak involving lettuce and food services. From weeks 06 to 37 in 2007, *USA Today* released articles addressing the value chain, politics, process, and medicine. During that period, *The Sacramento Bee* addressed politics, the source of the outbreak, and the value chain. Finally, articles published in week 35 and 37 of 2007 recaptured events, due to the one-year anniversary of the outbreak. Each week, FDA press releases addressed similar topic: states affected by the outbreak, symptoms of STEC, consumer advice, laboratory findings, and recalls. The content of FDA releases and media reporting showed limited matching in the beginning of the outbreak. During the initial weeks, media reporting covered a broad range of topics. Therefore, matching may even have occurred accidentally.

U.S. market data show that sales of fresh-bagged spinach decreased after the recalls in 2006. After the FDA advised consumers to avoid bagged spinach, consumers started avoiding all types of spinach and other bagged salads in the short term (Arnade et al. 2008; Calvin 2007; Klonsky 2006). In addition, the spinach market closed down (Calvin 2007). Also, Calvin outlined that consumers changed their consumption habits within the leafy green category, substituting salads, such as head lettuce and Romaine, for bagged spinach. All other types of bulk leafy greens, except bulk iceberg lettuce, increased in sales (Arnade et al. 2008). After the FDA announced the end of the outbreak, sales of bagged spinach increased only slowly. Five months after the outbreak, retail sales of bagged spinach were still 27% lower than in the same period of the previous year (Calvin 2007). These findings are confirmed by Arnade et al. (2008) who stated that some retailers did not sell spinach for months after the outbreak. The lower sales can be attributed to a reduction in demand, as well as a decrease in production. However, the overall purchasing behavior shows that consumers trust in advisories of governmental authorities.

German Media Reporting and Market Developments

In Germany, *Die Welt* and *Gabot.de* released 505 articles (399 and 106, respectively) during the reporting period. The STEC outbreak occurred in week 20 of 2011. In this week, *Die Welt* started reporting on the categories process, source, and politics (Figure 3).

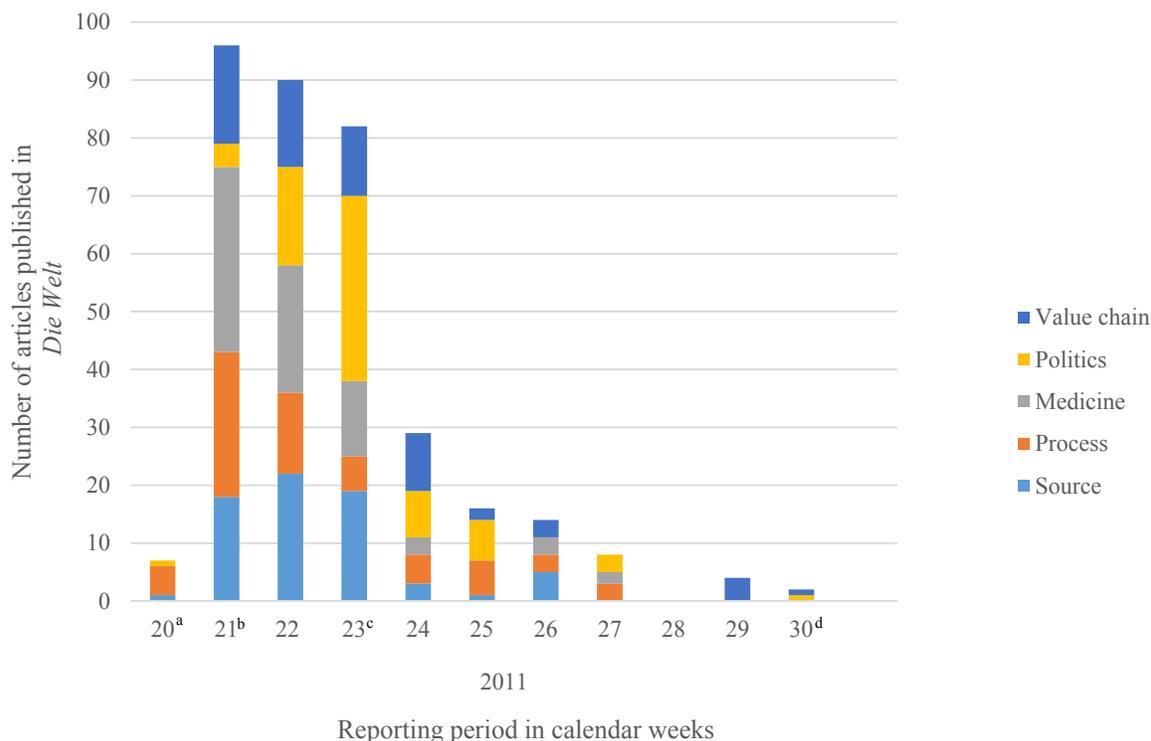


Figure 3. *Die Welt* reporting on STEC outbreak in 2011

^aW20: Outbreak occurred, ^bW21: First recalls, ^cW23: Source found, ^dW30: Outbreak ends

As the number of articles increased during the following three weeks, all categories were addressed, in keeping with the mission of *Die Welt* as a national newspaper that covers all fields

of the economy. After the source of the STEC outbreak was identified in week 23, *Die Welt* decreased the number of published articles. The number of articles gradually decreased until week 30, when governmental authorities officially declared the end of the outbreak. In week 24 all categories were still present. In the following three weeks, *Die Welt* informed mostly on process, source of the outbreak, and the value chain. By the end of the outbreak, actual damages incurred by members of the value chain could be calculated. Moreover, the EU supported farmers in 22 states to mitigate the damages. Therefore, *Die Welt* reported about the categories value chain and politics in the last articles on STEC in 2011.

Gabot.de started to inform its audience four days after the outbreak occurred, in week 21 (Figure 4). During first two weeks of reporting, weeks 21 and 22, the portal released the highest number of articles, and informed on all categories. During the entire reporting period, the categories value chain, politics, and source of the outbreak were present. *Gabot.de* mostly addresses horticultural producers, which explains the focus on these categories. Information on the cause of the outbreak, damage incurred by value chain actors, and governmental support to farmers were central points of reporting. The number of articles decreased only slightly after week 24.

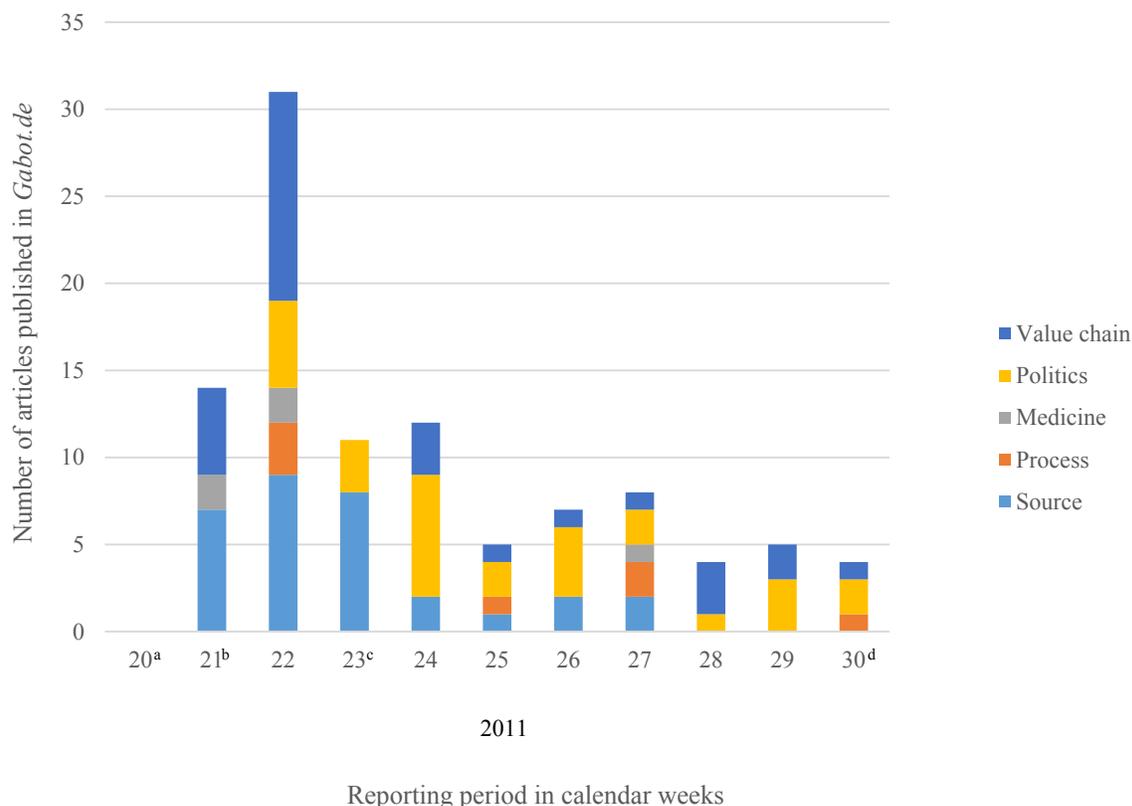


Figure 4. *Gabot.de* reporting on STEC outbreak in 2011

^aW20: Outbreak occurred, ^bW21: First recalls, ^cW23: Source found, ^dW30: Outbreak ends

Comparing the reporting of both media outlets, some differences stand out. *Die Welt* released a higher number of articles overall, 399 articles compared to 106 articles released by *Gabot.de*. The reasons behind the difference are the frequency of updating and broader range of topics

covered. *Die Welt* reported almost equally on all categories, while *Gabot.de* informed mostly on topics deemed important to horticultural producers, e.g., source of the outbreak, vegetables linked to the pathogen, and the effects on the sector and on policy issues.

During the same period, FIRA informed the public about the official state of the STEC outbreak. The analysis showed that a certain matching between the reporting of *Die Welt* and FIRA exists, especially until the source of the outbreak was identified in week 23. The high number of articles released by the national newspaper partially contributed to the information matching. Once *Die Welt* reduced the number of articles released, the relationship between news reporting and the official reporting decreased. Moreover, *Gabot.de* showed similar matching with the information content released by FIRA in the period before the source of the outbreak was identified. This is in line with findings by Shan et al. (2013) who reported that media depends to a large extent on information provided by government officials. However, the reasons behind the mismatching between reporting of governmental authorities and media outlets after the source was identified remain unclear.

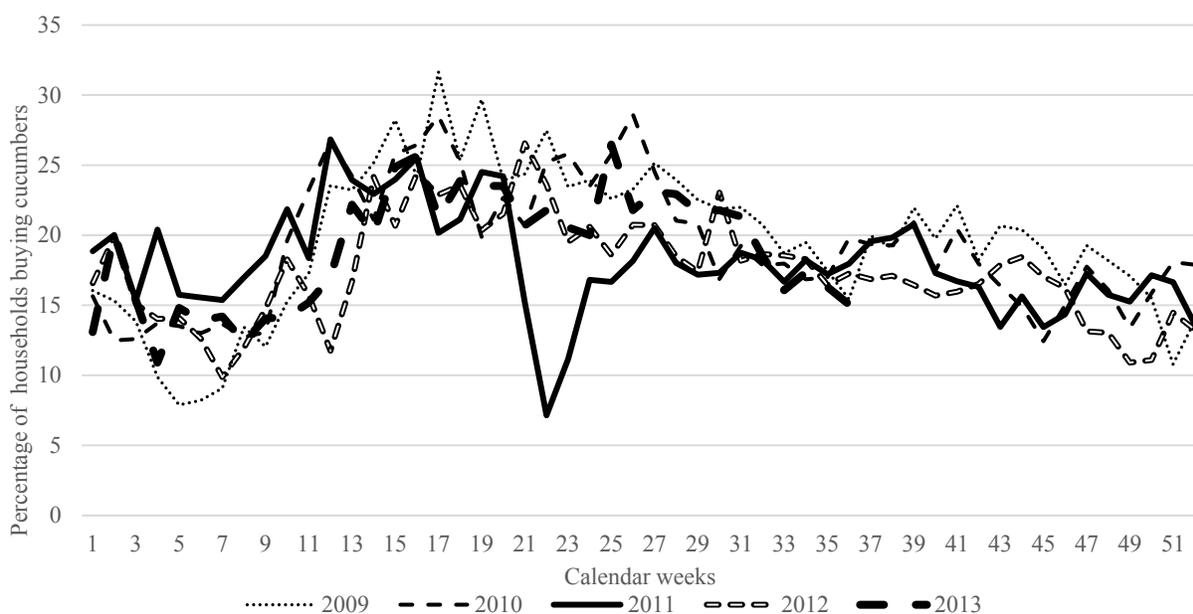


Figure 5. Percentage of households buying fresh cucumbers (week 1-2009 to week 36-2013)
Data source. AMI (2013)

Market data (i.e., percentage of households buying fresh cucumbers, and average retail unit prices for cucumber) show that media reporting impacted consumer purchasing behavior (Figure 5). The outbreak occurred in week 20, when the percentage of households buying fresh cucumbers started to decrease sharply. Recovery started only after the source of the outbreak was positively identified in week 23. In the following weeks, consumption increased, at times reaching higher levels than in 2009 and 2010. By the end of the year, consumption followed the tendency of previous years, meaning that the STEC outbreak had no impact on cucumber purchases in 2012 and 2013.

Analyzing retail prices for cucumbers between 2009 and 2013 shows a similar tendency. In 2011, the average retail price per unit reached the lowest level, with \$0.65 (AMI, 2013).

Afterwards, prices recovered slowly, but continued to climb in 2013. The price development is in line with findings by McKenzie and Thomsen (2001) of a significant and negative price response to adverse product safety information. However, the STEC outbreak contributed only partially to the low price level in Germany in 2011, since unit prices were already low in the beginning of the year, caused by an unusual coinciding of production periods in different European regions.

Country Comparison

The number of articles released by media outlets in both countries differs. The U.S. media outlets covered the STEC outbreak with a lower number of articles, compared to the German outlets. One explanation is likely the frequency of publishing, *USA Today* (39 articles during the observed period) releases articles only during weekdays, and *Die Welt* (399 articles during the observed period) reports several times per day, including weekends. Also, the outbreak in Germany led to a much higher number of illnesses and deaths, which triggered even more media attention. The same explanation holds for *The Sacramento Bee* (41 articles during the observed period) and *Gabot.de* (106 articles during observed period), but to a lesser extent.

Orientation and target audiences impacted the focus of the reporting of the examined media outlets in both countries. *USA Today* and *Die Welt*, elite national newspapers, showed a broad scope, informing the public about all categories. The Californian newspaper *The Sacramento Bee* and the online portal *Gabot.de* more specifically addressed producers' interests. As expected, the categories value chain, politics, and source of the outbreak were more frequently the focus of reporting for these outlets. After the respective sources of the outbreaks were identified, media outlets in both countries reduced the number of articles. An explanation could be the boredom effect, since the media had released a high amount of information for weeks. Particularly, in the German case, where media outlets had published information on vegetables falsely determined as sources of the outbreak. Also, De Jonge et al. (2010) found that over time when the release of information decreases, and the effect of newspaper coverage on consumers' memory fades.

Saggau (2012) argued that governmental authorities have crucial responsibilities in reducing negative effects on consumers and the wider society during events of foodborne illnesses. In both cases, FDA and FIRA reported on the state of the STEC outbreaks frequently. However, the analysis showed premature proclamations of the authorities in Germany. While in the U.S. consumers misinterpreted the official advisory, in Germany, the official advisories contributed to public confusion, which resulted in consumers not purchasing cucumbers and other vegetables. Findings of Calvin (2007) and Arnade et al. (2008), as well as the German purchasing data (Figure 5) show that once the actual source of the outbreak was positively identified, purchases started to recover. When comparing the content of reporting by governmental authorities (i.e., FDA and FIRA), and the selected media outlets, only limited matching occurred. Nucci et al. (2009) argue that journalists have the crucial role in shaping the information released. In addition, Imtihani and Mariko (2013, p. 944) found that reporters frame the news content according to their viewpoint, which is not always in an objective manner.

Conclusions

Both cases can be interpreted as indications of the cultivation theory. As proposed by Rowe et al. (2000), consumers show reduction of purchases or avoidance of implicated products, in the wake of governmental authorities' press releases and elevated frequency of media reporting. However, increased risk awareness due to frequency of reporting is not the only determinant of consumer behavior. For the products implicated in the outbreaks, but not the actual source, the findings show that the STEC outbreak analyzed had only short-term effects on consumer purchasing behavior. Nevertheless, for the product both implicated and identified as the source of the outbreak, namely bagged spinach, the situation developed differently. Sales of bagged spinach in the U.S. required a longer recovery period, while bunched spinach recovered quickly after the outbreak. In Germany, the market for cucumbers recovered shortly after the actual source of the outbreak was identified. Moreover, lower retail prices for cucumbers cannot be attributed to the outbreak alone. However, data on consumer behavior regarding the actual source of the outbreak in Germany (i.e., fenugreek sprouts) was not available, therefore a direct comparison with the U.S. market data was not possible.

In both cases, consumers trusted the governmental authorities, and followed their recommendations during the outbreaks of the foodborne illness. Therefore, with regard to purchasing implicated produce, we found no evidence that U.S. consumers are more risk-taking, and less state-reliant than Germans. During both outbreaks, consumers avoided implicated products, and turned back to consume them quickly after the actual source of the foodborne illness was identified. However, this holds only for falsely accused products. The actual source of the outbreak, bagged spinach in the U.S., showed a much longer recovery period. Accordingly, neither case of a large outbreak of foodborne illness analyzed, provides an indication of the quantity-of-coverage theory, which would propose that consumers avoided related products independent of the nature of press releases and reporting. In addition, after the initial confusion, consumers in both countries showed rather differentiated risk perception with their purchasing behavior. Finally, the long recovery period of bagged spinach sales in the U.S. and similar anecdotal evidence regarding sprout sales in Germany show that consumers, do not forget as quickly as some authors and industry actors seem to assume (see also Arnade et al. 2010).

In both countries, content and amount of media releases depend on the orientation of the media outlet (i.e., focus on the wider public, or focus on producers). Media reporting contributed to consumer distrust in food safety and influenced their purchasing behavior. Consumers showed distrust in food safety only in the short-term, and restored their previous consumption patterns with respect to similar products when the source of the outbreak was identified. The study also supports the findings of Nucci et al. (2009) that journalists have a crucial role in shaping the information released and transferring the information to the wider community.

Insights into the concept of media influence on consumer trust in food safety in both cases give rise to questions of risk communication during foodborne illnesses. Particularly, the limited matching between press releases and reports of governmental authorities and media outlets during the STEC outbreaks led to problems regarding information accuracy, source credibility, and consumer trust (see also Rutsaert et al. 2013). Better exchange and synchronization of

information between governmental authorities and media outlets can improve the trust of supply chain actors, depending on that information. This is especially important due to the fact that negative information release immediately impacts consumers' risk perception, and therefore their purchasing behavior, while positive information on the outbreak status leads to delayed influence on purchasing (Liu et al. 1998; McKenzie and Thomsen 2001). Another strategy suggested by Saghaian and Reed (2007), could be governmental marketing campaigns promoting the safety of products.

Since several vegetables were affected during the STEC outbreaks in both countries, entire food supply chains need to clearly communicate improvements in safety practices and standards. Duration of time until market recovery, as well as reputational damage, and economic losses can be reduced if the actors of the entire supply chain managed a coordinated response to outbreaks. They need to acknowledge previous problems and communicate how they were overcome. As de Jonge et al. (2010) stated, among determinants of consumer confidence in food safety are trust in regulators and actors in the supply chain. According to Labrecque and Charlebois (2006), the food system becomes more prone to risk events due to globalization, requiring the implementation of rigorous traceability systems among supply chain members. However, Nganje and Skilton (2011) argued that trust and transparency in supply chains may reduce perception of risk without reducing the actual risk. Therefore, these cannot be substitutes for inspection and prevention measures.

Further research should investigate how social media reporting impacts public behavior during foodborne illnesses, especially considering the increased influence of social media compared to traditional media. Additional information outlets to investigate are news on radio and television. As many consumers decide to eat raw vegetables, such as spinach and sprouts, due to health benefits, medium and long-term purchasing and consumption decisions may be less impacted than regarding other products, such as meat or eggs, where raw and undercooked consumption is due to taste preferences. Research on other food products may therefore lead to different results.

The study showed that both outbreaks impacted consumer purchasing behavior mostly in the short-term. In addition, producers and retailers had to bear reputational damage, and product litigation. Therefore, another venue for future research would be the incentives to invest in food safety technologies and practices among the supply chain actors. Future research could build on findings of Richards et al. (2009) who argued that actors along the U.S. food supply chain appear reluctant to undertake such investments, due to hysteresis effects and free riding. On the other hand, Calvin (2007) emphasized that the application of additional food safety standards still bears incentives, such as the protection of sales, reputation, and assets. The German case is of particular interest, since food safety standards have been applied for over a decade, and upgraded over time, but foodborne illnesses still occur (see also Gawron and Theuvsen 2009; Gay and Schneider 2007). Further incentives for improving food safety in Germany should be explored, since lawsuits related to the STEC outbreak in 2011 were not successful and farmers were compensated by the European Commission.

Acknowledgements

The authors thank Hans-Christoph Behr of Agricultural Market Information Inc. (AMI) for generously providing German cucumber market data, and Stefan Balling and Marianne Kreissig for contributing to data coding and analysis.

References

- An, S. K. and K. K. Gower. 2009. How do the news media frame crises? A content analysis of crisis news coverage. *Public Relations Review* 35 (3): 107-12.
- Arnade, C., L. Calvin and F. Kuchler. 2008. Market Response to a Food Safety Shock: The 2006 Foodborne Illness Outbreak of E. coli O157:H7 Linked to Spinach. Paper presented at the 2008 American Agricultural Economics Association Annual Meeting, July 27-29, 2008, Orlando, Florida.
- Arnade, C., L. Calvin and F. Kuchler. 2010. Consumers' Response to the 2006 Foodborne Illness Outbreak Linked to Spinach. USDA Economic Research Service. <http://www.ers.usda.gov/amber-waves/2010-march/consumers%E2%80%99-response-to-the-2006-foodborne-illness-outbreak-linked-to-spinach.aspx#.UuPNihCIUuU> [accessed November 12, 2013].
- Berg, L. 2004. Trust in food in the age of mad cow disease: a comparative study of consumers' evaluation of food safety in Belgium, Britain and Norway. *Appetite* 42 (1), pp. 21-32.
- Bitsch, V. 2005. Qualitative Research: A Grounded Theory Example and Evaluation Criteria. *Journal of Agribusiness* 23 (1): 75-91.
- Bitsch, V. and M. Hogberg. 2005. Exploring horticultural employees' attitudes towards their jobs: A qualitative analysis based on Herzberg's theory of job satisfaction. *Journal of Agricultural Applied Economics* 37 (3): 659-71.
- Bitsch, V. and E. K. Yakura. 2007. Middle Management in Agriculture: Roles, Functions, and Practices. *International Food and Agribusiness Management Review* 10 (2): 1-28.
- Calvin, L. 2007. Outbreak Linked to Spinach Forces Reassessment of Food Safety Practices. *Amber Waves* 5 (3): 24-31.
- Calvin, L. 2013. *The Food Safety Modernization Act and the Produce Rule*. Vegetables and Pulses Outlook: Special Article (VGS-353-SA2). Economic Research Service, USDA, March 29, 2013.
- Chen, M.F. 2008. Consumer Trust in Food Safety-A Multidisciplinary Approach and Empirical Evidence from Taiwan. *Risk Analysis* 28 (6): 1553-69.
- De Jonge, J., H. van Trijp, R. J. Renes and L. Frewer. 2007. Understanding Consumer Confidence in the Safety of Food: Its Two-Dimensional Structure and Determinants. *Risk Analysis* 27 (3): 729-40.

- De Jonge, J., H. Van Trijp, R. J. Renes and L. J. Frewer. 2010. Consumer Confidence in the Safety of Food and Newspaper Coverage of Food Safety Issues: A Longitudinal Perspective. *Risk Analysis* 30 (1): 125-42.
- European Commission. 2011. Lessons learned from the 2011 outbreak of Shiga toxin-producing *Escherichia coli* (STEC) O104:H4 in sprouted seeds. Commission staff working document, SANCO/13004/2011, Brussels. http://ec.europa.eu/food/food/biosafety/salmonella/docs/cswd_lessons_learned_en.pdf [accessed September 3, 2013]
- Federal Institute for Risk Assessment (FIRA). *Escherichia coli*. <http://www.bfr.bund.de/en/home.html> [accessed November 12, 2013].
- Gawron, J.C. and L. Theuvsen. 2009. Agrifood Certification Schemes in an Intercultural Context: Theoretical Reasoning and Empirical Findings. Paper presented at the 113th EAAE Seminar, A resilient European food industry and food chain in a challenging world, September 3-6, 2009, Chania, Crete, Greece.
- Gay, S.H. and A. Schneider. 2007. A comparative analysis of food quality assurance schemes: The case of Neuland and EurepGap. Paper presented at the 47th GEWISOLA and the 17th ÖGA conference, September 26-28, 2007 Freising/Weihenstephan, Germany.
- Goldsmith, P., N. Turan and H. Gow. 2003. Food Safety in the Meat Industry: A Regulatory Quagmire. *International Food and Agribusiness Management Review* 6 (1): 25-37.
- Grunert, K. G. 2002. Current issues in the understanding of consumer food choice. *Trends in Food Science & Technology* 13 (8): 275-85.
- Imtihani, N. and Y. Mariko. 2013. Media coverage of Fukushima nuclear power station accident 2011: A case study of NHK and BBC WORLD TV stations. *Procedia Environmental Sciences* 17: 938-46.
- Kennedy, P. L. and E. J. Luzar. 1999. Toward Methodological Inclusivism: The Case for Case Studies. *Review of Agricultural Economics* 21 (2): 579-91.
- Klonsky, K. 2006. *E. coli* in Spinach, Foodborne Illnesses, and Expectations about Food Safety. Agricultural and Resources Economics Update. Gianni Foundation of Agricultural Economics, University of California 10 (2): 1-4.
- Labrecque, J. and S. Charlebois. 2006. Conceptual Links between Two Mad Cow Crises: The Absence of Paradigmatic Change and Policymaking Implications. *International Food and Agribusiness Management Review* 9 (2): 1-29.
- Liu, S., J. C. Huang and G. L. Brown. 1998. Information and Risk Perception: A Dynamic Adjustment Process. *Risk Analysis* 18 (6): 689-99.
- Maysenhalder, R., Farmer, E. and G. Baker. 2007. Reforming the Fresh Produce Food Safety System: An Analysis of the 2006 *E. coli* Spinach Outbreak in California. IAMA 17th Annual World Food and Agribusiness Symposium, June 23 & 24, 2007, Parma, Italy.

- McCluskey, J. J., K. M. Grimsrud, H. Ouchi and T. I. Wahl. 2005. Bovine spongiform encephalopathy in Japan: consumers' food safety perceptions and willingness to pay for tested beef", *Australian Journal of Agricultural and Resource Economics* 49 (2): 197-209.
- McKenzie, A. M. and M. R. Thomsen. 2001. The Effect of "E. Coli" O157:H7 on Beef Prices. *Journal of Agricultural and Resource Economics* 26 (2): 431-44.
- Mugera, A. W. and V. Bitsch. 2005. Managing Labor on Dairy Farms: A Resource-Based Perspective with Evidence from Case Studies. *International Food and Agribusiness Management Review* 8 (3): 79-98.
- Nganje, W. E. and P. Skilton. 2011. Food Risks and Type I & II Errors. *International Food and Agribusiness Management Review* 14 (5): 109-23.
- Nucci, M. L., C. L. Cuite and W. K. Hallman. 2009. When Good Food Goes Bad. Television Network News and the Spinach Recall of 2006. *Science Communication* 31 (2): 238-65.
- Onyango, B., D. Miljkovic, W. Hallman, W. Nganje, S. Condry and C. Cuite. 2007. Food recalls and food safety perceptions: The September 2006 spinach recall case. Agribusiness and applied Economics Report, No. 602. Department of Agribusiness and Applied Economics, Agricultural Experiment Station, North Dakota State University, Fargo.
- Painter, J.A., R.M. Hoekstra, T. Ayers, R.V. Tauxe, C.R. Braden, F.J. Angulo and P.M. Griffin. 2013. Attribution of foodborne illnesses, hospitalizations, and deaths to food commodities by using outbreak data, United States, 1998-2008. *Emerging Infectious Diseases* 19 (3): 407-15.
- Parker, J. S., R. S. Wilson, J. T. LeJeune, L. Rivers III and D. Doohan. 2012. An expert guide to understanding grower decision relates to fresh fruit and vegetable contamination prevention and control. *Food Control* 26 (1): 107-16.
- Pouliot, S. and D.A. Sumner. 2013. Traceability, recalls, industry reputation and product safety. *European Review of Agricultural Economics* 40 (1): 121-42.
- Richards, T.J. and P.M. Patterson. 1999. The Economic Value of Public Relations Expenditures: Food Safety and the Strawberry Case. *Journal of Agricultural and Resource Economics* 24 (2): 440-62.
- Richards, T.J., W. E. Nganje and R. N. Acharya. 2009. Public Goods, Hysteresis and Underinvestment in Food Safety. *Journal of Agricultural and Resource Economics* 34 (3): 464-82.
- Rowe, G., L. Frewer and L. Sjöberg. 2000. Newspaper reporting of hazards in the UK and Sweden. *Public Understanding of Science* 9 (1): 59-78.
- Rutsaert, P., Á. Regan, Z. Pieniak, Á. McConnon, A. Moss, P. Wall and W. Verbeke. 2013. The use of social media in food risk and benefit communication. *Trends in Food Science & Technology* 30 (1): 84-91.

- Saggau, V. 2012. Too Many Cooks Spoil the Broth- Agent Based Simulations to Investigate Federal Governance Confusion During the EHEC Crisis. Paper presented at the 52nd GEWISOLA, September, 26–28, 2012, University Hohenheim.
- Saghalian, S.H. and M.R., Reed. 2007. Consumer Reaction to Beef Safety Scares. *International Food and Agribusiness Management Review* 10 (1): 18-35.
- Shan, L., A. Regan, A. De Brun, J. Barnett, M. C. A. van der Sanden, P. Wall and A. McConnon. 2013. Food crisis coverage by social and traditional media: A case study of the 2008 Irish dioxin crisis. *Public Understanding of Science* 22 (2): 1-18.
- Sterns, J. A., D. B. Schweikhardt, and H. C. Peterson. 1998. “Using Case Studies as an Approach for Conducting Agribusiness Research.” *International Food and Agribusiness Management Review* 1 (3): 311-27.
- Swinnen, J. F. M., J. McCluskey and N. Francken. 2005. Food safety, the media, and the information market. *Agricultural Economics* 32 (1): 175-88.
- Tauxe, R. V., M. P. Doyle, T. Kuchenmüller, J. Schlundt and C. E. Stein. 2010. Evolving public health approaches to the global challenge of foodborne infections. *International Journal of Food Microbiology* 139 (Supplement):16-28.
- Thøgersen, J. 2006. Media Attention and the Market for “Green” Consumer Products. *Business Strategy and Environment* 15 (3): 145-56.
- U. S. Food and Drug Administration (FDA). <http://www.fda.gov/> [accessed November 12, 2013].
- Verbeke, W. 2005. Agriculture and the food industry in the information age. *European Review of Agricultural Economics* 32 (3): 347-68.
- Westgren, R. and K. Zering. 1998. Case Study Research Methods for Firm and Market Research. *Agribusiness* 14 (5): 415-24.
- Zhang, H., Marsh, T and J. McCluskey. 2010. A Generalized Event Analysis of the 2006 E. coli Outbreak in Spinach and Lettuce. http://www.impact.wsu.edu/MarshFiles/E.coli_paper_V1.pdf [accessed September 12, 2013].



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Connecting Sensory Quality Characteristics and Local Designations to Willingness to Pay for Cheese at the Retail Level

Ryan N. Barnes^a, Ryan C. Bosworth^b, DeeVon Bailey^c, and Kynda R. Curtis^d

^a *Graduate Student, Department of Applied Economics Utah State University, 4835 Old Main Hill Logan, Utah 84322-4835, USA*

^b *Assistant Professor, Department of Applied Economics Utah State University 4835 Old Main Hill, Logan, Utah 84322-4835, USA*

^c *Professor, Department of Applied Economics Utah State University 4835 Old Main Hill, Logan, Utah 84322-4835, USA*

^d *Associate Professor, Department of Applied Economics Utah State University 4835 Old Main Hill, Logan, Utah 84322-4835, USA*

Abstract

This study links sensory analysis with consumer willingness to pay (WTP) for national, private label, and local brands of cheese at the retail level. Results indicate that a lesser-known local brand is rated the highest of four cheese brands for its sensory characteristics, but is not competitive with the other brands, in terms of consumer WTP, unless it has a state-sponsored designation (SSD). The competitiveness of a second local brand with high label recognition was aided when labeled “locally-produced,” but not by the SSD. Hence, local designations strengthen brands in general, but SSDs are best for lesser known, high quality products.

Keywords: cheese, choice experiments, local designations, sensory analysis, willingness to pay

^①Corresponding author: Tel: + 1 435.797.2300

Email: D. Bailey: deevon.bailey@usu.edu

R.N. Barnes: barnes.ryan.n@gmail.com

R. C. Bosworth: ryan.bosworth@gmail.com

K. R. Curtis: Kynda.curtis@usu.edu

Introduction

A growing body of evidence suggests many American consumers seek out and are willing to pay more for locally-produced food products than non-local food products. For example, a recent national survey of retail food shoppers found that 86% of respondents believed it was either very important or somewhat important for retail food stores to carry local produce and other locally-produced packaged foods (National Grocers Association 2012). Food retailers are aware of consumers' interest in locally-produced food products and they are expanding the number of locally-produced food items they carry (USDA, AMS 2011; A. T. Kearney 2013; Bosworth, Bailey, and Curtis 2013; Onken, Bernard, and Pesek, Jr. 2011; Clifford 2010; Kroger 2012; Whole Foods 2012; Wild Oats Market 2012; Martinez et al. 2010).

While much of the initial interest in locally-produced food centered on fresh fruits and vegetables, there is evidence suggesting locally-produced packaged food items may be able to compete with national brands and private labels (also known as store brands) at the retail level (Bosworth, Bailey, and Curtis 2013). The market for packaged food is different than for unpackaged fruits and vegetables. Packaged food markets are dominated by national brands owned primarily by large food manufacturers and private labels owned by food retailers while locally-produced packaged food items are typically produced by relatively small, local food manufacturers (Volpe 2011).

Developing, promoting, and executing a strategy for a national brand food product is a complex and expensive undertaking and advertising expenditures in the U. S. for food and candy products (mostly national brands) amounted to over \$6.5 billion USD in 2012 (Kantar Media 2014). National brands often aim at addressing markets large enough to take advantage of economies of scale in manufacturing, advertising, and distribution. National brands also strive to develop "brand equity," meaning the brand is recognizable and often associated with product quality (Liu and Sporleder 2007).¹

Packaged private label food products are also an important component of retail food markets and, while the market share for private label products is not publicly available, the consensus is that it is expanding. For example, the number of American consumers indicating they purchase private label products increased from 18% in 2000 to 27% in 2011 (NPD Group 2012; Volpe 2011). Private label sales typically have higher margins for retailers than national brand products suggesting retailers have an incentive to expand private label sales if possible (Sageworks Inc. 2012). Average price differences between private labels and national brands have also decreased over time (Hass and Weaver 2010; Volpe 2011). As a result, national brand food manufacturers are expected to aggressively seek and recapture market share they may be losing to private label food products (Steenkamp, Heerde, and Geyskens 2010).

Communicating the "quality" of a product, in the case of a national brand is critical to its overall market strategy (see Appleby et al. 2012), especially when competing with private labels as

¹Examples include Nestle or Kraft.

demonstrated by Hassan and Monier-Dilhan (2006). Defining product quality² for any brand depends heavily on this strategy including communicating different brand characteristics to consumers such as superior taste, nutrition, health claims, status, convenience, intrinsic characteristics (organic, natural, environmentally-friendly, animal-friendly, etc.) or a combination of these and many other possible product characteristics.

When it comes to labels or designations for locally-produced food products, one of the most obvious value-adding strategies being pursued is “localness”. At the retail level locally-produced food products must compete against national brands and private labels, which may have broad brand recognition and brand equity. Consequently, it becomes relevant to consider what other attributes or qualities locally-produced packaged food needs to have to compete effectively in a retail situation.

In this study, we consider how local designations on locally-produced packaged food items might make these products more competitive with national brands and private labels at a retail point of purchase. We also examine how local designations may or may not aid in market and brand development when the locally-produced food is of high or low quality in terms of its sensory characteristics. This is accomplished through blind sensory analysis of cheese products using national brands, private labels, and local brands with different local designations followed by choice experiments of willingness-to-pay (WTP) based on brand and type of local designation. As this study uses cheese as the basis for the analysis (a food product with taste often used as a market promotion strategy), selected sensory characteristics (taste, feel (texture), sight, and smell) are used to define product quality.

The results demonstrate that a lesser-known, but high quality local cheese product becomes more competitive with national brands and private labels, in terms of WTP, when a state-sponsored designation (SSD)³ is used in conjunction with the cheese brand. However, we also find that the SSD fails to enhance consumer WTP for an already well-known locally-produced cheese brand, but that a simple “Locally-Produced” designation does. The findings indicate that brand recognition interacts strongly with the SSD and that the SSD is likely best used with high quality locally-produced food products that have low brand recognition. While our results can only be used to draw inferences for consumer choices at a given point in time (i.e., are not proof of long-term sustainability of purchasing behavior), they demonstrate that local products are strengthened by local designations as they provide an important component in opening the door to possible long-term market development for local products.⁴

²No single definition of “food quality” exists because quality depends on the dimension or characteristic of a food product being evaluated at any given point in time. For example, dieticians would define food quality by its nutritional content and contribution to healthy lifestyles while others might define it by the characteristics listed in this paragraph. Judging “quality” for other products besides cheese might well involve evaluating different product characteristics than are used in this study. Ultimately, through their purchasing decisions consumers decide what quality is and the tradeoffs among the possible definitions of quality.

³In the case of this study, “Utah’s Own.” For explanation of Utah’s Own specifications and qualifications see www.utahsown.utah.gov.

⁴A thorough analysis of the long-term sustainability for local designations and market development would require following a consumer panel over a period of time to observe repeat purchases of local products based on local designations. The analysis presented here, while providing only information connecting WTP, local designations, and sensory characteristics at a given point in time, still provides evidence that the elements necessary for long-term

Data Collection and Methodology

Types of Local Designations Considered

SSDs for food products in the U.S. have proliferated during the past 10 years. In fact, every U.S. state has had a promotional program for its agricultural products at one time or another (Darby et al. 2008; Onken and Bernard 2010). SSDs offer only one of several possible strategies to communicate localness to consumers. For example, these manufacturers could simply promote their brand as being “local” or they could use a SSD or simply a “locally-produced” designation on their products. Local food manufacturers and retailers need to consider the “best” of these differing strategies when seeking to communicate to consumers due to the highly competitive nature of retail food markets and limited self-space available in retail stores (Bosworth, Bailey, and Curtis 2013; Clifford 2010; Kroger 2012; Whole Foods 2012; Wild Oats Market 2012).⁵

Most SSDs are managed by political entities in the U.S., such as state departments of agriculture. The political nature of these designations may make it more difficult for the public managing entities for SSDs to enforce quality standards on participants (Onken and Bernard 2010). Onken and Bernard suggested that better quality controls for locally-produced foods with SSDs would provide more value (utility) to consumers than if no quality controls were placed on these products. Jekanowski, Williams, and Schiek’s (2000) findings also supported this conclusion when they determined Indiana consumers had a strong willingness to purchase locally-produced foods, but that quality was an important factor in the purchase decision.

The political aspect of most American SSDs makes them quite different than geographic designations in the European Union (EU) such as Protected Designation of Origin (PDO) or Protected Geographical Designation (PGI). The reputation of PDOs and PGIs are built principally on the perceived quality of these products. Research indicates that these EU protections are recognized by consumers and are capable of adding value to food products (McCluskey and Loureiro 2003; Loureiro and McCluskey 2000; Galli et al. 2011)⁶. These EU designations, while geographically-based relating to production or process, do not attempt to define markets based on geographical locations as do SSDs. Contrast this to the recent intense interest in the U.S. and Europe in buying locally-produced foods, where the principal emphasis is the close proximity of production and consumption.

As the market for locally-produced food continues to grow and mature, the role played by SSDs and other local designations needs to be examined to address their connection to quality (in this case sensory quality). Understanding the connection between quality, brands, and local designations is critical if these designations hope to sustain local brands and other local market

market development based on local designations are present. These include consumer evaluation of product quality based on sensory characteristics and WTP based on local designations compared to national brands and private labels.

⁵A recent national survey of retail food shoppers indicated that 86% of respondents believed that it was either very important or somewhat important for retail food stores to carry local produce and other locally-produced packaged foods (National Grocers Association 2012).

⁶See Deselnuci et al. (2013) for an over view of geographically-identified food studies.

development efforts over time. This study examines the connection between the quality of locally-produced foods and the likelihood of promoting and sustaining a local brand over time.

This study was completed in cooperation with a food retailer and the Utah Department of Agriculture and Food (UDAF), the managing entity for the Utah's Own program (the SSD for the State of Utah). A survey was administered at five retail grocery stores located in northern Utah between Logan and Salt Lake City to a total of 334 shoppers during May and June, 2013. Survey respondents were selected on an intercept basis.⁷ As part of the interview administered during the survey, respondents participated in a blind sensory test of four different brands of cheddar cheese. They then completed the remainder of the survey without being informed which brand of cheese corresponded to the cheese samples in the blind sensory analysis.

Selection of Cheese for Analysis

Cheese was chosen as the target product for this study as it a well-known and well-understood product and a national brand, a private label, and local brands were available. Additionally, cheese has been used in EU studies to assess the impact of origin on consumer WTP (Galli et al. 2011; Bonnet and Simioni 2001). The four brands of cheddar cheese considered in this study included two locally-produced brands (Gossner's, and Cache Valley), a national brand (Tillamook), and a private label (Western Family). All four cheese brands were sold at each of the stores where the surveys were conducted and were all available in medium-sharp cheddar. Consequently, medium-sharp cheddar cheese was used for all four brands in the sensory test. Prices for a particular cheese brand can fluctuate independently of the other brands over short periods of time due to promotional activities affecting a single brand. As a result, respondents were expected to have had experience with prices varying singly or together. Given the nature of the choice experiment employed, this fact added to the realism of the choice experiment.

Survey, Sensory Evaluation, and Choice Experiment

The object of the sensory evaluation was to measure the perceived quality of different brands of cheddar cheese by respondents (Miller et al. 2008; Combris et al. 2005). Past research suggests state food product promotional programs will be effective only if the quality of the product is high (Jekanowski, Williams, and Schiek). High quality products with a Utah's Own designation would likely generate repeat purchases by consumers and build the reputation of the designation.

The samples for each cheese brand were identified to the respondent only as sample "A", "B", "C" or "D." The four samples were presented singly and in random order to the respondent who then tasted the individual samples. The respondent silently rated each cheese on a seven-point scale for *Taste*, *Texture*, *Odor* and *Overall Acceptability*. The respondent was also requested to provide a rank order for the samples.

⁷If the respondents completed the survey, they received an electronic coupon for a \$2 discount on private label cheese. There was a relatively high refusal rate. So, when the interviewers were not busy with people filling out the survey, most people passing the survey location were politely asked to participate. Consequently, while the intercepts were not random in the classical sense, individuals were not systematically excluded from the survey.

Following the sensory evaluation, the respondent was presented six choice sets which were the foundation of the WTP analysis presented in this study. The six choice sets constituted a conjoint design embedded in a choice experiment framework. A representative choice set presented to the respondents is found in Figure 1. Each choice set consisted of three alternatives: two different brands of cheese, at stated prices, and a “neither” alternative. By showing six choice sets, each respondent was offered choices between each possible combination of the brands in the study: (Western Family vs. Tillamook, Western Family vs. Gossners, Western Family vs. Cache Valley, Tillamook vs. Gossners, Tillamook vs. Cache Valley, and Gossners vs. Cache Valley). The order in which these choices were presented to respondents and the order of brand placement left to right were randomized and also randomly distributed across respondents. One quarter of the surveys were randomly assigned the “Utah’s Own” designation (Gossners and/or Cache Valley designated as being Utah’s Own) and one quarter were randomly assigned the “locally-produced” designation (Gossners and/or Cache Valley designated as being locally-produced).

Prices were also randomized across choices.⁸ The distribution of prices was chosen to be as realistic as possible. Consultation with the food retailer regarding pricing ranges across brands provided the price range for a two-pound block of cheese. Given that typical grocery store prices end in “9”, we rounded our randomized prices down to the nearest price ending in “9”. As a result, we randomly drew prices from a U[\$5.99, \$9.49] distribution for Tillamook, Gossners, and Cache Valley and a U[\$5.49, \$6.99] distribution for Western Family.⁹

Randomly assigning the local brands (Gossner’s and Cache Valley) to be shown with or without labels designating them as “Utah’s Own” or “Locally-Produced” resulted in the choice sets measuring WTP based on the actual brands and also based on the type of local designation the two local brands had. The other survey questions ascertained the respondent’s perceptions and familiarity with the Utah’s Own designation and their basic demographics such as age, gender, ethnicity, education level, income level, and household characteristics.

Taste Rankings and Choices

Respondents were asked following the sensory analysis to provide a ranking of the four cheeses against each other¹⁰ and Table 1 displays these rankings. The average rank of each cheese was calculated as the average placement in the rank order of the cheese (first, second, third, or fourth) weighted by the proportion of respondents that gave that cheese each ranking. The lower the average rank number the better the brand performed in the blind sensory test. Gossner’s ranked highest, on the average (2.25), followed by Cache Valley (2.50), then Tillamook (2.60), and finally Western Family (2.64). A brand that could carry the Utah’s Own label, Gossner’s in this case, was the highest-rated cheese in the sensory analysis.

⁸Randomizing prices in choice experiments is consistent with “best practices” in these types of analyses (e.g., Cameron and DeShazo (2013) and Taylor, Morrison, and Boyle (2010)).

⁹The food retailer indicated that Western Family was typically priced lower than the other brands. Hence, the lower values for the extremes of the uniform distribution for Western Family compared to the other brands.

¹⁰The samples A, B, C, and D were placed in rank order from 1 (best) to 4 (worst) based on a survey question asking for “overall ranking” of the four samples.

Table 1. Summary of blind Sensory test rank order by cheese brand and percentage of times selected in choices provided in the Choice Experiment

	Ranked 1 (%)	Ranked 2 (%)	Ranked 3 (%)	Ranked 4 (%)	Average Rank	Percentage of Times Selected In Choice Experiment
<i>Tillamook</i>	24.51	21.52	22.42	31.39	2.60	17.89
<i>Gossner's</i>	31.24	29.75	23.17	16.29	2.25	14.55
<i>Cache Valley</i>	23.92	24.81	28.10	23.02	2.50	21.87
<i>Western Family</i>	20.33	23.92	26.31	29.30	2.64	20.39
<i>Neither</i>						15.30

The sensory analysis also asked respondents to rate the “Overall Acceptability” of each of the cheeses. This response was for each cheese individually and was separate from the rank order of the four cheeses reported in Table 1. “Overall Acceptability” was measured on a seven-point scale, with one being “highly acceptable” and seven being “highly unacceptable.”¹¹ As will be described later, “Overall Acceptability” was used in the analysis to connect quality preferences to choices made in the choice experiment.

Table 1 also shows that, despite its high average rank in the blind sensory test, Gossner's was chosen the least often of any of the brands in the choice experiments. The low frequency of being chosen in the choice sets is likely due, at least in part, to low brand recognition for Gossner's. This is based on the fact that average prices in the choice sets were virtually the same for Gossner's, Tillamook, and Cache Valley, but Gossner's was chosen less often than either Tillamook or Cache Valley (Table 2). Almost 35% of respondents indicated they had never heard of the Gossner's brand before (Table 3). These facts imply that if the Utah's Own label “works,” in terms of inducing consumers to choose Gossner's, consumers may continue purchasing it because of its superior taste compared to the other three brands studied.

Table 2. Summary of price statistics for choices offered in Choice Experiment for a two-pound cheese package

Brand	Mean	Std. Dev.	Minimum	Maximum
<i>Price (Overall)</i>	\$7.24	\$1.24	\$4.59	\$9.49
<i>Tillamook</i>	\$7.72	\$1.00	\$5.99	\$9.49
<i>Gossner's</i>	\$7.72	\$1.00	\$5.99	\$9.49
<i>Cache Valley</i>	\$7.73	\$0.98	\$5.99	\$9.49
<i>Western Family</i>	\$5.79	\$0.69	\$4.59	\$6.99

The sensory perception is not the only characteristic that consumers consider when deciding whether or not to purchase a food product. Brand recognition may be just as important as the sensory perception in the consumer's decision. A recognized brand name conveys information to the consumer about a product's attributes. Price also plays a prominent role in the decision process because less expensive products are more likely to be chosen, all else equal.

¹¹This measure can be recovered through the use of principal components analysis on the acceptability of the taste, texture, and odor of each cheese. This result indicates that this variable does in fact measure the overall acceptability of each cheese for the respondent.

The effects of brand recognition and price can be seen in the private and national labels that were considered. The low-priced private label (Western Family) ranked lowest, on the average, of all brands in the blind sensory test. However, Western Family was the most frequently chosen brand in the choice experiment. This contradictory result can be explained by the price distributions used in the choice experiment (see Table 2). Lower average prices for Western Family in the choice sets together with high brand recognition,¹² likely contributed to the high frequency of Western Family being chosen in the choice sets despite its low ranking in the blind sensory test. The national brand, Tillamook, ranked almost as low as Western Family in terms of the results of the blind sensory test (Table 1).

These facts suggest that sensory rankings (quality) for these cheese brands do not closely align with brand recognition and selections in the choice sets (market acceptance). Bridging the gap between quality and market acceptance for high quality, but low-recognition brands such as Gossner's, might be aided by a local designation. That is, a local designation may boost consumer interest in a high-quality, lesser-known brand and, once tried, has a high probability of leading to repeat purchases of the brand (sustainability of the marketing effort). Table 3 shows that of those respondents that had made an initial purchase 23.0% of Gossner's purchasers and 32.6% of Cache Valley purchasers made a repeat purchase. These results indicate that local designations that induce an initial purchase may lead to a substantial number of repeat purchases. In contrast, the high number of repeat purchasers for Tillamook and Western Family are likely due to their high brand recognition and low price, respectively. The type of local designation may also be important as the signal each designation provides may be different for different respondents.

Table 3. Survey respondents' familiarity with cheese brands used in the analysis

Level of Familiarity	Gossners	Cache Valley	Western Family	Tillamook
Never heard of this brand before	34.6%	5.4%	6.0%	17.6%
Know about the brand but never purchased before	19.7%	14.9%	12.8%	24.2%
Bought the brand maybe once	35.2%	53.7%	36.7%	29.6%
Bought this brand several times	5.4%	17.9%	31.9%	19.7%
Buy this brand frequently	5.1%	8.1%	12.5%	9.0%
Probability of repeat purchase conditional on previous purchase	23.0%	32.6%	54.7%	49.2%

Table 4 presents summary statistics for respondent attributes. The statistics indicate the typical respondent to the survey was a white (86%) female (72%), between 26 and 35 years old (22%), with at least a bachelor's degree (29%). The typical respondent is responsible for making food purchases in the household (86%). The average household income was between \$50,001 and \$75,000 (29%) and the average household size was 3.67 individuals with 1.32 children.

Data obtained from the choice experiment and other questions in the survey are used in an econometric model described in the next section. The model estimates the effect of brand, local

¹²Ninety-four percent of survey participants had heard of the Western Family cheese brand before (Table 3).

designation, and respondent characteristics (demographics) on their WTP for a two-pound package of cheddar cheese purchased at a retail food store.

Table 4. Comparisons of U. S. Census demographics and the Utah shopper in-store survey participants

Category	2010 U. S. Census for Utah	In-Store Survey
Gender		
Female	49.8%	71.9%
Male	50.2%	28.1%
Race		
African-American	1.3%	0.3%
American Indian	1.5%	0.0%
Asian	2.2%	1.8%
Caucasian	80.1%	86.6%
Hawaiian/Pacific Islander	1.0%	0.0%
Hispanic	13.2%	7.5%
Middle Eastern		0.0%
Not on list		1.5%
Prefer not to answer		2.4%
Education		
High School Graduates	90.6%	98.5%
Bachelor's degree or higher	29.4%	38.6%
Age		
Persons Aged 65 or Above	9.2%	16.8%
Percent of Household under Age 18	31.2%	36.0% ^a
Household Characteristics		
Number in Household	3.04	3.67
Children in Household		1.32
Estimated Household Income	\$56,330	\$61,679 ^b

Source. U. S. Census. <http://quickfacts.census.gov/qfd/states/49000.html>.

^a Estimated by dividing respondents' indication of number of children in the household by their indication of total persons in the household (1.32/3.67). ^b Estimated as a weighted average of mid-points in the income price ranges in the survey.

Econometric Framework

As the analysis included two local brands and there are three separate ways to designate each local brand (brand only, brand with Utah's Own designation, and brand with locally-produced designation), survey respondents were assigned surveys in one of nine possible configurations: 1) no designation on either local brand, 2) a "Utah's Own" designation on both local brands, 3) a "Locally-Produced" designation on both local brands, 4) a "Utah's Own" designation on Gossner's and a "Locally-Produced" designation on Cache Valley, 5) a "Utah's Own" designation on Cache Valley and a "Locally Produced" designation on Gossner's, 6) a "Utah's Own" designation on Gossner's and no designation on Cache Valley, 7) a "Utah's Own"

designation on Cache Valley and no designation on Gossner's, 8) a "Locally-Produced" designation on Cache Valley and no designation on Gossner's, and finally, 9) a "Locally-Produced" designation on Gossner's and no designation on Cache Valley. Because these configurations were assigned randomly, each configuration makes up approximately 1/9 of the total number of surveys.

Our choice sets are simple, with only price and brand label attributes (see Figure 1). This simplicity, combined with the fact that tastes and preferences over cheese can vary across consumers, enables us to use prices that are, by design, orthogonal to the brand attributes without sacrificing realism or efficiency in estimation.

Conceptual Model to Analyze Choice Experiments

We used a standard random-utility framework as our conceptual model (Train 2003). Assuming that respondents make choices to maximize their utility, we model the unobserved or latent utility of respondent i from alternative j as a linear function of the attributes of the alternatives and an unobserved random component of utility:

$$(1) u_{ij}^* = \beta \text{Price}_j + \delta X_j + \varepsilon_{ij}$$

Denoting the latent utility of respondent i for alternative j as u_{ij}^* , we interpret the coefficient β as marginal utility associated with paying for an alternative. The quantity X_j contains a vector of attributes describing alternative j and δ represents the vector of associated marginal increments to utility associated with each attribute. In this model, each alternative is described completely by a price and set of indicators for brand and designation. Note that both Price_j and the vector X_j are equal to zero for the "neither" alternative.

Random utility models can be estimated using maximum likelihood by assuming a distribution for the unobserved component of utility. We have analyzed the choices using a variety of different models. However, our preferred model for these results is an alternative-specific multinomial (ASM) probit model. This model assumes the latent errors are distributed jointly normal and has the advantage of being free from the independence of irrelevant alternatives assumption inherent in logit models. The probit-based model also permits us to employ an error structure allowing for cross-alternative heteroscedasticity and an unstructured cross-alternative correlation pattern. We also employ standard errors that are clustered at the respondent level to account for the repeated-choice nature of the data.

As a simple example, suppose there were two brands, Gossner's and Western Family (denoted "G" and "WF"), and one designation, *Utah's Own* (denoted UO) that varied the designation on Gossner's. The vector X_j would then consist of three variables: a constant for the omitted category (WF in this case), a dummy variable for Gossner's and a dummy variable for the interaction between Gossner's and the *Utah's Own* designation. Representative utility would then be modeled as:

$$(2) u_{ij}^* = \beta \text{Price}_j + \delta_0 + \delta_1 G_j + \delta_2 UO_j * G_j + \varepsilon_{ij}$$

A test of the statistical significance of the parameter δ_2 indicates any meaningful difference to utility and choice probability when the *Utah's Own* designation was shown compared to simply being offered Gossner's with no designation.

Willingness to Pay

WTP for a particular alternative j can be estimated by solving for the price that would make the representative consumer with the indicated utility function indifferent between paying for alternative j at the stated price or not. Let this price be denoted Price_j^* and set utility equal to zero:

$$(3) u_{ij}^* = \beta \text{Price}_j^* + \delta X_j = 0$$

Solving for Price_j^* yields:

$$(4) \text{WTP for alternative } j = \text{Price}_j^* = \frac{\delta X_j}{-\beta}$$

For example, total WTP for the omitted category (WF) in the example above is:

$$(5) \text{Price}_j^* = \frac{\delta_0}{-\beta}$$

While WTP for Gossner's (with the *Utah's Own* designation) would be:

$$(6) \text{Price}_j^* = \frac{\delta_0 + \delta_1 G_j + \delta_2 UO_j * G_j}{-\beta} \\ = \frac{\delta_0 + \delta_1 + \delta_2}{-\beta}$$

Note that marginal WTP is calculated by taking the derivative of Price_j^* with respect to a given characteristic. For example, marginal WTP for Gossner's, relative to Western Family is:

$$(7) \frac{\partial \text{Price}_j^*}{\partial G} = \frac{\delta_1}{-\beta}$$

if the *Utah's Own* designation were zero (Gossner's presented in the choice without the *Utah's Own* designation) and

$$(8) \frac{\partial \text{Price}_j^*}{\partial G} = \frac{\delta_1 + \delta_2}{-\beta}$$

if the *Utah's Own* designation were one. Similarly, marginal WTP for Gossner's with the *Utah's Own* designation, relative to Western Family without the designation, is:

$$(9) \frac{\partial \text{Price}^*}{\partial UO} \text{Marginal WTP for Utah's Own label} = \frac{\delta_2}{-\beta}$$

Finally, confidence intervals for WTP and marginal WTP can be calculated via the parametric bootstrap method, described by Krinsky and Robb (1986 and 1990), by taking a large number of draws from the estimated variance-covariance matrix of the parameter estimates. The means of this distribution are given by the parameter estimates and the covariance is given by the variance-covariance matrix of the parameter estimates. See Hole (2007) for a detailed discussion of how to construct confidence intervals for WTP estimates and Bosworth et al. (2009) for an applied example.

Results and Discussion

Construct Validity: Sensory Preferences Are Predictive of Hypothetical Choices

As the blind sensory analysis was conducted just prior to the choice experiment, the extent to which respondent preferences for different cheeses are predictive of choices made in the actual choice experiment can be tested. If actual preferences, as indicated in the sensory experiment, are strongly predictive of the hypothetical choices made in the survey, this result would provide a strong degree of construct validity for the choice experiment that was conducted. On the other hand, if the sensory data do not provide explanatory power, it is likely the experiment may suffer from a significant degree of hypothetical bias. We therefore model the probability that a given cheese is chosen as a simple function of the price of the cheese and the “Overall Acceptability” rating of the cheese in the sensory analysis. To avoid contaminating the results of these models with the influence of the local designations, we use only observations from those choice sets that did not include local designation labels.¹³

Table 5 compares three different functional forms of the same model. The first model is a conditional logit specification, the second is an ASM probit with a fixed correlation pattern, and the final specification is a fully-flexible ASM probit. All of the models are estimated with clustered standard errors clustered on each respondent. Table 5 shows that as the selected value for “Overall Acceptability” of the cheese in the blind sensory test decreases, the probability that cheese will be chosen in the choice experiment decreases. Because the respondents were shown brands only in the choice experiment and not in the sensory analysis, this result provides evidence that the choice experiment has substantial construct validity in the sense that the brands convey actual information about the relative quality of the cheeses in terms of its sensory characteristics. That is, the quality identified in the sensory analysis (as measured by “Overall Acceptability”) when labels were not provided, corresponded closely with the choices made in the choice experiment when brand names were provided. This result is robust to the different specifications for the model as indicated in Table 5.

¹³Excluding those observations where the cheeses were labeled with a local designation is important because these labels increase the probability that the cheese will be chosen in the choice set, but this increased probability is not due to observed consumer preferences for the cheese. We wish to isolate the effect of pre-existing consumer preferences on the probability that the cheese is chosen in the choice experiment. Subsequent models explore the effect of local designations on choice probabilities.

Table 5. Sensory information as a predictor of respondent choice.

Variable	Model		
	[1] Conditional Logit	[2] Fixed ASM Probit	[3] ASM Flexible Probit
<i>Price</i>	-0.598*** (0.0557)	-0.506*** (0.0589)	-0.518*** (0.0598)
<i>Overall</i>	0.179*** (0.0663)	0.150*** (0.0560)	0.154*** (0.0564)
<i>Acceptability</i>	5.592*** (0.429)	4.713*** (0.462)	4.746*** (0.465)
<i>Constant</i>			
Observations	3,727	3,727	3,727

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Because these results indicate that consumers make purchase decisions based on quality, if SSDs, such as Utah's Own, are designed to convey quality signals to consumers and not just production location, they are likely to be more effective than if quality is not a consideration in granting the designation. This supports the notion that combining locational designations with quality characteristics is likely more effective than when they are separated. In this respect, the findings support the concepts of PDO and PGI in the EU.

Table 6 indicates that only 27% of survey respondents view the Utah's Own designation as a signal of high quality. The highest positive perceptions of Utah's Own appear to be tied either identifying a locally-produced product or as helping the local economy and local farmers. While these are positive perceptions, they may or may not produce repeated purchases of products with the Utah's Own designation. But, if a perception of high quality is combined with the other positive aspects of purchasing a local product (e.g., helps the local economy and local farmers) the desired result of local designations in terms of expanding markets for local products is more likely be realized than if quality is not considered in issuing the local designation.

Table 6. Respondent perceptions of the Utah's Own Designation

Variable	Mean	St. Dev.	Min	Max
<i>High Quality</i>	0.271	0.444	0	1
<i>Same Quality</i>	0.237	0.426	0	1
<i>Low Quality</i>	0.024	0.153	0	1
<i>Locally Produced</i>	0.630	0.483	0	1
<i>Utah Product</i>	0.768	0.422	0	1
<i>Fresher Product</i>	0.531	0.499	0	1
<i>Expensive Product</i>	0.128	0.335	0	1
<i>Inexpensive Product</i>	0.147	0.354	0	1
<i>Environmentally Friendly</i>	0.097	0.296	0	1
<i>Helps Local Farmers</i>	0.757	0.429	0	1
<i>Helps Local Economy</i>	0.711	0.453	0	1

Local Designations Significantly Impact WTP

Table 7 presents the results of three ASM probit models which employ respondent-level clustered standard errors and allow for fully-flexible correlation patterns in the unobserved

errors. Table 8 presents the associated WTP measures for these models. The first model reported in Tables 7 and 8 indicates that brand effects exist in the data, because each brand has a statistically significant positive effect on the probability of selection (significant coefficient on each brand). We estimate average WTP for two-pound of Gossner's cheese to be \$8.67, for Cache Valley \$9.61, for Tillamook \$9.10, and for Western Family \$8.61 (Table 8). Notice that the WTP for Cache Valley is nearly a dollar more than it is for Western Family and their marginal WTP lies outside of the 95% confidence interval of the other cheese in both cases. This indicates that Cache Valley and Western Family likely have fundamentally different average WTP. The sensory results suggest this is because quality differences exist in the brands.

The second model in Table 7 is identical to the first model except it adds an interaction effect with a designation dummy variable on the two locally-produced brands (Gossner's and Western Family). This dummy variable was equal to 1 if either of the two types of designations was shown in the choice sets given to the respondent. The coefficient for both interaction term for "Any Designation" (Model 2 in Table 7) is positive and statistically significant providing evidence that SSDs do, on the average, increase the probability that consumers will purchase products with a local designation. WTP reported for Model 2 in Table 8 indicates that, on the average, a local designation adds about \$0.51 to the WTP for Gossner's and Cache Valley.

Table 7. Estimates of effectiveness of brands and designations

Variable	Conditional Logit	ASM Fixed Probit	ASM Flexible Probit
<i>Price</i>	-0.469*** (0.0614)	-0.475*** (0.0638)	-0.479*** (0.0636)
<i>Tillamook</i>	4.266*** (0.408)	4.315*** (0.426)	4.337*** (0.425)
<i>Western Family</i>	4.035*** (0.388)	4.081*** (0.405)	4.100*** (0.403)
<i>Gossner's</i>	4.064*** (0.395)	3.942*** (0.416)	3.960*** (0.416)
<i>*Utah's Own</i>	--	--	0.314** (0.159)
<i>*Locally Produced</i>	--	--	0.184 (0.156)
<i>*Any Designation</i>	--	0.247* (0.137)	--
<i>Cache Valley</i>	4.501*** (0.429)	4.389*** (0.416)	4.410*** (0.416)
<i>*Utah's Own</i>	--	--	0.156 (0.161)
<i>*Locally Produced</i>	--	--	0.328** (0.164)
<i>*Any Designation</i>	--	0.241* (0.145)	--
Observations	6,021	6,021	6,021

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The final model in Table 7 allows the designation effect to vary across the two different types of labels (“Utah’s Own” and “Locally-Produced”). Interestingly, the separate designations affect the two brands differently. The Utah’s Own label has a statistically significant positive effect on Gossner’s, but not on Cache Valley, while the locally-produced label has a statistically significant positive effect on Cache Valley, but not on Gossner’s. The reason behind this difference is unclear. However, it could be the result of differences in brand recognition and what the two local designations may or may not communicate to consumers.

The Cache Valley brand is the most recognized of the four cheese labels in the study (Table 3) and some respondents may connect the Cache Valley label to a geographic location, namely Cache Valley, Utah. The choice experiment results indicate that brand recognition is an important factor in respondent choices and WTP. Cache Valley’s strong brand recognition and connection to Utah may make the Utah’s Own designation redundant to some respondents. Other respondents may view “Locally-Produced,” in the case of a well-known product like Cache Valley, as new and useful information they had not previously associated with the brand.

Gossner’s is the least familiar brand in the survey being recognized by only about 65% of respondents (Table 3). On the other hand, almost 84% of respondents had some familiarity with the Utah’s Own designation. In the case of brands with low recognition, a SSD, in this case Utah’s Own, may act to a degree as a substitute for the brand in communicating quality in the minds of some respondents. In this respect, the Utah’s Own designation is a stronger branding signal than “locally-produced” if a brand is not well-known. This may be the result of promotional activities associated with the SSD. The SSD appears to be filling an information and trust gap for respondents who are not familiar with the Gossner’s brand that is not needed in the case of the well-known Cache Valley brand.

The final column in Table 8 shows that for Gossner’s to compete at the same price points as Cache Valley and Tillamook, it needs to have the Utah’s Own label. Given that Gossner’s was the highest rated cheese in the sensory analysis, the Utah’s Own designation appears to boost the credibility of Gossner’s label so that respondents regard it as the same quality as Cache Valley and Tillamook. Without the Utah’s Own designation, respondents WTP would have been less for Gossner’s compared to these other two brands. Gossner’s high quality would ensure that consumers drawn to Gossner’s by the Utah’s Own label might continue to purchase it.¹⁴

¹⁴Again, the analysis is only measuring WTP based on local designations at a given point in time. However, the results reported here indicate that elements necessary for repeat purchases of Gossner’s are present, i.e., high quality based on sensory characteristics and WTP.

Table 8. WTP measures for a two-pound cheese package with reported 95%

Variable	Conditional Logit	ASM Fixed Probit	ASM Flexible Probit
<i>Tillamook</i>	\$9.10 (\$8.46 - \$ 9.94)	\$9.08 (\$8.45 - \$9.86)	\$9.06 (\$8.45 - \$9.84)
<i>Western Family</i>	\$8.61 (\$8.05 - \$9.36)	\$8.59 (\$8.02 - \$9.37)	\$8.57 (\$8.00 - \$9.34)
<i>Gossner's</i>	\$8.67 (\$8.00 - \$9.50)	\$8.59 (\$8.02 - \$9.37)	\$8.27 (\$7.56 - \$9.13)
<i>*Utah's Own</i>			\$0.66 (-\$0.12 - \$1.17)
<i>*Locally Produced</i>			\$0.38 (-\$0.17 - \$0.94)
<i>*Any Designation</i>		\$0.52 (\$0.05 - \$0.99)	
<i>Cache Valley</i>	\$9.61 (\$8.94 - \$10.43)	\$9.23 (\$8.49 - \$10.21)	\$9.22 (\$8.49 - \$10.18)
<i>*Utah's Own</i>			\$0.33 (-\$0.30 - \$0.84)
<i>*Locally Produced</i>			\$0.68 (\$0.10 - \$1.20)
<i>*Any Designation</i>		\$0.51 (\$0.03 - \$0.94)	

Variation in Results by Respondent Characteristics

The data were also analyzed for the effects of respondent characteristics. Table 9 (see Appendix) reports the effect of respondent age, gender, and income on respondent choice and WTP. Brand is a significant determinant of WTP for both genders and all age groups. However, the local designations clearly appeal to respondents over the age of 56 but not to the other age groups and only for the Gossner's brand (significant estimated coefficients on Utah's Own and Locally-Produced only for Gossners and only for the 56+ age category (Table 9)). The Locally-Produced designation is effective on Gossner's for low income people and on Cache Valley for high income people. The effect on the high income group is large and very significant for Locally-Produced. Gossner's Utah's Own effect is significant for the middle income group.

The Utah's Own designation was found to have a positive effect on Gossner's for people who are familiar with the Utah's Own designation (Table 10, see Appendix). This was also true for those respondents who indicated they had previously purchased a Utah's Own product. The Locally-Produced designation is effective on both Gossner's and Cache Valley for those who have not purchased Utah's Own products before. Finally, perceptions of the impact of Utah's Own on local farmers and the local economy are very important (Table 10). The Utah's Own label has strong positive effects on both cheeses for those who believe it helps farmers and for those who believe it helps the local economy. However, the Utah's Own label actually has a negative effect on Cache Valley for those who believe it does not help local farmers. This is the only subgroup where the designations have a statistically significant negative effect and appears to be connected to respondents who are skeptical about the benefit of the Utah's Own designation to farmers.

These results suggested that brands are a critical component of cheese marketing because respondents' WTP was heavily influenced by brands. Local designations also have an important role to play for local brands, but the effects of different local designations are very brand specific. WTP for the least well-known of the brands, Gossner's, is clearly enhanced by Utah's Own for older female shoppers who are familiar with the Utah's Own program and who sympathize with the economic plight of local farmers. This provides a target audience and strategy for promoting Utah's Own for its managing entity, UDAF. The sensory results also indicated that many people who try Gossner's as a result of the Utah's Own designation will like the product and may become repeat purchasers. This suggests that the SSD is most effective when used on lesser-known, but high quality local products compared to better-known local brands or brands of low quality.

The well-known local product, Cache Valley, was not aided by the Utah's Own designation, probably because the Utah's Own designation may be somewhat redundant to many of the respondents. However, the Locally-Produced designation on Cache Valley did appeal, in terms of higher WTP, to older, high income, female respondents who saw the designation as helping the local economy (but not necessarily farmers). This result suggests that the Locally-Produced designation is important to this demographic; more so than the Utah's Own designation. This group may identify with the buy-local movement more than other respondents and the Locally-Produced designation appears to be an important signal to them.

Conclusions

The study results indicate that local brands were able to compete well, in terms of pricing, with the national brands and private labels, especially when local designations were appropriately applied. The locally-produced designation increased consumer WTP more than the state-sponsored designation for the well-known local brand, but not for the lesser-known brand. This suggests that consumers will react favorably to a simple locally-produced designation, especially when they are already familiar with the brand. This result is consistent with Deselnicu et al. (2013) where premiums for geographically-identified products were lower for products otherwise differentiated, such as through brands.

For SSDs connecting sensory quality to locally-produced products with low brand recognition or no separate differentiation strategy would likely be effective in increasing consumer WTP, as was the case in this study and also in Moschini, Menapace, and Pick (2008). However, the degree of impact on consumer WTP will likely be product specific, and thus exact extrapolations are not recommended. For example, Deselnicu et al. (2013) suggests that globally, origin identified fresh produce and meat tend to command the highest premiums, followed by cheese, with olive oils and lastly wine. Additionally, in order for the SSD to maintain its impact on product pricing, quality must also be maintained. As discussed in Menapace and Moschini (2012) minimum-quality standards set by the SSD may be integral to maintaining consumer confidence in the quality of SSD products.

Also, in this study the SSD appears to have a greater impact on older, mid-income females, looking to support local farmers. Products seeking to access this target market may find SSD

membership a potential benefit. Market and promotional decision makers should consider if this market corresponds to the strategy of pursuit.

Finally, this study examined consumer decision making in a realistic shopping experience, as data collection and sensory analysis was conducted in a retail grocery atmosphere. But, while the results provides convincing evidence of the connection between stated preferences and local designations at a point in time, the long-term effect of local designations on repeat purchases would require further study using information on purchases by a consumer panel over time.

References

- Appleby, C. M. Costanigro, D. Thilmany McFadden, and S. Menke. 2012. Measuring Consumer Willingness to Pay for Low-Sulfite Wine: A conjoint Analysis. *American Association of Wine Economics Working Paper No. 117*. August.
- A.T. Kearney. "Buying into the Local Food Movement." Available online at http://www.atkearney.com/paper/-/asset_publisher/dVxv4Hz2h8bS/content/buying-into-the-local-food-movement/10192. January 2013. [accessed January 24, 2014].
- Bonnet, C. and M. Simoni. 2001. "Ascension Consumer Response to Protected Designation of Origin Labeling: A Mixed Multinomial Logic Approach." *European Review of Agricultural Economics* 28: 433-449.
- Bosworth, Ryan C., DeeVon Bailey, and Kynda R. Curtis. 2013. "Willingness to Pay for Private Labels, National Brands, and Local Designations at the Retail Level." Selected paper at the Australian Agricultural and Resource Economics Society meetings, Sydney, Australia. February 4-8.
- Bosworth, R., Trudy A. Cameron, and J. R. DeShazo. 2009. Demand for Environmental Policies to Improve Health: Evaluating Community-level Policy Scenarios. *Journal of Environmental Economics and Management* 57(3): 293-308.
- Cameron, T. A. and J. R. DeShazo. 2013. Demand for Health Risk Reductions. *Journal of Environmental Economics and Management* 65(1):87-109.
- Clifford, Stephanie. 2010. Wal-Mart to Buy More Local Produce. *The New York Times*. October 14.
- Combris, P., P. Bazoche, E. Giraud-Heraud, and S. Issanchou. 2009. Food choices: What do we learn from combining sensory and economic experiments? *Food Quality and Preference* 20(8):550-557.
- Darby, K., M. T. Batte, S. Ernst, and B. Roe. 2008. Decomposing Local: A Conjoint Analysis of Locally-Produced Foods. *American Journal of Agricultural Economics* 90(2):476-486.

- Deselnicu, O., M. Costinigo, D. Souza-Monteiro, and D. Thilmany McFadden. 2013. A Meta-Analysis of Geographical Indication Food Evaluation Studies: What Drive the Premium for Origin-Based Labels? *Journal of Agricultural and Resource Economics* 38(2): 204-219.
- Galli, F., A. Carbone, J.A. Caswell, and A. Sorrentino. 2011. A Multi-Criteria Approach to Assessing PDOs/PGIs: An Italian Pilot Study. *International Journal of Food System Dynamics* 2(3):219-236.
- Hass, Rainer, and Robert D. Weaver. 2010. "Private Labels: A Sign of Changing Times." Proceedings of the 4th International European Forum on System Dynamics and Innovation in Food Networks. Innsbruck-Igls, Austria. February 8-12.
- Hassan, D., and S. Monier-Dilhan. 2006. National brands and Store Brands: Competition through Public Quality Labels. *Agribusiness* 22(1): 21-30.
- Hole, A. R. 2007. A Comparison of Approaches to Estimating Confidence Intervals for Willingness to Pay Measures. *Health Economics* 16(8): 827-840.
- Jekanowski, M. D., D. R. Williams II, and W. A. Schiek. 2000. Consumers' Willingness to Purchase Locally Produced Agricultural Products: An Analysis of an Indiana Survey. *Agricultural and Resource Economics Reviews* 29(8):43-53.
- Krinsky, I. and A. L. Robb. 1986. On Approximating the Statistical Properties of Elasticities. *The Review of Economics and Statistics* 68(4):715-719.
- Krinsky, I. and A. L. Robb. 1990. On Approximating the Statistical Properties of Elasticities: Correction. *The Review of Economics and Statistics* 72(1):189-190.
- Kroger. Find Home Grown Produce at Your Local Store. Available online at http://www.kroger.com/fresh_foods/fruits_veggies/Pages/home_grown.aspx. Accessed July 16, 2012.
- Liu, Juan, and Thomas L. Sporleder. 2007 Growth-Related Measures of Brand Equity Elasticity for Food Firms. *International Food and Agribusiness Management Review* 10(1):1-17.
- Loureiro, M. L., and J. J. McCluskey. 2000. Assessing Consumers Response to Protected Geographical Identification Labeling. *Agribusiness* 16(3):309-320.
- McCluskey, J.J., R.C. Mittelhammer, A.B. Marin, and K.S. Wright. 2007. Effect of Eating-Quality Characteristics on Consumers' Willingness to Pay for Gala Apples. *Canadian Journal of Agricultural and Resource Economics* 55(2):217-231.

- McCluskey, J. J. and M. L. Loureiro. 2003. Consumer Preferences and Willingness to Pay for Food Labeling: A discussion of Empirical Studies. *Journal of Food Distribution Research*. 34(2):95-102.
- Menapace, L., and G. Moschini. 2012. Quality Certification by Geographical Indication, Trademarks and Firm Reputation. *European Review of Agricultural Economics* 39(4):539-566.
- Miller, S., C. Hampson, R. McNew, L. Berkett, S. Brown, J. Clements, R. Crassweller, E. Garcia, D. Greene, and G. Greene. 2005. Performance of Apple Cultivars in the 1995 NE-183 Regional Project Planting: III. Fruit Sensory Characteristics. *Journal of the American Pomological Society* 59(1):28-43.
- Moschini, G., L. Menapace, and D. Pick. 2008. Geographical Indication and the Competitive Provision of Quality in Agricultural Markets.” *American Journal of Agricultural Economics* 90:794-812.
- National Grocers Association. National Grocers Association 2011 Consumer Survey Report. Available online at <http://www.supermarketguru.com/public/pdf/Consumer-Panel-Survey-2011.pdf>. Accessed 16 July 2012.
- NPD Group. “Use of Private Label Foods Continues to Rise but Satisfaction with These Value-Oriented Options is Declining, Reports NPD.” 1 May 2012. Available online at https://www.npd.com/wps/portal/npd/us/news/pressreleases/pr_120501. [accessed July 5, 2012.
- Onken, K. A., and J. C. Bernard. 2010. Catching the ‘Local’ Bug: A Look at State Agricultural Marketing Programs. *Choices* <http://www.choicesmagazine.org/magazine/article.php?article=112>
- Onken, K. A., J. C. Bernard, and J. D. Pesek Jr. 2011. Comparing Willingness to Pay for Organic, Natural, Locally Grown, and State Marketing Program Promoted Foods in the Mid-Atlantic Region. *Agricultural and Resource Economics Review* 40(1):33-47.
- Sageworks, Inc. 2012. Grocers, Wholesalers Saw Higher Profit Margins in 2011. February 10. <http://seekingalpha.com/article/357831-grocers-wholesalers-saw-higher-profit-margins-in-2011>. [accessed July 5, 2012.]
- Steenkamp, J. E. M., H. J. Van Heerde, and I. Geyskens. 2010. What Makes Consumers Willing to Pay a Price Premium for National Brands Over Private Labels? *Journal of Marketing Research* 47(6):1011-1024.
- Taylor, L. O., M. D. Morrison, and K. J. Boyle. 2010. Exchange Rules and the Incentive Compatibility of Choice Experiments. *Environmental and Resource Economics* 47(2): 197-220.

Train, K. E. *Discrete Choice Methods with Simulation*. Cambridge University Press: Cambridge UK. 2003.

United States Department of Agriculture, Agricultural Marketing Service (USDA, AMS). "Farmers Markets and Local Food Marketing: Farmers Market Growth: 1994-2011. Updated 8 August 2011. Available online at <http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateS&leftNav=WholesaleandFarmersMarkets&page=WFMFarmersMarketGrowth&description=Farmers%20Market%20Growth&acct=frmrdirmt>. [accessed 3 July 2012].

Utah's Own Website. Welcome to Utah's Own. <http://www.utahsown.utah.gov/>. [accessed 6 July 2012].

Volpe, Richard. 2011. The Relationship between National Brand and Private Label Food Products: Prices, Promotions, Recessions, and Recoveries. U. S. Department of Agriculture, Economic Research Service, Economic Research Report Number 129. December.

Whole Foods Website. Locally Grown: The Whole Foods Market Promise. <http://www.wholefoodsmarket.com/products/locally-grown/>. [accessed on July 3, 2012].

Wild Oats Market Website. "10 Reasons to Buy Local Food." <http://www.wildoats.coop/10%20reasons%20to%20buy%20local%20food.pdf>, [accessed on July 3, 2012].

Appendix

For the first six questions, please base your answers on the type of cheese you USUALLY purchase in a 2 lb. package.

1 Which of the following products would you choose to purchase at the prices given?

Gossner's (Utah's Own) Price: \$6.89	Cache Valley (locally-produced) Price \$6.29	Neither
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2 Which of the following products would you choose to purchase at the prices given?

Western Family Price: \$5.19	Tillamook Price \$8.99	Neither
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3 Which of the following products would you choose to purchase at the prices given?

Gossner's (Utah's Own) Price: \$7.99	Western Family Price \$6.69	Neither
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4 Which of the following products would you choose to purchase at the prices given?

Cache Valley (locally produced) Price: \$7.79	Tillamook Price \$6.49	Neither
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5 Which of the following products would you choose to purchase at the prices given?

Tillamook Price: \$7.29	Gossner's (Utah's Own) Price \$6.59	Neither
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6 Which of the following products would you choose to purchase at the prices given?

Western Family Price: \$6.89	Cache Valley (locally-produced) Price \$7.39	Neither
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1. Representative choice set used for the store survey

Table 9. Variation in results by gender, age and income.

Variable	Females	Males	Age 18-35	Age 36-55	Age 56+	Low Income	Middle Income	High Income
<i>Price</i>	-0.472*** (0.0616)	-0.124 (0.0912)	-0.348*** (0.103)	-0.526*** (0.0964)	-0.526*** (0.104)	-0.395*** (0.0833)	-0.457*** (0.0940)	-0.752*** (0.130)
<i>Tillamook</i>	4.207*** (0.413)	2.346*** (0.482)	3.641*** (0.642)	4.782*** (0.680)	4.478*** (0.718)	3.551*** (0.518)	4.132*** (0.642)	6.844*** (0.984)
<i>Western Family</i>	4.109*** (0.372)	2.189*** (0.367)	3.630*** (0.636)	4.425*** (0.588)	4.065*** (0.613)	3.668*** (0.514)	3.968*** (0.588)	5.532*** (0.752)
<i>Gossner's</i>	3.731*** (0.387)	2.312*** (0.462)	3.473*** (0.623)	4.419*** (0.650)	3.860*** (0.636)	3.420*** (0.511)	3.673*** (0.596)	5.967*** (0.895)
<i>*Utah's Own</i>	0.357** (0.170)	0.0428 (0.0609)	0.0522 (0.190)	0.346 (0.233)	0.569** (0.255)	0.108 (0.192)	0.448* (0.242)	0.516 (0.319)
<i>*Locally Produced</i>	0.216 (0.164)	0.00525 (0.0560)	0.0990 (0.190)	-0.0513 (0.241)	0.522** (0.238)	0.346* (0.194)	0.0288 (0.220)	0.249 (0.352)
<i>Cache Valley</i>	4.045*** (0.405)	2.489*** (0.577)	3.708*** (0.665)	4.659*** (0.653)	4.754*** (0.755)	3.890*** (0.582)	4.230*** (0.656)	6.229*** (0.915)
<i>*Utah's Own</i>	0.350** (0.164)	-0.0902 (0.0755)	0.0182 (0.179)	0.219 (0.235)	0.234 (0.225)	0.163 (0.182)	-0.0253 (0.200)	0.528 (0.343)
<i>*Locally Produced</i>	0.614*** (0.172)	-0.0756 (0.0780)	0.333 (0.210)	0.372 (0.248)	0.210 (0.211)	0.126 (0.179)	0.152 (0.204)	1.203*** (0.387)
Observations	4,320	1,710	1,836	2,142	2,052	2,646	1,764	1,620

Statistically significant designation effects in bold.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10. Variation in results based on experience with and perceptions of Utah's Own designation.

Variable	Familiar With	Not Familiar	Have Purchased	Have Not Purchased	Helps Farmers	Doesn't Help Local Farmers	Helps Local Economy	Does Not Help Local Economy
<i>Price</i>	-0.335*** (0.0830)	-0.573*** (0.0815)	-0.374*** (0.0776)	-0.545*** (0.148)	-0.500*** (0.0683)	-0.371*** (0.0956)	-0.481*** (0.0715)	-0.445*** (0.0893)
<i>Tillamook</i>	3.516*** (0.527)	4.886*** (0.561)	3.861*** (0.504)	4.451*** (1.021)	4.588*** (0.466)	3.307*** (0.614)	4.394*** (0.486)	4.012*** (0.613)
<i>Western Family</i>	3.353*** (0.480)	4.579*** (0.493)	3.549*** (0.432)	4.260*** (0.915)	4.256*** (0.411)	3.319*** (0.570)	4.100*** (0.432)	3.878*** (0.548)
<i>Gosner's</i>	3.211*** (0.473)	4.494*** (0.540)	3.528*** (0.451)	3.751*** (0.910)	4.078*** (0.426)	3.325*** (0.622)	4.029*** (0.454)	3.627*** (0.585)
<i>*Utah's Own</i>	0.343** (0.163)	0.126 (0.215)	0.391** (0.160)	0.220 (0.403)	0.353** (0.159)	0.266 (0.234)	0.262* (0.151)	0.524* (0.284)
<i>*Locally Produced</i>	0.206 (0.149)	0.126 (0.206)	0.178 (0.141)	0.717* (0.407)	0.195 (0.157)	0.0761 (0.211)	0.158 (0.153)	0.188 (0.242)
<i>Cache Valley</i>	3.640*** (0.542)	4.901*** (0.574)	3.987*** (0.516)	3.988*** (0.964)	4.561*** (0.465)	3.767*** (0.704)	4.446*** (0.492)	4.182*** (0.638)
<i>*Utah's Own</i>	0.0407 (0.139)	0.243 (0.202)	-0.00858 (0.135)	0.395 (0.408)	0.330** (0.151)	-0.496* (0.264)	0.296** (0.145)	-0.359 (0.268)
<i>*Locally Produced</i>	0.253 (0.155)	0.328 (0.203)	0.192 (0.142)	1.011** (0.399)	0.350** (0.155)	0.0701 (0.223)	0.318** (0.152)	0.254 (0.249)
Observations	3,006	3,024	3,636	828	4,572	1,458	4,284	1,746

Statistically significant designation effects in bold.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Bottlenecks and Opportunities for Quality Improvement in Fresh Pineapple Supply Chains in Benin

V. Nicodème Fassinou Hotegni^a, Willemien J. M. Lommen[Ⓣ], Jack G. A. J. van der Vorst^c
Euloge K. Agbossou^d, and Paul C. Struik^e

^a *PhD Researcher, Centre for Crop Systems Analysis,
Wageningen University, Droevendaalsesteeg 1, 6708 PB Wageningen, the Netherlands and Faculté des Sciences
Agronomiques, Université d'Abomey Calavi, 01 BP 52, Cotonou, Benin*

^b *Assistant Professor, Centre for Crop Systems Analysis,
Wageningen University, Droevendaalsesteeg 1, 6708 PB Wageningen, the Netherlands*

^c *Professor, Operations Research and Logistics Group, Wageningen University, Hollandseweg 1, 6706 KN
Wageningen, the Netherlands*

^d *Professor, Faculté des Sciences Agronomiques, Université d'Abomey Calavi, 01 BP 526, Cotonou, Benin*

^e *Professor, Centre for Crop Systems Analysis,
Wageningen University, Droevendaalsesteeg 1, 6708 PB Wageningen, the Netherlands*

Abstract

This study mapped and diagnosed the fresh pineapple supply chains in Benin to identify bottlenecks in pineapple quality improvement for different markets. A research framework was defined that comprised all relevant aspects to be researched. After 54 semi-structured interviews with key informants, 173 structured interviews were held with actor groups. The chain diagnosis showed there was no concordance between actor groups in which quality attribute they valued most. Moreover, pineapple quality was found to be highly heterogeneous. Key bottlenecks identified were lack of training of primary producers in production practices, unconditioned transport, and unavailability of boxes for export.

Keywords: *Ananas comosus*, pineapple, quality, outlets, supply chain.

[Ⓣ]Corresponding author: Tel: + 31 317 48 4697

Email: W.J.M. Lommen: Willemien.Lommen@wur.nl

V.N. Fassinou Hotegni: nicodeme.fassinouhotegni@wur.nl
nicodemef@gmail.com

J.G.A.J. van derVorst: Jack.vanderVorst@wur.nl

E.K. Agbossou: agbossou.euloge@yahoo.fr

P.C. Struik: Paul.Struik@wur.nl

Introduction

Pineapple [*Ananas comosus* (L.) Merrill] is a tropical fruit with a large production volume in the world (FAO 2009). In West Africa, it is the second most important tropical fruit after banana (FAO 2009). In Benin, it is one of the main crops in the Atlantic department in the south (Arouna and Afomassè 2005), where it is grown by 70% of the farmers for fresh consumption and processing into juice. Since 2006, pineapple is among the crops selected by the government in Benin to potentially alleviate poverty (Agbo et al. 2008) since Benin is the fourth country in the world delivering the highest pineapple yields (FAO 2012). Different market outlets exist: (1) the local outlet for fresh and processed pineapple, (2) the regional outlet for export to neighboring countries (Nigeria, Ghana) for fresh and processed pineapple, and (3) the European outlet (export to Belgium, the Netherlands, France, etc.) for high-quality fresh pineapple.

The main problem of pineapple in Benin is the fact that the produce often does not meet the standards for any of the outlets and certainly not the European standards (Gbenou et al. 2006). Each time producers want to export fresh pineapple to European countries a huge quantity (more than 50% of what is delivered to be exported) is rejected because it does not meet the European import criteria (Gbenou et al. 2006). Despite frequent attempts, less than two percent of the total production of pineapple is exported to European countries (Agbo et al. 2008; FAO 2011). For example, in 2009, the pineapple production was about 222,223 Mg, but only 74 Mg (0.033 %) was exported (FAO 2009). In 2010, from 220,800 Mg of pineapple produced, only 82 Mg (0.037%) was exported (FAO 2011). The remaining pineapples were delivered to the local and regional markets with lower quality demands and lower prices. Unfortunately, most of these pineapples lose their quality before being consumed (Gbenou et al. 2006) resulting in huge losses.

These problems show that the current pineapple supply chains are not effective in supplying the right quality of pineapple to meet the demands of the present markets. Such problems are also encountered in other countries, e.g. in Thailand (one of the biggest pineapple producers in the world) (Joomwong and Sornsrivichai 2005), and other crops in most Sub-Saharan African countries (Temu and Marwa 2007), e.g. mango in Ethiopia (Joosten 2007) and fresh fruits and vegetables in Kenya (Neven and Reardon 2004). Increased knowledge on how the different supply chains operate, and on existing bottlenecks for improving quality, is important to tackle these problems and establish effective chains. The primary objective of this paper is to describe and analyze the fresh pineapple supply chains in Benin and identify the main constraints for quality improvement to fulfil the requirements for different markets. The secondary objective of this paper is to identify the pineapple quality preferred in the different outlets and compare the quality preferred to the quality supplied. We based our analysis of the pineapple supply chains on a framework of Lambert and Cooper (2000) adapted by Van der Vorst et al. (2005). Preliminary results from semi-structured interviews helped us formulate the appropriate questions within the selected framework and develop a proper sampling strategy for the subsequent in-depth questionnaires with actor groups in the fresh pineapple supply chains. This study is an essential step towards improving the fresh pineapple supply chains in Benin. The approach used in this study can be applied by researchers working on other agri-foods chains, mainly in developing countries where there is a great need to understand why different chains are not effective in achieving their objectives.

The paper is organized as follows: first the research framework is described. Second, the methods used to gather and analyze information in the chains are described. Thereafter, we present results obtained through this framework and discuss how they contribute to meeting the objectives. Answers to the question “why the chains are not effective in supplying the right pineapple quality”. Finally, the main findings are summarized followed by suggestions for quality improvements in the supply chains.

Research Framework

A supply chain (SC) is generally defined as “a network of physical and decision-making activities connected by material and information flows that cross organizational boundaries” (Van der Vorst et al. 2009) and aims to deliver superior consumer value in a sustainable way at low cost. In the present study, a supply chain was regarded as viewed by Bijman (2002) i.e. as an orderly sequence of processes and flows of products and information from primary producers to consumers. This implies that in supply chains studies, actor groups, processes, flows of products and information management should be considered. In the last two decades much research has taken place analyzing supply chains (foremost in the developed world) and identifying major improvement options (see Ebrahimi and Sadeghi 2013; Shukla and Jharkharia 2013 for recent reviews). A framework of Lambert and Cooper (2000), later adapted by Van der Vorst et al. (2005) is often used by scientists to evaluate and analyze logistic and information-management processes in food supply chains (Szymanowski 2007; Van der Vorst et al. 2007; Verdouw et al. 2008).

In line with Van der Vorst et al. (2005) five elements were used to analyze the different fresh pineapple supply chains: (1) chain objectives and performance indicators, (2) the supply chain network structure, (3) supply chain business processes, (4) supply chain management components, and (5) chain resources (Fig. 1). Preliminary results from semi-structured interviews (see Materials and Methods) helped us to phrase appropriate research questions within the framework, taking into account the characteristics of the pineapple chains studied. This resulted in 11 research questions that were projected within the elements of the framework described below (Fig. 1).

Chain Objective and Performance Indicators

The objective of the pineapple supply chain was assumed to be to deliver the right quality of pineapple to the different market outlets. To assess whether an objective is realized or not, specific performance indicators are required. In the present study, the main performance indicator was whether customer expectations regarding the quality of delivered product are met. In order to meet or exceed customer’s expectations, it is important to know what quality of pineapple customers prefer (quality preferred) and to ensure that they are supplied with pineapples of that quality (Research questions 1 and 2 in Fig. 1).

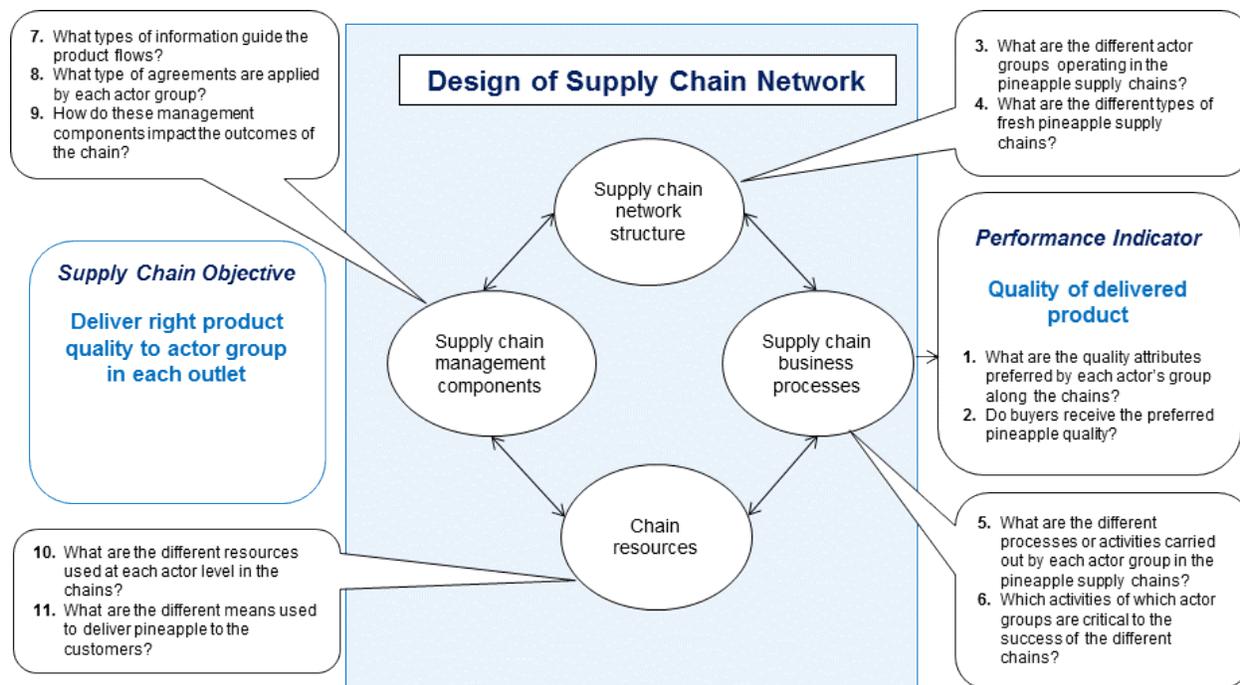


Figure 1. Research framework with research questions

Note. The research framework was adapted from Lambert and Cooper (2000) and Van der Vorst et al. (2005).

Supply Chain Network Structure

The network structure is a description of (1) the different groups of actors in the chains, their roles and their experience in performing their activities, and (2) the interrelationships between actor groups in the network, thereby describing the different routes products take from primary producers to consumers (Lambert and Cooper 2000). The aim of describing the network structure was to sort out prevailing chains and to identify and characterize different groups of actors operating in these chains (Research questions 3 and 4 in Fig. 1).

Supply Chain Business Processes

Business processes include all activities designed to produce a specific output for a particular customer or market (Lambert and Cooper 2000; Van der Vorst 2006). In our case, business processes refer to all practices executed to meet the buyer’s expectations in terms of pineapple quality. For example, how are pineapples grown and stored and what is done to reduce quality deterioration. The focus was on harvesting and storage practices because information on cultural practices was published by Fassinou Hotegni et al. (2012). The aims were to describe these practices in each actor group and to identify which practices influence product quality (Research questions 5 and 6 in Fig. 1).

Supply Chain Management Components

Lambert and Cooper (2000) defined nine management components in food supply chains needed for successful supply chain management: planning and control; work structure; organization structure; product flow facility structure; information flow facility structure; management methods; power and leadership structure; risk and reward structure; and culture and attitude. In

our case of the fresh pineapple supply chain two management components were considered: the information flow facility (what kind of information is exchanged between actor groups and how) and the management methods (what are the different types of agreements between actor groups and when are agreements made). These management components were identified as relevant from the results of the semi-structured interviews (Research questions 7, 8 and 9 in Fig. 1).

Chain Resources

To ensure product and information flows, resources are needed. Chain resources include facilities, logistics means and information capabilities (Van der Vorst et al. 2005). The aim of integrating chain resources in the framework is to know the resources used by each actor group in the chains and to analyze how these resources could constitute a bottleneck to the success of the supply chains. In the present study, the focus was on the transport means because they were identified as the most used chain resources (Research questions 10 and 11 in Fig. 1).

Methodology

A two-step method (Korneliussen and Gronhaug 2003) was used to collect data on the fresh pineapple supply chain network. First, 54 semi-structured interviews were held with key informants. Then, 173 structured interviews using in-depth questionnaires were held with different supply chain actors.

Semi-Structured Interviews

Semi-structured interviews (Leech 2002) were held with key informants in the fresh pineapple supply chains during September and October 2009 using a semi-structured questionnaire. Key informants comprised 13 primary producers, 1 exporter, 12 wholesalers plus retailers in different markets, 6 processors and 12 pineapple experts from 10 knowledge institutions. The aims of these semi-structured interviews were to obtain an overview of (1) actor groups in the chains (2) the activities carried out by the actor groups in the chains (3) information and product flows between actor groups in the chain and (4) the most important quality attributes for each actor group. This overview helped to select and elaborate proper research questions within the framework. The main themes of the semi-structured interviews were (1) the actor groups in the chain and the pineapple cultivars grown and sold, (2) existing chains (3) product and information flows in the chains (4) activities by each actor group (5) main quality attributes for fresh pineapple, and (6) constraints hampering high quality.

Structured Interviews Using In-Depth Questionnaires

Actor Groups Sampling

Based on the preliminary results of the semi-structured interviews with key informants, in-depth questionnaires were designed and administered face-to-face during May and June 2010, to 100 primary producers, 3 exporters, 50 traders (35 wholesalers and 15 retailers), 10 middlemen and 10 processors. The primary producers were interviewed in the municipalities of the Atlantic department where pineapple was mainly produced (Table 1). These municipalities contributed 99% of the total pineapple production in the Atlantic department (Gbenou et al. 2006). The number of interviewed primary producers per municipality was proportional to its contribution to

the total production in the Atlantic department. A stratified sampling method (Bailey 2008) based on the number of primary producers was used to determine the number of respondents per pineapple growing area within a municipality. Table 1 shows the number of primary producers surveyed per pineapple growing area. The wholesalers and retailers were selected proportionally to their number from the five main markets Sèmè Kraké, Dantokpa, Zè, Sékou and Sèhouè. Wholesalers on Zè, Sékou and Sèhouè sold to local customers only, whereas wholesalers on Sèmè Kraké and Dantokpa might focus on either local or regional customers. The processors and middlemen were randomly selected in the different municipalities. Local consumers, regional customers and importers were not part of this study.

Table 1. Number of primary producers surveyed per pineapple growing area

Municipality	Pineapple growing areas	Number of primary producers
	Fanto	11
	Glo-Centre	10
	Wawata	7
	Zinvié-Zoumè	6
	Kpé	4
	Kpaviédja	2
Zè	Agbondjedo	8
	Tangbo	7
	Anagbo	5
	Adjamè	4
	Houeta	3
	Gandaho	3
Allada	Adimalè	7
	Dodji Aliho	6
	Loto Dénou	4
	Lokoli	3
Tori	Sogbé Héтин	5
Toffo	Agbamè	3
	Ouègbo-Gare	2
TOTAL		100

Information Collected

The questionnaires were designed to gather information on the network structure, the business processes at each actor group level, the management components, the resources used, the most important quality attributes and quality criteria per actor group, and constraints experienced by the actor groups operating in the chain for successfully delivering the right quality to the right market. Below the *network structure* respondents were first asked their education level, their experience with pineapple, the contribution of pineapple to their total income and the pineapple cultivars cropped/sold. Next, respondents were asked to name the actor groups from whom they received the pineapple and to whom they delivered the pineapple. Below the *business processes*, primary producers were asked how they cultivated their pineapples, about their harvesting practices, whether they had received any training on the pineapple production practices and whether they belonged to a producer's organization or not. The other actor groups were asked

how and how long they stored their pineapples. Below *management components*, respondents were asked about the different types of agreements they had with other actor groups. Below *resources*, respondents were asked how the pineapple was transported from one actor to another.

Possible constraints on training and resources were identified based on the interviews with the key informants. Questions on these constraints during the in-depth interviews were pre-formulated. Respondents were asked to either agree or disagree using a five-point Likert scale (1 = completely disagree to 5 = completely agree) as suggested by Hensen and Loader (2001) to find the barriers to agricultural exports from developing countries. Later the Likert points were regrouped into three points: agree (combining “completely agree” and “agree”), neither agree nor disagree and disagree (combining “completely disagree” and “disagree”) (Allen and Seaman 2007).

Quality Attributes and Criteria Determination Along the Chains

To determine which quality attributes each actor group valued most, the five attributes most frequently mentioned in the semi-structured interviews (weight of the pineapple, skin color, skin damage, firmness and taste of the pineapple flesh) were presented to the respondents; they were asked to rank these five quality attributes for each of the pineapple cultivars grown and traded in Benin from the first to the fifth, with the first being what they valued most and the fifth being what they valued least.

To determine which criteria primary producers, wholesalers, retailers and processors applied to value different quality attributes, actor groups were asked to select the relevant criteria for weight of the pineapple, skin color, skin damage, firmness, taste of the pineapple flesh, translucency of the pineapple flesh and internal browning. To determine the preferred weight of the pineapple, an at-line measurement technique was used (Callis et al. 1987), i.e. three pineapples (fruit including crown) were selected by each respondent and weighted at their selling place. Skin color criteria were determined using different maturity degrees: [0-25]%, [25-50]%, [50-75]% and more than 75%, concerning how many of the eyes of the pineapple were yellow. The criteria regarding skin damage were determined from four modalities: skin free of damage, damage on 1-4% of the area, damage on 4-8% of the skin area and more than 8% of the skin area damaged. The firmness criterion had two modalities: high or low. The taste of the pineapple was determined using sugar and lemon taste (well known by the respondents) as reference in modalities: always a taste like sugar, always a taste in between sugar and lemon, and always the lemon taste. The criteria used for translucency and internal browning were derived from Soler (1992). For translucency three modalities were used: [0-25]%, [25-50]%, and more than 50% of the flesh of the pineapple showing translucency. For internal browning four modalities based on the proportion of the blackheart symptoms were used: [0-25]%, [25-50]%, [50-75]%, and more than 75% of the flesh of the pineapple showing blackheart symptoms. Pictures were taken from Soler (1992) to help respondents indicate their choice. The European market quality attributes and criteria of importers were derived from the Codex standard for pineapple (Codex Alimentarius 2005). The heterogeneity in the pineapple quality supplied, important for exporting pineapple to Europe, was also assessed. Respondents were asked to agree or disagree using a five-point Likert scale (1 = completely disagree to 5 = completely agree) (Hensen and Loader 2001) on whether the lot of the pineapple produced/supplied was highly heterogeneous.

Statistical Analysis

Data were analyzed using SPSS (Statistical Package for Social Science), version 16.0. To describe the supply chain network structure, descriptive statistics such as percentage were used to describe the (1) actor groups in the chain and (2) proportion of actors in a group supplying the next actor group(s) with pineapples. To describe the business processes, the management components and the resources at each actor group level, descriptive statistics such as percentages were used. Practices below the business processes, management components, and resources elements were viewed to be critical for the chain objective when they were demonstrated in literature to negatively affect the quality of the product. To establish differences in the percentage of actors falling in the different Likert-scale classes for the different constraints, non-parametric Chi-square tests were performed (Clason and Dormody 1994; Pallant 2010). For data on quality attributes, non-parametric Kendall coefficient of concordance (W) tests were first performed to test whether there was agreement within groups of actors in ranking different quality attributes from first to fifth (Kendall and Smith 1939; Legendre 2005). To test for differences in quality criteria (quality criteria produced/supplied by primary producers/sellers versus quality criteria preferred by customers), non-parametric Kruskal-Wallis tests were used.

When differences between actor groups were significant, this test was followed by Mann-Whitney U tests (Field 2005) to compare a given actor group against all other groups. A Bonferroni's correction was applied (to control the type I errors), so all differences revealed by the Mann-Whitney U tests were reported at $0.05/10 = 0.005$ level of significance with 10 being the number of comparisons (Field 2005). To compare the differences in preferred weight among actor groups one way ANOVA was performed. For comparison of means, Gabriels pair-wise test procedure was applied at 0.05 significance level as the numbers of respondents in each actor group were not equal (Field 2005).

Results

The findings are presented as follows: first, the preliminary results of the semi-structured interviews are presented. Second, the structure of the chain network is described. Next, the business processes, the chain management components, and the chain resources are presented. Finally, the quality attributes and criteria preferred by the different actor's groups as well as a comparison between the pineapple quality supplied and the pineapple quality preferred are presented.

Preliminary Results of Semi-Structured Interviews

The fresh pineapple supply chain was composed of primary producers, exporters (i.e. producers selling to the international market), wholesalers¹ (selling at local or regional markets), retailers, processors and so-called "middlemen." The middlemen's role was to look for pineapple fields about to be harvested and connect primary producers to customers. The numbers of pineapple primary producers, fresh pineapple exporters and formal processors in the Atlantic department were estimated to be 3191, 3 and 25, respectively. Primary producers, exporters and middlemen were located in the pineapple growing areas in five municipalities, Abomey Calavi, Zè, Allada,

¹wholesalers in local market comprised those selling their pineapple mainly to local customers while wholesalers in regional market comprised those selling mainly to regional customers.

Tori and Toffo, out of the eight municipalities that constitute the Atlantic Department. Wholesalers and retailers were based on five market places Sèmè Kraké (in Sèmè- Kpodji), Dantokpa (in Cotonou), Zè (in Zè), Sékou (in Allada) and Sèhouè (in Toffo). Their number fluctuated in these five markets places. Sèmè Kraké and Dantokpa were the main market places for the regional market since they were visited by both local and regional customers, i.e. customers from neighboring countries, such as Nigeria, Ghana, Burkina Faso, Mali and Ivory Coast. Zè market, Sékou market and Sèhouè market were the main market places considered as local markets where pineapple was sold as the main commodity. Wholesalers and retailers had their base on the five market places considered in the study. Processors were located throughout the Atlantic department but most of them were not located in the pineapple growing areas, but in Littoral department (bordered by Atlantic department in West) close to the regional market places. Two pineapple cultivars were grown and sold: Smooth Cayenne and Sugarloaf.

Different activities took place at each actor group level. At primary producer's/exporter's level, the pineapple fruits were cultivated and harvested. At the wholesaler's/retailer's level, the pineapple fruits were just stored and sold. Wholesalers and retailers had their storage place on the five markets earlier mentioned. At processor's level, the pineapple was stored and processed into juice and dried pineapple. From one actor group to the next, trucks were used to transport the pineapple. Between primary producers and other actor groups in the chains, there were often some agreements made during the pineapple production which lasted 15-18 months. These agreements were often made by phone calls and were mainly based on the quantity, quality and the delivering time.

Wholesalers, retailers and processors affirmed not being supplied with their preferred pineapple quality. The most frequently mentioned quality attributes by actor groups, being the most valued ones, were the weight of the pineapple, skin color, skin damage, firmness and taste of the pineapple flesh.

Structure of the Pineapple Chain Network

Actor Groups

Table 2 (See Appendix) summarizes the characteristics of the actor groups in the fresh pineapple chains. Most primary producers, exporters, processors and all middlemen were male; all wholesalers and retailers were female. Producers, and especially middlemen, wholesalers and retailers had less education than exporters and processors. 56% of the producers, all exporters and 63% of the wholesalers had 10 or more years of experience in pineapple cropping or selling, whereas all middlemen, 67% of the retailers and 60% of the processors had less than 10 years of experience in pineapple selling/processing. The contribution of pineapple to the total income was at least 40% for at least 90% of the respondents in each actor group, and at least 80% for the exporters and the majority of the wholesalers and retailers. Sugarloaf was the most cultivated and sold cultivar. Smooth Cayenne was the most exported cultivar.

Chain Structures

Fig. 2 shows the different structures of the fresh pineapple chains. Two types of fresh pineapple supply chains prevailed to reach the local and regional markets: (1) chains where the customers (retailers, wholesalers and processors) reach the consumers after obtaining their pineapples

directly from the primary producers, and (2) chains where customers reach the consumers after obtaining their pineapples through middlemen. In the local markets, seven fresh pineapple supply chains were prevailing: 1) primary producers-retailers-local consumers, 2) primary producers-wholesalers-retailers-local consumers, 3) primary producers-wholesalers-processors, 4) primary producers-middlemen-wholesalers-retailers-local consumers, 5) primary producers-middlemen-wholesalers-processors, 6) primary producers-middlemen-processors and 7) primary producers-processors. Three chains prevailed in the regional markets: 1) primary producers-wholesalers-regional customers, 2) primary producers-middlemen-wholesalers-regional customers, and 3) primary producers-middlemen-wholesalers-wholesalers-regional customers.

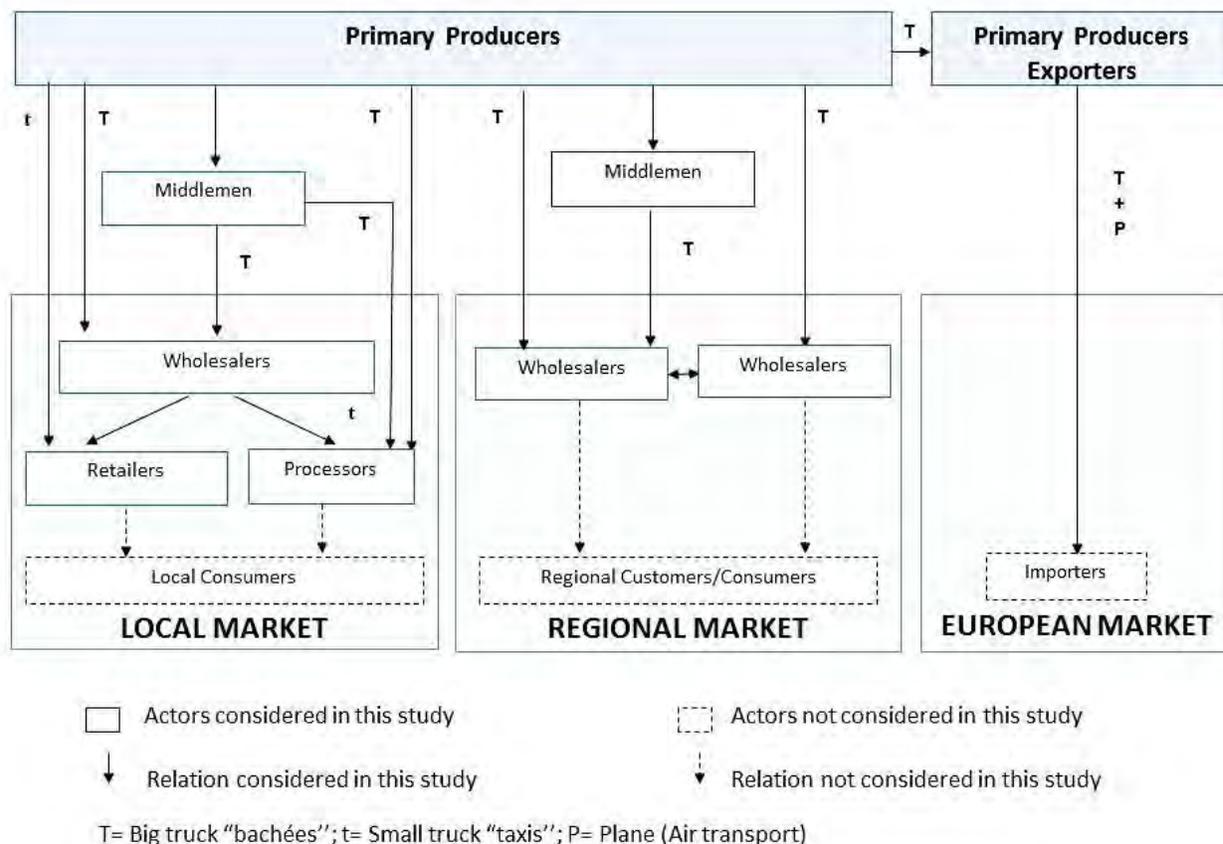


Figure 2. Structure of the pineapple chains in Benin including means of transport of pineapple between actor groups

For the European markets, the exporters sent their own pineapples to the importers, but incidentally bought pineapples from other primary producers (non-exporters) to meet the demand.

From Primary Producers to Wholesalers, Retailers, Processors and Exporters

Most of the Sugarloaf and 50% of the Smooth Cayenne wholesalers that obtained their pineapple directly from producers, bought from 6 or more producers (Table 3, see Appendix), while the limited number of retailers buying Sugarloaf directly from primary producers, bought only from

1-5 primary producers. Processors bought Sugarloaf directly from 6 or more primary producers. No retailers bought Smooth Cayenne from primary producers. All exporters obtained their additional pineapples directly from 11 or more primary producers. When middlemen were involved in obtaining pineapples from primary producers, the number of middlemen was no more than 4 for most wholesalers and 5 or more for most processors, for both cultivars (Table 3).

From Wholesalers to Wholesalers, Retailers and Processors

Wholesalers constituted another source of pineapple for the retailers and processors in the local market and for other wholesalers in the regional markets (Fig. 2). The pineapple was delivered to retailers and processors on a first come first served basis by means of small trucks.

Most wholesalers obtaining pineapple from other wholesalers bought from 1-6 wholesalers (Table 3). This was observed at Dantokpa and especially Sèmè Kraké market places where 90% of the wholesalers sold their pineapples to regional customers. To meet those customers' demands, wholesalers were often obliged to turn to other wholesalers at the same market. Most sales to regional customers took place during the evening and night at Sèmè Kraké market place.

Most retailers buying Sugarloaf from wholesalers obtained their pineapples from 4 or more wholesalers whereas retailers buying Smooth Cayenne got their pineapples from fewer than four wholesalers (Table 3). Most retailers bought and sold from the same market.

For both cultivars, most processors buying from wholesalers obtained their pineapples from 4 or more wholesalers.

Business Processes

At Primary Producer's/Exporter's Level

The processes at primary producer's level consisted of cultivating and harvesting pineapple for different outlets. According to Fassinou Hotegni et al. (2012), the production system was either inspired from neighbor producers or inspired from those in use in neighboring countries. Inputs used by producers included planting material (slips, hapas and suckers), fertilizers, and chemical products to induce flowering and to synchronize maturity. The planting materials were derived from plants kept in the field after harvest of the fruits for about 6 months. The primary producers obtained planting material either from their own previous field or from other producers' fields. Shops and CeRPA (Centre Régionale de la Production Agricole) were used to obtain the fertilizer; the chemical products to induce flowering and to synchronize maturity were obtained from shops and CeRPA.

After planting, fertilizers were applied, and carbide of calcium and ethephon were applied to induce flowering and synchronize maturity, respectively. Details on production practices are described by Fassinou Hotegni et al. (2012). Here attention is given to the harvesting practices and the producer's training.

At harvest time, pineapples were harvested by workers (generally women) hired by either the buyers or the primary producers. After harvest, 83% of the primary producers stated that they kept their pineapple fruits on the soil for a period proportional to the size of the field (generally this period ranged from 1 to 6 hours). The pineapple was loaded by two loaders hired by the drivers in unconditioned trucks. At the exporter's level, the pineapple once harvested were first sorted at the production site based on the quality attributes (mainly the external quality attributes, i.e. the skin color, crown height, fruit height and fruit size) and then packed in boxes based on the uniformity in quality attributes before being sent to importers. The boxes were bought from neighboring countries and were often not available leading to reduction or delay in the volume being exported.

There was a significant difference between the number of primary producers agreeing and disagreeing on not having received training to cultivate pineapple for (1) fertilizer application time and rate, (2) flowering synchronization practices, time of application and rate, and on (3) pest and weed management ($P < 0.05$ in all cases) (Table 4).

Table 4. Percentage of primary producers that did not receive training on pineapple production practices since they have been producing pineapple based on the Likert-scale, n=100

Likert-scale ^a	No training on fertilizers application rate	No training on fertilizers application time	No training on flowering induction practices	No training on flowering induction time	No training on pest and weed management
Disagree	37	36	32	31	16
Neither agree nor disagree	4	4	4	4	5
Agree	59	60	64	65	79
χ^2 (Chi-square) ^b	5.042 *	6.000 *	10.667 *	12.042 *	41.779 *

^aThe five Likert-scale points were regrouped into three points: Agree (combining "completely agree" and "agree"), neither agree nor disagree and disagree (combining "completely disagree" and "disagree").

^bChi square test was performed to compare the number of primary producers who disagree with those who agree. Therefore, the number of primary producers that "neither agree nor disagree" with the statements were not considered.

* Significant, $P < 0.05$

The number of primary producers agreeing that they never had received training since they had been cultivating pineapple was higher than the number disagreeing. Fifty eight per cent of the producers were not member of a producer's organization.

At Wholesalers and Retailers and Processors Level

Pineapples delivered to wholesalers, retailers and processors were stored on the ground in a pile and kept in sunlight or shade, covered with bags or not covered. About 43% of the wholesalers stored their pineapples in the shade without covering, 32% in sunlight without covering, whereas 20% and 70% of the processors, respectively, stored their pineapple in these ways. Pineapple stayed in these conditions for 1-3 days. All retailers stored their pineapple in shade without covering them, for a period of 1-7 days.

Chain Resources

From Primary Producers to Wholesalers, Retailers, Processors and Exporters

The pineapples were transported by independent drivers hired by the buyers, from primary producers to wholesalers, processors, retailers or exporters using either big trucks called “bachées” or small trucks called “taxis” (Fig. 2); “bachées”, of which the capacity ranged from 1200 to 1400 pineapples for Smooth Cayenne and from 1440 to 2160 pineapples for Sugarloaf, were used when customers were wholesalers, processors or exporters; “taxis”, of which the capacity ranged from 400 – 470 pineapples for Smooth Cayenne and from 480 – 720 pineapples for Sugarloaf, were used for transport to retailers (Fig. 2). In both cases, environmental conditions were not controlled and pineapples were loaded individually next to each other by the loaders.

About 26% of the wholesalers deemed that they did not receive their pineapple on time and this was, next to lack of quality, one of the reasons why they rejected pineapple from the primary producers. However, most of the wholesalers accepted the pineapple even if the quality was not what they expected; but in that case the price was reduced.

From Exporters to Importers

Exporters sent their pineapples to importers in European countries by plane (Fig. 2). The pineapples were transported to the airport by means of either big trucks under uncontrolled conditions (when the volume of pineapple being exported was less than 5 Mg) or very big trucks (when the volume of pineapple being exported was more than 5 Mg) under controlled conditions. Once at the airport, the pineapples were unloaded from the trucks and loaded in the plane. However, it often occurred that the pineapple stayed for some hours or days under uncontrolled conditions at the airport before being loaded in the plane. Generally this situation was due to a lack of synchronization between the pineapple harvest time and the plane (generally Air France) departure to Europe. The importers transported the pineapples to the different European markets (Belgium, the Netherlands, France, etc.).

Management Components

Three types of agreements existed between the primary producers and their customers (Table 5): (1) agreements made before planting time; in that case, producers had fixed customer(s) and the pineapple was delivered to them no matter the harvesting time; (2) agreements made between planting and before harvest; producers delivered all pineapple no matter the harvest time and quantity to a fixed customer(s) and (3) no agreements made before harvest time; primary producers falling in the third type of agreement had no contact with the buyer before the pineapple reached the closest stage to the harvest time.

Table 5. Proportion of primary producers making selling agreements with wholesalers and processors at different pineapple developmental phases for two cultivars

Pineapple cultivar	Type of agreement			χ^2 ^a
	Agreement made before planting	Agreement made between planting time and harvest	No agreement made before harvest	
Sugarloaf (n=97)	41	29	30	1.292 ns
Smooth Cayenne (n=30)	30	37	33	

^a χ^2 -analysis was carried out on numbers
ns: Not significant, $P \geq 0.05$

Sometimes, primary producers making the third type of agreement could not find a buyer until they harvested their pineapple and brought them to the closest market. The proportion of producers making a certain type of agreement was not cultivar dependent (Table 5).

The quantity of pineapple bought by wholesalers, retailers and processors depended on the quantity of pineapple in store and the period of the year. Most wholesalers (71%) bought one or two big trucks of pineapple from the producers when the quantity of pineapple in store was reaching a level of 60-90 pineapples. Retailers who obtained their pineapple from the wholesalers generally bought 40 pineapples (one forty) only when they had no pineapple left to sell. Retailers who obtained their pineapple directly from the primary producers generally bought 320-600 pineapples (8 to 15 forties) when the quantity of pineapple in store was reaching a level of 40-60 pineapples. Processors bought a quantity of pineapple that ranged from one to four trucks for both cultivars when the quantity of pineapple in store was reaching one truck. The quantity of pineapple asked for by regional customers ranged from 120 pineapples to two big trucks loads.

Wholesalers, retailers obtaining their pineapple directly from primary producers, and processors affirmed that their buyer demand for pineapple was lower from mid-March to July and from mid-September to mid-October, while in the other months of the year (Mid-October to Mid-March and Mid-July to Mid-September) the demand was high. However, wholesalers, retailers and processors agreed that they bought their highest volume of pineapple from August to October, coinciding with the Muslim fasting period of the study year.

Generally, exporters received orders from importers in European markets some months before the exporting date. The demand for pineapple by the importers varied between 20-40 Mg (8-16 big trucks) per week. During the long dry season (January, February, March and early April), exporters faced problems to meet this quantity of fresh pineapple; they then collected additional pineapple from 20-40 well-known producers to whom they provided technical assistance in pineapple production. This collection was based on the external quality attributes and the uniformity in quality attributes required by the importers.

Quality Attributes and Criteria along the Chains

Most Important Quality Attributes for Different Actor Groups

Actor groups differed in their ranking of the quality attributes, weight of the pineapples, skin color, skin damage, firmness and taste of the pineapple flesh, from the most valued (first rank, first quality attribute) to the least valued (fifth rank, fifth quality attribute) (Fig. 3).

For Sugarloaf, there was agreement among primary producers in ranking the weight of the pineapple as first quality attribute followed by respectively the taste of the pineapple, the firmness, the skin color and the skin damage (Kendall's $W=0.571$, $P < 0.001$) (Fig. 3). The same observations were made for the Sugarloaf wholesalers selling at the regional market (Kendall's $W=0.524$, $P < 0.001$), whereas Sugarloaf wholesalers at the local market agreed on ranking the taste of the pineapple as first followed by skin color (Kendall's $W=0.416$, $P < 0.001$). Contrary to the wholesalers, Sugarloaf retailers agreed on ranking the skin color as first quality attribute followed by firmness and taste of the pineapple (Kendall's $W=0.452$, $P < 0.001$). The Sugarloaf processors differed from the other actor groups by agreeing on ranking firmness as first quality attribute followed by skin color and weight of the pineapple (Kendall's $W=0.339$, $P < 0.01$).

For Smooth Cayenne, primary producers, wholesalers at the local and wholesalers at the regional market agreed on ranking the weight of the pineapple as first quality attribute (Fig. 3). Differences among these actor groups were noticed in ranking the remaining quality attributes. For the primary producers, the second quality attribute was the taste of the pineapple, the skin color being the third (Kendall's $W=0.385$, $P < 0.001$), whereas for the wholesalers selling Smooth Cayenne at the local market, skin color and taste appeared to be the second and the third quality attributes respectively (Kendall's $W=0.539$, $P < 0.05$). Wholesalers selling Smooth Cayenne at the regional market agreed on ranking firmness and taste of the pineapple as second and third quality attributes (Kendall's $W=0.792$, $P < 0.01$). For the processors processing Smooth Cayenne, the five quality attributes were given more or less the same ranking when compared with their ranking for Sugarloaf.

Skin damage was the least valued quality attribute by all actor groups except processors (Fig. 3).

Pineapple Quality Produced/Supplied Versus Pineapple Quality Preferred

For both cultivars, the weight (fruit with crown) preferred by retailers was significantly lower than the weight preferred by wholesalers (Table 6); there was no significant difference in the desired weight between wholesalers at the local or the regional market.

Preferred fruit weights were higher for Smooth Cayenne than for Sugarloaf. Processors were not exigent for fruit weight, so every pineapple size was convenient to them (Table 6). For the European markets, the average weight of the pineapple should be at least 0.80 kg with the crown and 0.664 kg without crown for the lowest weight class and no more than 2.75 kg with crown and 2.28 kg without crown for the highest weight class (Table 7).

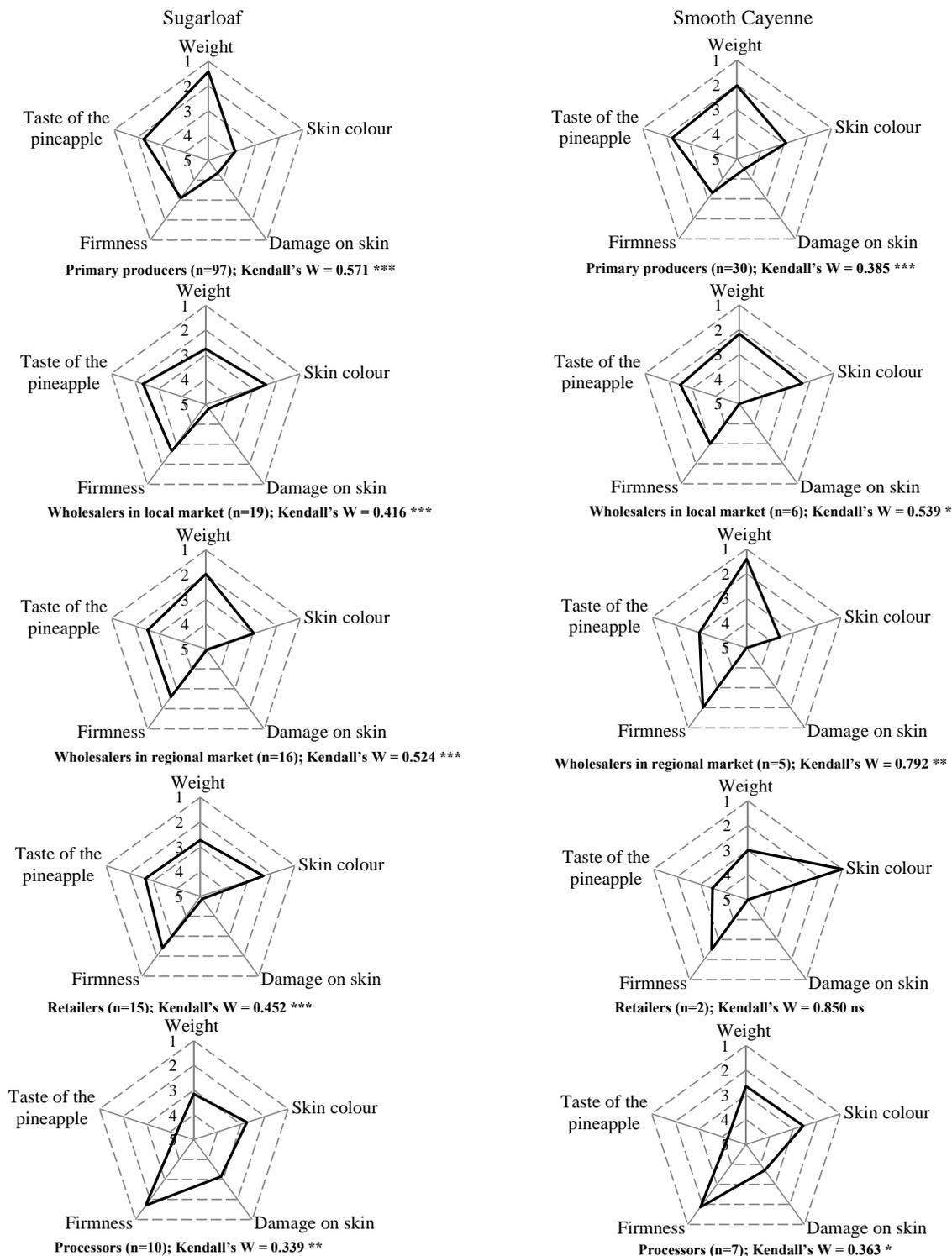


Figure 3. Quality attributes of pineapple as ranked by different actors

Note. Mean rank assigned by different actors to the five most frequently mentioned quality attributes for the pineapple cultivars Sugarloaf (left) and Smooth Cayenne (right). A significant Kendall's coefficient of concordance (Kendall's W) indicates that there was agreement within actors' group on ranking the quality attributes from 1=first (most important) to 5 = fifth (least important).

*** Significant, $P < 0.001$; ** Significant, $P < 0.01$; * Significant, $P < 0.05$; ns: Not significant, $P \geq 0.05$

Table 6. Pineapple fruit weight (kg per fruit) preferred by different actor groups for two cultivar

Cultivar	Actor group				P-value ^a
	Wholesalers Local market	Wholesalers Regional market	Retailers	Processors	
Sugarloaf	1.47 ± 0.28 b	1.50 ± 0.27 b	1.08 ± 0.33 a	Every size	0.000
Smooth Cayenne	2.71 ± 0.35 b	2.85 ± 0.52 b	1.53 ± 0.18 a	Every size	0.011

^a P-value from ANOVA test comparing the different groups of actors except processors;

Values followed by the same letter within a row are not significantly different at 0.05 according to the Gabriel pairwise test.

Table 7. Average pineapple weight (kg ± 12%) with/without crown in different weight classes for pineapple export

Weight class	Weight with crown	Weight without the crown
A	2.75	2.28
B	2.30	1.91
C	1.90	1.58
D	1.60	1.33
E	1.40	1.16
F	1.20	1.00
G	1.00	0.83
H	0.80	0.66

Source. Codex Alimentarius (2005)

For Smooth Cayenne, the weights preferred by wholesalers were the top end of what would be the highest weight class suitable for export.

Kruskal-Wallis tests revealed that there were also significant differences between actor groups in taste ($H=20.54$, $P < 0.001$), firmness ($H=29.66$, $P < 0.001$), skin color ($H=13.33$, $P < 0.01$) and translucency ($H=27.84$, $P < 0.001$) produced/preferred for Sugarloaf (Table 8, see Appendix) and in taste ($H=14.22$, $P < 0.01$) and skin color ($H=30.56$, $P < 0.001$) produced/preferred for Smooth Cayenne (Table 9, see Appendix).

Differences in taste criteria preferred for Sugarloaf were observed between primary producers and processors ($U=183.50$, $P < 0.005$) and between wholesalers in regional markets and processors ($U = 23.00$, $P < 0.005$) (Table 10, see Appendix).

Most processors preferred Sugarloaf pineapples with always a taste in between sugar and lemon whereas most wholesalers at the regional market preferred pineapples having always a taste like sugar; most primary producers at the same time produced pineapple having a taste like sugar (Table 8). Differences in firmness and flesh translucency preferred for Sugarloaf existed between primary producers and other actors except processors (Table 10); all wholesalers at local and regional markets and all retailers preferred “always firm pineapple”, while only 62% of the primary producers always aimed to produce firm pineapple (Table 8, see Appendix); similarly 70% of the primary producers produced Sugarloaf having 25-50% of the flesh translucent while most wholesalers in local and regional markets as well as retailers preferred pineapple having 0-25% of the flesh translucent (Table 8). For skin color, a difference in quality criteria preferred for

Sugarloaf was only observed between primary producers and wholesalers in the local market ($U = 589.00$; $P < 0.005$) (Table 10). Sixty five percent of primary producers produced Sugarloaf pineapple with 25-50% yellow skin, while 68% of the wholesalers at the local market preferred pineapple with 0-25% yellow skin (Table 8).

Difference in taste preferred for Smooth Cayenne was observed between primary producers and processors ($U = 32.50$; $P < 0.005$) (Table 11, see Appendix).

Most Smooth Cayenne primary producers produced pineapple with a taste like sugar whereas most processors preferred pineapple with a taste between sugar and lemon (Table 9). As to the skin color, difference in quality criteria was observed between primary producers and all other actor groups except retailers (Table 11). Eighty percent of the primary producers produced pineapple with less than 50% of skin yellow, while all wholesalers in local and regional markets as well as most of the processors preferred pineapple with more than 50% of the skin yellow (Table 9).

Wholesalers in both markets as well as retailers and processors preferred pineapple presenting less than 25% of blackheart symptoms and free of skin damage, independent of the cultivar; primary producers responded well to these quality criteria requirements since all of them affirmed producing pineapple fulfilling these criteria (Table 8 and Table 9).

Another aspect of the pineapple quality preferred by actor groups including the importers (affirmed by exporters) along the chain was a very low heterogeneity in the different quality attributes. It was noticed that more than 50% of wholesalers in local and regional markets as well as retailers and processors agreed that there was a large heterogeneity in the pineapple size delivered to them no matter the cultivar (Fig. 4). Likewise, most primary producers also admitted that there was a large heterogeneity in pineapple size at harvest (Fig. 4).

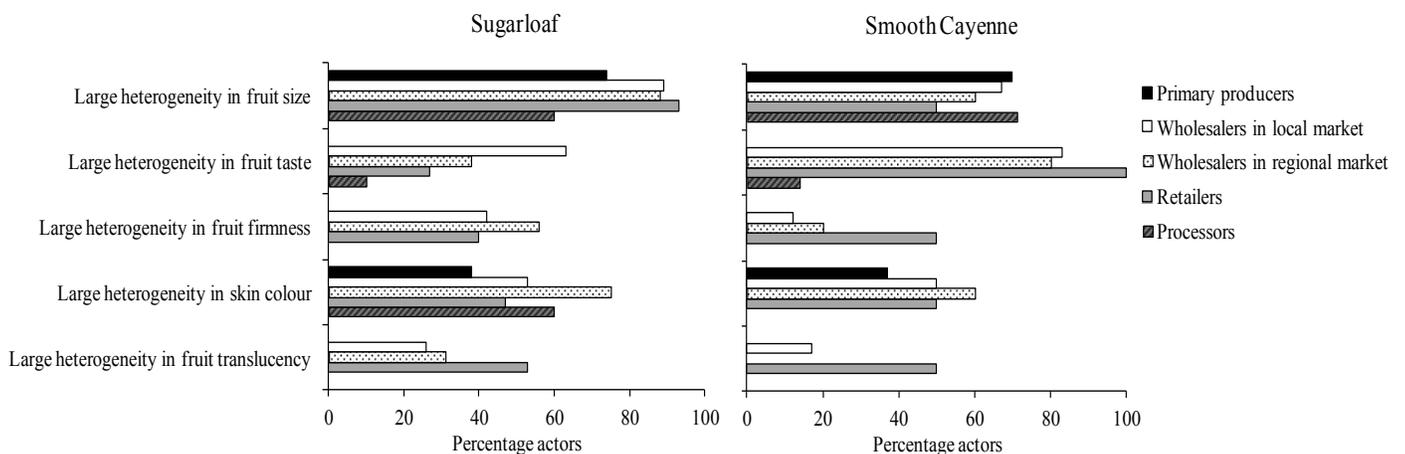


Figure 4. Heterogeneity in quality of pineapple cultivars, as perceived by different actors

Note. The diagrams list the percentage of actors in different groups, agreeing (combining the responses “agree” and “completely agree”) with statements on the heterogeneity in quality of pineapple cultivars Sugarloaf (left) and Smooth Cayenne (right) that they produced or received.

Concerning heterogeneity in the taste of the pineapple, most Sugarloaf wholesalers at the local market and most Smooth Cayenne retailers agreed that there was a large heterogeneity in taste; a large heterogeneity in fruit firmness was confirmed to exist by most Sugarloaf wholesalers in regional markets and most Smooth Cayenne retailers. Most Sugarloaf and Smooth Cayenne wholesalers at the regional market agreed on a large heterogeneity existing in the pineapples they received for skin color (Fig. 4). Most Sugarloaf and Smooth Cayenne processors agreed there was a large heterogeneity in pineapple flesh translucency. For the European market, heterogeneity in quality attributes is very important since fruits in the same boxes should be uniform in skin color, weight, etc. (Codex Alimentarius 2005); exporters faced difficulties meeting this quality demand since they often collected pineapple from many primary producers.

Discussion

Fresh Pineapple Supply Chains Structure

The fresh pineapple supply chain network in Benin was composed of six main groups of actors: primary producers, exporters, middlemen, wholesalers, retailers and processors. For all these actor groups, but especially for the exporters, pineapple was very important due to its high contribution to the total income constitution (Table 2). Actor groups were integrated in differently structured chains leading to four outlets: (1) the local outlet for fresh pineapple, (2) the local outlet for processing pineapple, (3) the regional outlet for export to neighboring countries for either fresh or processing pineapple, and (4) the export outlet for import in Europe (Fig. 2). The chains to the local outlets differed in the involvement of wholesalers versus direct delivery by primary producers to retailers and processors and in the involvement of middlemen to search for fields and contact primary producers versus direct contact by wholesalers and processors. Chains to the regional market operated always through wholesalers, who might use middlemen or have direct contact with primary producers. Chains to the European outlet were direct, with exporting farmers contacting neighboring primary producers (Fig. 2). The same situation defined as partial integration between exporting farmers and primary producers was observed in Ghanaian pineapple chains where exporters used purchases from primary producers as buffers to respond to the European Union demand in pineapple (Suzuki et al. 2011). In these conditions, primary producers obtaining advice on cultural practices and assistance in getting inputs to grow their crop from exporters, would tend to produce high-quality pineapple and so meet the demands of exporters for quality as well (Suzuki et al. 2011).

Business Processes and Constraints for the Success of the Chains

Business processes at each actor group level can impact the quality of the pineapple delivered to customers/consumers and affect the success of the pineapple chain. In analyzing the pineapple production systems, Fassinou Hotegni et al. (2012) found that constraints in the pineapple cultivation in Benin were the diverse production systems and a lack of planting material and some fertilizers. In our study, most primary producers agreed on not having received any training on pineapple production practices such as fertilizer application time and rate, flowering synchronization time and rate and pest and weed management since they had started producing pineapple (Table 4). This will also be a bottleneck to high-quality pineapple production since Subramanian and Matthijs (2007) reported the lack of training as one of the critical factors in

high-quality production. The lack of training of primary producers can be viewed as a threat to the success of the pineapple chain since Cetinkaya (2011) argued that training actor groups in their activities constituted a key element in implementing successful supply chains.

It was also noticed that the pineapple was left for hours in sunlight on the soil after harvest before being loaded. This exposure of the fruit to high temperature was reported as one of the causes associated with translucency (Chen et al. 2009). Then, the fruits may become translucent, i.e. the flesh of the fruit will show water soaking, and therefore becomes fragile (Py et al. 1987) and more susceptible to diseases (Gortner et al. 1963).

Results also showed that most primary producers were not a member of a producer's organization. The same findings were reported in Brazil by Brito et al. (2009) and this was argued to be a negative factor contributing to the lack of organization of the chains and therefore to non-successful chains. Belonging to producer's organizations facilitates the organization of the production and the access to credit and other support services (Coulter et al. 1999) and promotes good practices in the chains (UNEP 2012).

Results also indicated the unavailability of boxes for export. The government should either make the boxes needed by exporters available in the country or stimulate the private sector to take this up. This would create opportunities for off-farm employment and incite exporters to continue producing pineapple for European countries.

At wholesaler and processor's level, the storage of pineapples in the sun could also increase fruit translucency as previously stated for the primary producer's level.

Chain Resources and Constraints for the Success of the Chains

From one actor group to another, the pineapple was delivered under non-controlled conditions in "taxis" or "bachées" by independent drivers hired by the buyers (Fig. 2). When combining the ways the fruits are treated after harvest, i.e. the exposure of the fruits in sunlight for some hours, the loading in trucks next to each other and the unconditioned transport conditions, the quality of the fruit, especially the firmness, could be reduced (Crisosto et al. 1995) and thus will limit the possibilities to reach higher-valued markets and increase losses. In Benin, there are no cold facilities for pineapple. It is well known that temperature conditions affect the fruit shelf life (Nunes and Edmond 2002). According to Hardenburg et al. (1986) and Cantwell (2002) the optimum storage temperature for a long shelf life for pineapple is 10 °C. In Cotonou, Zè, Allada and Toffo where the Dantokpa, Zè, Sékou and Sehouè markets are located, the mean monthly temperatures range from 27-31 °C; they range from 25-30 °C in Sèmè-Kpodji where the Sèmè Kraké market is located (INSAE 2004). In these conditions of high temperature, the pineapple shelf life will be reduced leading to high degree of rotting when not quickly sold. These high temperature conditions may also play a positive role, since they may be the cause of the absence of blackheart problems (cf. Tables 8 and 9); blackheart symptoms develop when fruits are exposed to temperatures below 10-12 °C (Akanine et al. 1975; Keetch and Balldorf 1979).

In the current situation, the chain resources used do not help in keeping the quality of produced pineapple. The establishment of a cold chain especially in the export chain as is the case in

Ghana (Fassinou Hotegni 2013) is needed for keeping the quality. Cold storage facilities at exporter level and at the airport will reduce rejection of pineapples by importers since the fruits will still be fresh and well-looking. Therefore, actions need to be taken by the government to implement the storage facilities or to stimulate the private sector to take this up.

Management Components and Constraints for the Success of the Chains

Our results indicated that 30% of the primary producers producing Sugarloaf and 33% of the primary producers producing Smooth Cayenne had no selling agreement with their customers at the time of harvest (Table 5). This could be considered as a factor preventing primary producers to meet their customers' quality criteria. In pineapple it takes 15-18 months before the fruit is harvested (Fassinou Hotegni et al. 2012). Having an order before harvesting time would allow primary producers to know the type of pineapple quality they have to produce. This means that information sharing between actor groups in the chains should be more intensive to facilitate the supply of preferred pineapple quality. Cooperation between actor groups within a chain is essential to access high quality export markets as highlighted by Garcia Martinez and Poole (2004) for the Moroccan citrus chain.

Mismatch between Pineapple Quality Supplied and Pineapple Quality Preferred

Primary producers producing Sugarloaf pineapple and wholesalers in the regional market selling Sugarloaf pineapple shared the weight as the "most valued" quality attribute; this was not the case for wholesalers at the local market selling Sugarloaf pineapple, retailers selling Sugarloaf pineapple and processors (Fig. 3). As to the Smooth Cayenne cultivar, actor groups sharing the weight as the "most valued" quality attribute were primary producers, wholesalers in the local market as well as wholesalers in the regional market (Fig. 3). However, retailers desired a lower weight than wholesalers; processors were not exigent in pineapple weight (Table 6). Considering the fact that wholesalers constituted a major source of pineapple for all retailers (Table 3), the observed mismatch in pineapple weight criteria between wholesalers and retailers could be viewed as a constraint for not meeting retailer's quality criteria in pineapple weight. Wholesalers will have the tendency to buy big pineapple from primary producers and will most likely present that big pineapple to the retailers who will be obliged to buy them although their quality criteria are not met. So for the chains where retailers bought their pineapple from wholesalers, wholesalers appeared to be the critical actor group to the success of the chains.

For the other quality attributes criteria, results revealed that there was a mismatch between (1) primary producers and processors for the taste criteria for both cultivars (Tables 10 and 11), (2) primary producers and wholesalers in the local market, primary producers and wholesalers in the regional market and primary producers and retailers for the firmness and translucency criteria for cultivar Sugarloaf, (3) primary producers and wholesalers in local market for the skin color criteria for both cultivars, primary producers and wholesalers in regional market and primary producers and processors for skin color criteria for Smooth Cayenne pineapple (Tables 10 and 11). These mismatches between the quality of pineapple supplied and the quality of pineapple preferred could be considered as a bottleneck to the success of the chains as stated by Fisher (1997), stressing once more the importance of information exchange between actor groups in the chains.

The fact that primary producers were the main pineapple source of wholesalers and processors (processing Sugarloaf) and an additional source for some retailers (Table 4), and the fact that there was a mismatch between the quality of pineapple supplied by primary producers and the quality preferred by processors, wholesalers and retailers show that primary producers are the actors critical to the success of the chains where wholesalers, processors (Sugarloaf processors) and retailers obtained their pineapple from them.

The results also revealed that another problem encountered in the chains was the heterogeneity in pineapple quality, mainly in size (comparable to weight) and skin color (Fig. 4). This was an important point especially for the exporters since they should fit uniform fruits with specific quality criteria in the boxes. So, in addition to the quality criteria that should be met (Codex Alimentarius 2005), a higher uniformity in fruit quality is needed to improve the volume of exported pineapple. According to Luning and Marcelis (2006), the heterogeneity in quality is linked to production practices. Therefore, it is important to fully understand and analyze the pineapple production system so as to implement good production practices yielding more uniform and acceptable pineapple quality. On the other hand, the heterogeneity of the pineapple (mainly the size) could create opportunities for hawker salers² and pineapple processors.

Conclusions and Implications

Many actor groups operate in the fresh pineapple supply chains of Benin. The chains were not successful in delivering the right product quality to the markets. First, the research identified a large mismatch in perception of quality between different actor groups. There was a mismatch between wholesalers and retailers for the weight demands of the pineapple fruit; a mismatch for taste, firmness and translucency criteria was identified between primary producers and wholesalers, retailers and processors. These observations make wholesalers and primary producers critical actor groups in the chains. Second, all buyers concluded there was a large heterogeneity in quality delivered by the producers. This could be due to the way the pineapple is produced. Bottlenecks for achieving and keeping a high quality level of the fruits were lack of training of primary producers in production practices, limited organization of farmers, the poor transportation system and the poor storage conditions at wholesaler and processor levels, and also at the airport when the pineapple was intended to be exported. In addition, the lack of transport boxes constituted another constraint for export.

For the establishment of successful fresh pineapple supply chains in Benin, it is important to first tackle the main bottlenecks. Emphasis should be given to solve the problems at primary producers' level so that the chain starts with high-quality produce with low heterogeneity in pineapple quality. This requires not only training of primary producers in best production practices but also research on tools to reduce the heterogeneity in pineapple quality. In addition, the performance of the chains could increase by aligning the quality criteria of actor groups in the chain.

² Hawker salers are people selling pineapple occasionally.

Acknowledgements

Authors are grateful to pineapple primary producers (including exporters), wholesalers, retailers, processors and middlemen for kindly providing us with required information and to the Interdisciplinary Research and Education Fund (INREF) of Wageningen University and Research Centre for its financial support through the Co-Innovation for Quality in African Foods Chains (CoQA) programme.

References

- Agbo, B., G. Agbola, E. Sissinto, and O. Akele. 2008. *Atelier de validation de la stratégie et d'élaboration de plan d'actions de la filière ananas au Bénin*. MAEP and GTZ, Cotonou.
- Akamine, E.K., T. Goo, T. Steepy, T. Greidanus, and N. Iwaoka. 1975. Control of endogenous brown spot of pineapple in postharvest handling. *Journal of the American Society for Horticultural Science* 100: 60–65.
- Allen, I.E. and C.A. Seaman. 2007. Likert scales and data analyses. *Quality Progress* 40: 64-65.
- Arouna, A. and D. Afomasse. 2005. *Analyse de la compétitivité de la filière ananas au Bénin*. Institut National de Recherches Agricoles au Bénin (INRAB), Cotonou.
- Bailey, K. 2008. *Methods of social research (Fourth ed.)*. Free Press, New York.
- Bijman, W. J. J. 2002. Essays on agricultural co-operatives. Governance structure in fruit and vegetable chains. PhD Thesis Erasmus University, Rotterdam.
- Brito Neto, J.F., W.E. Pereira, R.G. de Sá Sobrinho, J.A. Barbosa, D. de S. Costa, S. Lacerda, D.P. dos Santos, and D. de O. Vieira. 2009. Commercialization forms and organization of pineapple producers in the state of Paraíba, Brazil. *Acta Horticulturae* 822: 313-316.
- Callis, J.B., D.L. Illman, and B.R. Kowalski. 1987. Process analytical chemistry. *Analytical Chemistry* 59: 104-116.
- Cantwell, M. 2002. Optimal handling conditions for fresh produce. In *Postharvest Technology of Horticultural Crops*, edited by A.A. Kader, 511-518. University of California: Division of Agricultural and Natural Resources (Special publication).
- Cetinkaya, B. 2011. Developing a sustainable supply chain strategy (Chapter 2). In *Sustainable supply chain management: Practical ideas for moving toward best practice*, edited by B. Centinkaya, et al., 17-55. Springer-Verlag, Berlin, Heidelberg.
- Chen, N.J., R.E. Paull, C-C. Chen, and P. Saradhuldhath. 2009. Pineapple production for quality and postharvest handling. *Acta Horticulturae* 822: 253-260.
- Clason, L.D. and J.T. Dormody. 1994. Analyzing data measured by individual Likert-Type items. *Journal of Agricultural Education* 35(4): 31-35.

- Codex Alimentarius, 2005. *Codex standard for pineapples, Codex Standard 182-1993, Revision 1-1999, Amendment 1-2005*. http://www.codexalimentarius.net/web/more_info.jsp?id_sta=313. [accessed July, 11 2012].
- Coulter, J., A. Goodland, A. Tallontire, and R. Stringfellow. 1999. Marrying farmer cooperation and contract farming for service provision in a liberalising Sub-Saharan Africa. *ODI Natural Resource Perspectives* 48.
- Crisosto, H.C., G. Mitchell, and S. Johnson. 1995. Factors in fresh market stone fruit quality. *Postharvest News and Information* 6: 17N-21N.
- Ebrahimi, M. and M. Sadeghi. 2013. Quality management and performance: An annotated review. *International Journal of Production Research* 51(18): 5625-5643.
- FAO (Food and Agriculture Organization). 2009. *Statistical databases*. <http://faostat.fao.org/DesktopDefault.aspx?PageID=567&lang=fr#ancor> [accessed December 31, 2010].
- FAO (Food and Agriculture Organization). 2011. *Statistical databases*. <http://faostat.fao.org/DesktopDefault.aspx?PageID=339&lang=fr> [accessed May 25, 2013].
- Fassinou Hotegni, V.N. 2013. *Exploring the fresh pineapple export chains in Ghana*. Spring Newsletter 2013: 13-14. West Africa Research Association.
- Fassinou Hotegni, V.N., W.J.M. Lommen, J.G.A.J. van der Vorst, E.K. Agbossou, and P.C. Struik. 2012. Analysis of pineapple production systems in Benin. *Acta Horticulturae* 928: 47-58.
- Field, A. 2005. *Discovering Statistics Using SPSS*, 2nd edition, 521-550. Sage Publications, London.
- Fisher, M.L. 1997. What is the right supply chain for your product? *Harvard Business Review* 75 (2): 105-116.
- Garcia Martinez, M. and N. Poole. 2004. The development of private fresh produce safety standards: implications for developing Mediterranean exporting countries. *Food Policy* 29: 229-255.
- Gbenou, R.K., M. Taoré, and E. Sissinto. 2006. *Etude Accélérée de Marché (EAM) sur les différents produits ananas au Bénin*. 42. Helvetas-Benin, Cotonou.
- Gortner, W.A., C.H. Spiegelberg, G.G. Dull, and B.H. Krauss. 1963. Field-fresh pineapple for export. *Pineapple Research Institute Research Report* 99.
- Hardenburg, R.E., A.E. Watada, and C.Y. Wang. 1986. *The commercial storage of fruits, vegetables, and florist and nursery stocks*. US Dept. Agric. Handbook.

- Henson, S., and R. Loader. 2001. Barriers to agricultural exports from developing countries: the role of sanitary and phytosanitary requirements. *World Development* 29(1): 85-102.
- Institut National de la Statistique et de l'analyse économique (INSAE), 2004. *Troisième recensement général de la population et de l'habitation (RGPH3). Cahier des villages et quartier du département de l'Atlantique*. DED (Direction des Etudes Démographiques). Cotonou.
- Joosten, F. 2007. Development strategy for the export-oriented horticulture in Ethiopia. *Wageningen UR Digital Library*, <http://library.wur.nl/way/bestanden/clc/1891396.pdf> [accessed January 25, 2014].
- Kendall, M.G. and B.B. Smith. 1939. The problem of m rankings. *Annals of Mathematical Statistics* 10 (3): 275–287.
- Keetch, D.P. and D.B. Balldorf. 1979. The incidence of certain pineapple fruit blemishes in the Eastern Cape and Border. *Citrus and Subtropical Fruit Journal* 551: 12–15.
- Korneliussen T. and K. Grønhaug. 2003. Quality perceptions in international distribution: an empirical investigation in a complete distribution chain. *Supply Chain Management: An International Journal* 8(5): 467-475
- Lambert, D.M. and C.M. Cooper. 2000. Issues in supply chain management. *Industrial Marketing Management* 29: 65–83.
- Leech, B. L. 2002. Asking questions: techniques for semi structured interviews. *American Political Science Association* 35(4): 665-668.
- Legendre, P. 2005. Species Associations: The Kendall coefficient of concordance revisited. *Journal of Agricultural, Biological, and Environmental Statistics* 10 (2): 226–245.
- Luning, P.A. and W.J. Marcelis. 2006. A techno-managerial approach in food quality management research. *Trends in Food Science and Technology* 17 (7): 378–385.
- Neven, D. and T. Reardon. 2004. The rise of Kenyan supermarkets and evolution of their horticulture product procurement systems: Implications for agricultural diversification and smallholder market access programs. *Development Policy Review* 22: 669–699.
- Nunes, M.C.N. and J.P. Edmond. 2002. Storage temperature. In *Postharvest Physiology and Pathology of Vegetables*, edited by J.A. Bartz, and J.K. Brecht, 209-228. Marcel Dekker Inc., New York.
- Pallant, J. 2010. *SPSS survival manual: A step by step guide to data analysis using SPSS*. Open University Press.
- Py, C., J.J. Lacoeyllhe, and C. Teisson. 1987. *The pineapple cultivation and uses*. G.-P. Maisonneuve et Larose, Paris.

- Shukla, M. and S. Jharkharia. 2013. Agri-fresh produce supply chain management: a state-of-the-art literature review. *International Journal of Operations and Production Management* 33(2): 114-158.
- Soler, A. 1992. *Pineapple quality criteria*. CIRAD-IRFA, Paris.
- Subramanian, U. and M. Matthijs. 2007. *Can Sub-Saharan Africa leap into global network trade? World Bank Policy Research Working Paper 4112* (2007). http://papers.ssrn.com/sol3/papers.cfm?abstract_id=956492 [Accessed 28 May 2012].
- Suzuki, A., L.S. Jarvis, and R.J. Sexton. 2011. Partial vertical integration, risk shifting, and product rejection in the high-value export supply chain: the Ghana pineapple sector. *World Development* 39 (9): 1611-1623.
- Szymanowski, W. 2007. Application of information technologies in food supply chain and networks management in the environment of food market globalization—Traceability concept. *Olsztyn Economic Journal* (2): 88-100.
- Temu, A.E. and N.W. Marwa. 2007. Changes in the governance of global value chains of fresh fruits and vegetables: opportunities and challenges for producers in Sub-Saharan Africa. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.193.8858&rep=rep1&type=pdf> . [accessed January 25, 2014].
- United Nations Environment Programme (UNEP). 2012. *Avoiding future famines: Strengthening the ecological foundation of food security through sustainable food systems*. United Nations Environment Programme (UNEP), Nairobi, Kenya.
- Verdouw, C.N., A.J.M. Beulens, D. Bouwmeester, and J.H. Trienekens. 2008. Modelling demand-driven chain networks using multiple CODPs. In *Lean Business Systems and Beyond*, edited by T. Koch, 433–442. Springer, Boston.
- Van der Vorst, J.G.A.J., S-O. Tromp, and Zee, D.-J. van der. 2009. Simulation modelling for food supply chain redesign; integrated decision making on product quality, sustainability and logistics. *International Journal of Production Research* 47: 6611-6631.
- Van der Vorst, J.G.A.J., A.J.M. Beulens, and P. van Beek. 2005. Innovations in logistics and ICT in food supply chain networks (Chapter 10). In *Innovation in agri-food systems*, edited by W.M. Jongen and M.T.G. Meulenberg, 245-292. Wageningen Academic Publishers, Wageningen.
- Van der Vorst J.G.A.J. 2006. Performance measurement in agrifood supply chain networks: an overview. In *Quantifying the agri-food supply chain*, edited by C. Ondersteijn, J. Wijnands, R. Huirne and O. van Kooten, 15-26. Wageningen UR Frontis Series, Springer Science.
- Van der Vorst, J.G.A.J., M.P.J. Duineveld, F.-P. Scheer, and A.J.M. Beulens. 2007. Towards logistics orchestration in the pot plants supply chain network. Paper presented at the 14th International Annual Euroma Conference, Ankara, Turkey, 17-20, June 2007.

Appendix

Table 2. Classification of the respondents based on different characteristics (%)

Characteristics	Modalities	Primary producers (n=100)	Exporters ^a (n=3)	Middlemen (n=10)	Wholesalers (n=35)	Retailers (n=15)	Processors (n=10)
Sex	Male	93	66	100	0	0	70
	Female	7	34	0	100	100	30
Education level	Non educated	42	0	60	74	86	0
	Literate	8	0	10	3	0	0
	Primary school	28	0	30	17	7	0
	Middle school	21	0	0	3	7	40
	University level	1	100	0	3	0	60
Experience (Exp) in pineapple	< 5 years	13	0	30	11	40	20
	5 ≤ Exp < 10 years	31	0	70	26	27	40
	10 ≤ Exp < 15 years	33	0	0	40	27	40
	≥ 15 years	23	100	0	23	6	0
Contribution of pineapple to total income (Inc)	< 20%	0	0	0	0	0	0
	20 ≤ Inc < 40%	7	0	0	0	0	10
	40 ≤ Inc < 60%	13	0	70	11	0	20
	60 ≤ Inc < 80%	51	0	30	20	33	30
	≥ 80%	29	100	0	69	67	40
Pineapple cultivars cropped/sold	Sugar loaf only	70	0	-	69	87	30
	Smooth Cayenne only	3	0	-	0	0	0
	Both cultivars	27	100	-	31	13	70

^a: Primary producers who exported to European markets

-: did not crop/sell pineapple

Table 3. Percentage customers buying Sugarloaf and Smooth Cayenne pineapple from a given number of primary producers and wholesalers

Pineapple source	Chain type	Number of people	Customers							
			Wholesalers (n=35)		Retailers (n=15)		Processors (n=10)		Exporters (n=3)	
			Sugarloaf (n=35)	Smooth Cayenne (n=11)	Sugarloaf (n=15)	Smooth Cayenne (n=2)	Sugarloaf (n=10)	Smooth Cayenne (n=7)	Sugarloaf (n=3)	Smooth Cayenne (n=3)
Primary producers	Directly ^a from primary producers	1-5	12	36	13	0	40	0	0	0
		6-10	34	9	0	0	20	0	0	0
		≥ 11	34	27	0	0	0	0	100	100
		Total	80	72	13	0	60	0	100	100
Through middlemen		1-2	20	55	0	0	0	0	0	0
		3-4	20	9	0	0	30	29	0	0
		≥ 5	9	18	0	0	70	71	0	0
		Total	49	82	0	0	100	100	0	0
Wholesalers ^b	Directly from wholesalers	1-3	14	18	40	100	20	0	0	0
		4-6	14	27	47	0	10	14	0	0
		≥ 7	6	0	13	0	30	42	0	0
		Total	34	45	100	100	60	56	0	0

^a: Directly from primary producers means they contact primary producers themselves either by cell phone or face to face

^b: No customers obtained their pineapple from wholesalers through middlemen

Table 8. Percentage of actor groups producing/supplying Sugarloaf pineapple and valuing the different quality criteria within each quality attribute

Quality attributes	Quality criteria	Local market (n=97)			Regional market (n=16)			Processors (n=10)	Kruskal Wallis test(H)
		Primary producers (n=19)	Wholesalers (n=15)	Retailers (n=10)	Wholesalers (n=16)	Retailers (n=10)	Processors (n=10)		
Taste	Always a taste like sugar	72	47	81	53	10	20.54 ***		
	Always a taste in between sugar and lemon	28	53	19	40	90			
	Always the lemon taste	0	0	0	7	0			
Firmness	Always firm pineapple	62	100	100	100	40	29.66 ***		
	Always pineapple with low firmness	38	0	0	0	60			
Skin colour	0-25% of the eyes has yellow colour	33	68	56	53	70	13.33 ***		
	25-50% of the eyes has yellow colour	65	32	44	40	30			
	50-75% of the eyes has yellow colour	2	0	0	7	0			
	>75% of the eyes has yellow colour	0	0	0	0	0			
Translucency	0-25% of the flesh translucent	15	69	56	53	30	27.84 ***		
	25-50% of the flesh translucent	70	26	38	40	70			
	>50% of the flesh translucent	15	5	6	7	0			
Internal browning	0-25% of the blackheart symptoms	100	100	100	100	100	- ^a		
	25-50% of the blackheart symptoms	0	0	0	0	0			
	50-75% of the blackheart symptoms	0	0	0	0	0			
	>75% of the blackheart symptoms	0	0	0	0	0			
Skin damage	Free of damage	100	100	100	100	100	- ^a		
	Damage on 1-4% of the skin area	0	0	0	0	0			
	Damage on 4-8% of the skin area	0	0	0	0	0			
	Damage on more than 8% of the skin area	0	0	0	0	0			

***: Significant, $P < 0.001$; **: Significant, $P < 0.01$

^a: Kruskal-Wallis test was not performed because actor groups answers felt in the same quality criteria

Table 9. Percentage of actor groups producing/supplying Smooth Cayenne pineapple and valuing the different quality criteria within each quality attribute

Quality attributes	Quality criteria	Primary producers				Wholesalers		Retailers		Processors		Kruskal-Wallis test(H)
		(n=30)	(n=6)	(n=5)	(n=2)	(n=7)	(n=2)	(n=5)	(n=7)	(n=2)	(n=7)	
Taste	Always a taste like sugar	83	50	60	100	15	100	0	0	0	14.22 **	
	Always a taste in between sugar and lemon	17	50	40	0	85	0	0	0	0		
	Always the lemon taste	0	0	0	0	0	0	0	0	0		
Firmness	Always firm pineapple	60	100	100	100	43	100	0	0	0	8.85 ns	
	Always pineapple with low firmness	40	0	0	0	57	0	0	0	0		
Skin colour	0-25% of the eyes has yellow colour	10	0	0	0	0	0	0	0	0	30.56 ***	
	25-50% of the eyes has yellow colour	80	0	0	0	29	50	0	0	0		
	50-75% of the eyes has yellow colour	10	50	80	50	71	50	0	0	0		
	>75% of the eyes has yellow colour	0	50	20	0	0	0	0	0	0		
Translucency	0-25% of the flesh translucent	57	83	20	50	71	50	0	0	0	5.03 ns	
	25-50% of the flesh translucent	43	17	80	50	29	50	0	0	0		
	>50% of the flesh translucent	0	0	0	0	0	0	0	0	0		
Internal browning	0-25% of the blackheart symptoms	100	100	100	100	100	100	0	0	0	- ^a	
	25-50% of the blackheart symptoms	0	0	0	0	0	0	0	0	0		
	50-75% of the blackheart symptoms	0	0	0	0	0	0	0	0	0		
	>75% of the blackheart symptoms	0	0	0	0	0	0	0	0	0		
Skin damage	Free of damage	100	100	100	100	100	100	0	0	0	- ^a	
	Damage on 1-4% of the skin area	0	0	0	0	0	0	0	0	0		
	Damage on 4-8% of the skin area	0	0	0	0	0	0	0	0	0		
	Damage on more than 8% of the skin area	0	0	0	0	0	0	0	0	0		

***: Significant, $P < 0.001$; **: Significant, $P < 0.01$

^a: Kruskal-Wallis test was not performed because actor groups answers felt in the same quality criteria

Table 10. Mann-Whitney U test values comparing actor groups producing/supplying Sugarloaf pineapple for the different quality criteria within each quality attribute

Quality attributes	Quality criteria	Actor group	Primary producers		Wholesalers		Retailers	Processors
			local market	regional market	local market	regional market		
Taste	Always a taste like sugar and lemon Always the lemon taste	Primary producers	-	693.0 ns	693.0 ns	705.0 ns	577.0 ns	183.5 *
		Wholesalers local market	693.0 ns	-	-	100.5 ns	139.0 ns	59.5 ns
		Wholesalers regional market	705.5 ns	100.5 ns	-	-	85.0 ns	23.0 *
		Retailers	577.0 ns	139.0 ns	85.0 ns	-	-	47.0 ns
		Processors	183.5 *	59.5 ns	23.0 *	47.0 ns	-	
Firmness	Always firm pineapple Always pineapple with low firmness	Primary producers	-	570.0 *	570.0 *	480.0 *	450.0 *	379.0 ns
		Wholesalers local market	570.0 *	-	-	152.0 ns	142.0 ns	38.0 *
		Wholesalers regional market	480.0 *	152.0 ns	-	-	120.0 ns	32.0 *
		Retailers	450.0 *	142.5 ns	120.0 ns	-	-	30.0 *
		Processors	379.0 ns	38.0 *	32.0 *	30.0 *	-	
Skin colour	0-25% of the eyes has yellow colour 25-50% of the eyes has yellow colour 50-75% of the eyes has yellow colour >75% of the eyes has yellow colour	Primary producers	-	589.0 *	589.0 *	588.0 ns	605.5 ns	302.5 ns
		Wholesalers local market	589.0 *	-	-	133.0 ns	118.0 ns	93.5 ns
		Wholesalers regional market	588.5 ns	133.5 ns	-	-	113.0 ns	69.0 ns
		Retailers	605.0 ns	118.0 ns	113.0 ns	-	-	61.0 ns
		Processors	302.5 ns	93.5 ns	69.0 ns	61.0 ns	-	
Translucency	0-25% of the flesh translucent 25-50% of the flesh translucent >50% of the flesh translucent	Primary producers	-	492.5 *	492.5 *	446.0 *	440.5 *	362.0 ns
		Wholesalers local market	492.5 *	-	-	134.0 ns	121.0 ns	62.0 ns
		Wholesalers regional market	448.0 *	134.0 ns	-	-	116.0 ns	62.5 ns
		Retailers	440.5 *	121.5 ns	116.0 ns	-	-	61.0 ns
		Processors	362.0 ns	62.0 ns	62.0 ns	61.0 ns	-	

*: Significant, $P < 0.005$ (0.005 was selected based on Bonferroni's correction), ns: Not significant, $P \geq 0.005$

Table 11. Mann-Whitney U test values comparing actor groups producing/selling Smooth Cayenne pineapple for the different quality criteria within each quality attribute

Quality attributes	Quality criteria	Actor group	Primary producers	Wholesalers local market	Wholesalers regional market	Retailers	Processors
Taste	Always a taste like sugar	Primary producers	-	60.0 ns	57.5 ns	25.0 ns	32.5 *
	Always a taste in between sugar and lemon	Wholesalers local market	60.0 ns	-	13.5 ns	3.0 ns	13.5 ns
		Wholesalers regional market	57.0 ns	13.5 ns	-	3.0 ns	9.5 ns
	Always the lemon taste	Retailers	25.0 ns	3.0 ns	3.0 ns	-	1.0 ns
		Processors	32.5 *	13.5 ns	9.5 ns	1.0 ns	-
Skin color	0-25% of the eyes has yellow color	Primary producers	-	4.5 *	6.0 *	16.5 ns	37.5 *
	25-50% of the eyes has yellow color	Wholesalers local market	4.5 *	-	10.5 ns	1.5 ns	7.5 ns
	50-75% of the eyes has yellow color	Wholesalers regional market	6.0 *	10.5 ns	-	2.0 ns	10.0 ns
	>75% of the eyes has yellow color	Retailers	16.5 ns	1.5 ns	2.0 ns	-	5.5 ns
		Processors	37.5 *	7.5 ns	10.0 ns	5.5 ns	-

*: Significant, $P < 0.005$ (0.005 was selected based on Bonferroni's correction); ns: Not significant, $P \geq 0.005$



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Introduction of Electronic Combinatorial Auction to a Food Manufacturer

Keith D Harris[Ⓐ], and Arlo W Biere^ᵇ

^ᵃ *Assistant Professor, Agribusiness Management, Department of Agricultural Economics
311J, Waters Hall, Kansas State University, Manhattan, Kansas, 66506, USA*

^ᵇ *Professor, Agricultural Economics, Department of Agricultural Economics, 314 Waters Hall,
Kansas State University, Manhattan, Kansas, 66506, USA*

Abstract

Food manufactures often face difficult purchasing decisions when multiple business constraints and several bidding options affect them. The objective of the buying organization is to ensure corn sweeteners are purchased so as to minimize the total operational cost. To do so, the purchasing department compared the conventional method of a sealed-bid auction to, first, a reverse auction with single-item bids and, then, to a reverse auction with bundled bids. The senior author—as director of corporate purchasing—researched, proposed and executed the combinatorial auction to source corn sweeteners for a large, processed-meat manufacturer who uses large quantities of four corn sweeteners at its eight processing plants located across the United States. Two buying techniques were — electronic reverse auctions and combinatorial reverse electronic auctions. First, we present the difficulties of using a reverse combinatorial auction and describe the method used to obtain the least cost combination of bids that satisfies buyer’s RFQ. Second, we show the progression of the bidding rounds and estimate the savings from this combinatorial auction as compared to what the company did with either a manual or a reverse single item auction. Finally, we address the diminishing marginal returns of repeated usage of CeRA, and describe how this food company advanced from the auction setting to a risk-management-based procurement process.

Keywords: transaction costs, optimization, eRA’s, combinatorial

[Ⓐ]Corresponding author: Tel: + 1. 785.532. 6925

Email: K. Harris: kdharris@ksu.edu

A. Biere: biere@ksu.edu

Introduction

A firm can outperform its competitors by being able either to charge a higher price or to produce at less cost or both (Porter 1998). To be able to charge a higher price the firm must offer greater customer value. To achieve the latter, the firm must realize more efficiencies than its competitors. Such efficiencies may be realized internally or externally—through working with its supply chain partners. The latter is the subject here; specifically, cost savings through purchasing. Among the ways to reduce purchase cost is to incentivize suppliers: first by being asked to compete—head-to-head—and, second, to find cost savings through bundling bids.

The customer's choice of procurement method determines the intensity of bid competition and bidder's flexibility to bundle items in a customer's RFQ. When the customer offers bidders' flexibility to assemble from an RFQ their most favorable bundles, and suppliers compete to win the bid(s); flexibility gains to suppliers will, at least in part, be returned to the customer. However, allowing for such flexibility makes it difficult for the customer to identify the least-cost set of bids that satisfies, exactly, its RFQ. Simple, electronic reverse auctions (eRAs)—where the industrial customer requests single item or fixed-bundle bids are popular because of their ease of use. Such auctions encourage price competition among bidders, but preclude bid flexibility.

Although allowing bidders to make up and bid on their own bundles can produce significant cost savings, doing so complicates, greatly, the bid evaluation process, which increases bid-evaluation costs and lengthen auction response time, especially when done manually. The electronic, reverse combinatorial auction, implemented here, provides the bundling flexibility and calculates “winning bids” to give rapid response to bidders so as to promote bid competition.

The senior author—as director of corporate purchasing—researched, proposed and executed the combinatorial auction to source sweeteners for a large, processed-meat manufacturer who uses large quantities of four corn sweeteners at its eight processing plants located across the United States. Those corn sweeteners help to bind the meat together add flavor and promote the fermentation essential to the production of semi-dry cured and dry-cured sausages and processed meats, such as hot dogs, and bologna. Corn Sweeteners, made from the starch of maize (corn U.S.), are composed mainly of fructose, which is equal to glucose in caloric value, but sweeter and less expensive.

The combinatorial auction allowed each qualified supplier to structure, within the specifications of the RFQ, bundles of sweeteners and plant delivery locations to take advantage of that supplier's unique synergies in production and delivery. Corn sweeteners, for example, are the result of some joint production, of corn syrup, crystalline fructose, glucose—commonly referred to as dextrose—and two formulations of high fructose corn syrups—42 percent and 55 percent fructose. Some the manufacturers are corn millers while others are just distributors of dry product. Likewise, delivery transportation options may offer savings that could affect the bid price. For example, there may be savings in delivering different products, all at once to, a plant or of delivering, on a milk run, to a cluster of two or more plants. Allowing each bidder to choose how to form its bidding bundles makes it possible for the bidder to exploit its efficiencies from synergies in production and transportation.

Problem Setting

The study subject is a meat manufacturer who produces both fresh and processed meats. Some of its fresh meat production is used to make processed meats, such as cured, deli, and smoked meats. Beside fresh meat, a major direct input is the class of corn sweeteners—corn syrup, corn syrup solids, dextrose and liquid dextrose. The business operates eight processed meat plants, each using corn sweeteners. Depending on the products produced a plant may require four or fewer sweeteners.

Corn sweetener suppliers often submit multiple bids ranging from a bid to supply a single item to a bid to supply a bundle of items. The supplier's bids are based on price, and non-price performance facets, which suggest the supplier's bids, take into consideration its transportation, purchasing power, or product quality advantages. Normally, purchasing departments organize bids into predetermine lot sizes. The problem is that buyers often force suppliers into unnecessary constraints, and the suppliers' bids are not the best for minimizing costs or reducing the cycle time needed to evaluate bid. The original process of selecting the most competitive bid was complicated and inefficient; therefore, multi-attribute purchasing presented decision problems for the buyer.

Prior to this work, the company's purchasing office used manual auctions by corresponding with bidder through the US Mail. As an employee of the meat manufacturer, the senior author identified over 700 different direct inputs used by the processed meat division and searched for a means to improve purchasing by reducing combined purchase and transaction costs. The study led to the introduction of electronic reverse auctions (eRA) and combinatorial electronic reverse auctions (CeRA). At the heart of the concerns were the buyer's inability to properly evaluate bids with multiple attributes and eRA's would affect the non-price performance aspects of suppliers such as delivery and flexibility, which are often promoted by suppliers.

The objective of the meat manufacturer is to ensure corn sweeteners are purchased so as to minimize the total operational cost. To do so, the purchasing department compared the conventional method of a sealed-bid auction to, first, a reverse auction with single-item bids and, then, to a reverse auction with bundled bids. But first, we present the difficulties of using a reverse combinatorial auction and describe the method used to obtain the least cost combination of bids that satisfies buyer's RFQ. Second, we show the progression of the bidding rounds and estimate the savings from this combinatorial auction as compared to what the company did with either a manual or a reverse single item auction. Finally, we address the diminishing marginal returns of repeated usage of CeRA, and describe how this food company advanced from the auction setting to a risk-management-based procurement process.

Purchasing Inputs for Food Manufacturing

Purchases can be classified according to two broad categories: manufacturing (direct) inputs and operating (indirect) inputs. Direct inputs are raw materials, which make up the finished product or packaging materials that come in direct contact with the finished product. Direct inputs are purchased from industry-specific suppliers and distributors, and manufacturing cannot proceed without them. Indirect products do not come in direct contact with the finished goods, but are overhead inputs of maintenance, repair, and operation (MRO) goods and services.

Because purchases of indirect input usually small, but many, the associated transactions costs are a high proportion of total purchase cost relative the direct inputs. Thus, for indirect inputs, businesses have adopted two methods that reduce, dramatically, the transactions cost with indirect input procurement: P-Cards and eProcurement. P-cards are special commercial credit cards that control for the types of expenditure a card holder may make based vendor category and risk category and provides for electronic data transfer from the card company to the owner of the cards. eProcurement is based on a catalog and price list negotiated between the vendor and the procuring business. To purchase such inputs, an employee browses the online catalogs, adds item(s) to a shopping cart and submits a requisition, electronically, to purchasing. Completed requisitions are routed for review or approval via electronic workflow. Approved requisitions will generate a purchase order, which is transmitted to the vendor. All other approved eProcurement requisitions are routed to purchasing agents for review and processing into purchase orders.

For direct inputs purchasing may use spot transactions—likely using manual or electronic auction—or contracts with food brokers, ingredient distributors, or input manufacturers. In some cases, the food company may have some form of ownership through vertical integration, partnerships, or joint ventures to produce its proprietary direct inputs. Business-to-Business online bidding events help to communicate prices between the buyer and seller much faster. The negotiations are set in real-time dynamic auctions between a buyer and several suppliers, who compete against each other, online; lowering their bid amounts (Beall et al. 2003) until the lowest competitive market prices is reached. Price descends during a reverse auction as opposed to the traditional English auction, run by the seller and where the highest bid is the “winning bid” at close of the auction. The purchases of major inputs will be a few, large transactions. However, the many minor inputs may create relatively high transactions cost. That is because the individual purchases of such direct input are small and numerous as compared to high volume major inputs. For the minor inputs the cost of face-to face purchasing or manual bid taking are high relative to the cost of the input. Stated differently transaction costs make up a significant proportion of the total order cost. Just as with sourcing indirect inputs, reducing transactions cost is an important means to reducing the cost of minor direct costs. Internet auctions are one method to reduce transaction cost, yet promote price competition among suppliers.

Literature Review

The literature on eRAs is particularly rich in examining competition, price-based criterion, leadership, and specificity. Kaufmann and Carter’s 2004 case-study covers the circumstances under which electronic or face-to-face negotiations are appropriate. Foroughi, Kocakulah and Williams 2008; Hawkins, Randall, and Wittmann 2010; Huang et al. 2010 use models to describe the extent by which a firm’s leadership and price-based selection criterion influences the decision of both suppliers and buyers to adopt eRA’s. The beneficial and controversial aspects of eRAs in buyer-seller dealings emphasize the impact of opportunistic behavior on strategic supply relationships (Beall, Carter, Carter, Germer, Hendrick, Jap, Kaufmann, Maciejewski, Monczka and Petersen 2003). Percy, Giunipero and Wilson 2007; Caniels and van Raaij 2009 focus on the factors that affect buyers' information processing and decision-making in e-RAs. Smeltzer and Carr 2003; Häubl and Popkowski, Leszczyc 2004; Ding, Eliashberg, Huber and Saini 2005 conclude product or service specifications must be clear and comprehensive to provide incentives for suppliers to participate in the auction. ERAs provide some measure of resolving the buyer’s problem. Both anecdotal and empirical evidence have

shown that eRAs can lower purchase prices and reduce the amount of time it takes for feedback-evaluation-selection of a winning bid (Aberdeen Group 2005; Ariba.com 2012). Ariba, a software supplier, reported savings using reverse auctions in the 5% to 10% range. Companies that report successful use of reverse auctions include General Electric (Kwasnica and Thomas 2002), Mars (Hohner et al. 2003), Owens Corning (Moozakis 2001), and major retail chains such as Wal-Mart (Sheffi 2004). With a single-unit reverse auction the buyer requests from its approved suppliers a single-quote bid for either one item or on all items.

Purchasing using single-bid auctions, however, limits competition and reduces supplier flexibility. The single-bid auction is an all or none option: bid to supply all on the RFQ or make no bid at all. Requesting a single bid on a bundle of items or on a single item to be delivered to a number of locations could be too constraining because at least some potential bidders may not want, nor be able to fulfill all that is on the RFQ. Conversely, if each item is bid separately, a supplier may not be able to provide its best offer because its best offer might be contingent on getting the bid on some combination of items. Four in five Fortune 1000 companies have tried e-sourcing tools, but only one in five have gone beyond price-focused electronic RFQ and reverse auctions to tackle more complex categories (Ariba 2012). Here is where the combinatorial auction shines. It allows a bidder to choose which RFQ items and shipment locations to include in its bid (Sandholm et al. 2002). Note, that bundle may be not just for selected inputs, but also for selected delivery locations. So far, the combinatorial auction would appear to offer no serious complication; however, the complication enters when the buyer begins to evaluate the bids received to find the set of offers that satisfies the RFQ at least cost (Aberdeen Group 2005). That is because each potential supplier on each bid makes its own choice of what to offer and not offer, and purchasing must decipher what combination of bids satisfies the RFQ at least cost.

Combinatorial Auction Processing

To find the least-cost solution for such a combinatorial auction, one might use either linear or integer programming, depending upon the bidding rules. Use linear programming when a bid can be accepted in whole or fractionally. Use integer programming, when a bid can be accepted only in total or not at all. Since each bid is treated as a single activity, mathematically, each activity can take on only two values (0 and 1) with integer programming. For the least-cost solution, the combination of all bids with activity values of 1 will provide a set that satisfies the RFQ at least cost. With linear programming, the least cost solution may include activity values from and including zero to one. Model constraints are set to assure that all RFQ items are satisfied—item, location and time period, if specified. The model can be constrained, further. For example, the RFQ may require only one supplier per plant. Likewise, other bid limitations or specifications could be represented by model constraints, such as no supplier can supply more than 95 percent. Such constraints are known as provide a rich bidding language because it offers bidders choices on a range of options.

Online reverse auctions as a part of the electronic sourcing portfolio and more advanced electronic sourcing tool: combinatorial expressive bidding, which is a part called optimization technology or decision-support tools. The tool uses advanced mathematical algorithms to very quickly analyze unlimited business constraints and what-if scenarios (Sandholm 2002). The food industry buyer uses the tool to allow suppliers to creatively develop bids that make most efficient

use of their production capability. With the expressive bidding tool, suppliers could bid on multiple combinations of materials. Suppliers can come back with a number of expressive offers. The food industry buyer needed a tool less expressive reverse auction tool to present single item bids. Today, commercial software is available to handle the bid processing to find the least-cost solution.

The Corn Sweetener Procurement Setting

The relatively low cost of corn sweetener's made sweeteners processed from corn a viable alternative to beet or cane sugars. Several suppliers, in different locations and in different container sizes, manufacture dextrose and corn syrup. Generally, corn sweeteners are contracted for one year. The negotiations typically start in December and end sometime during the first quarter. Once the contract terms have been agreed upon the buyers order weekly or monthly demand requirements throughout the length of the contract without exceeding the contract volume limits. Food manufacturing's sourcing of heterogeneous and differentiated materials is initiated once the buyer distributes an RFQ. In an RFQ process, a buyer announces the technical specification, lists a number of negotiable attributes and invites potential suppliers to submit multidimensional bids on the negotiable attributes. Subsequently, the buyer evaluates the submitted bids ranks them according to her preference regarding the negotiable attributes and awards the contract to the supplier who has submitted the highest ranked bid. The rationale underlying these procurement processes is that the buyer seeks to designate the contract to the supplier who offers the best price/performance ratio. The suppliers follow the instructions and submit bids without knowledge of the amount of the bid by other participants.

The demand for corn sweeteners had steadily increased on average of 1.7% between 1990 and 2010 (USDA-ERS). In 2006, the purchasing department was faced with rising corn sweetener costs and the inability to sort through computationally complex bids from its suppliers in a timely manner. In each of the previous two years prior to 2005 prices for corn sweeteners had increased 2-3%. The meat processor purchased nearly 1.7 million cwt. of corn sweeteners valued at \$2.4 million in 2005. Table 1 shows the estimated annual demand by plant and product specification.

Table 1. Quantity purchased by plant

Plant #	Dextrose cwt.	Corn Syrup cwt.	Corn Syrup Solids cwt.	Liquid Dextrose cwt.
Plant 1	250		1,810	
Plant 2	5,570		220	30,000
Plant 3	1,950		500	25,000
Plant 4	6,000		660	40,000
Plant 5	1,890	43,000	1,512	
Plant 6	3,600		580	
Plant 7	600			
Plant 8	1,650		17	
Total	21,510	43,000	5,299	95,000

The Bidding Event

The buyer's procurement policy stipulates that only suppliers that demonstrate ability to maintain standards of product quality, provide evidence of its financial stability, and can regularly make goods and services available for shipment are approved as a supplier. Five corn sweetener manufacturers and four food ingredient distributors had been pre-approved to supply the buyer, and only those nine were permitted to bid. Previously, the food processor only accepted a single bid for each different quality specification or corn sweetener type. This is referred to as single bids and there were 20 different possible bids given the supplier's capabilities and the number of locations. In addition, the buyer accepted bids to supply multiple locations with different quality specifications. This is referred to as bundle bids. There were 19 different possible bids under the single-bid format. Under the bundled-bid format 100 different bid packages were possible, given the number of different combinations of sweetener types. Bidders will bid on four products originating from the corn wet milling process: dextrose, corn syrup solids, corn syrup, and liquid dextrose.

The buyer used a web-based portal through which buyers and suppliers could interact. The focus was to conduct a combinatorial auction to source four types of sweeteners to be delivered in specified amounts to each of the buyer's eight plants located in five states. Bidders will bid on four products or a combination of products. Corn syrup and liquid dextrose are liquids that must be stored in tanks, which creates food safety and traceability concern should the company use more than one supplier, as the product would be mixed in the tanks. Because the company does not want mixing of liquids from different suppliers in the same tank, each liquid supplied to a location must come from a single supplier. The firm preapproved nine suppliers—five are manufacturers of corn sweeteners and four are distributors. Two suppliers, a manufacturer and a distributor, handled all four sweeteners, three handled three of the sweeteners, and four handled only two of the sweeteners.

Buyer and Supplier Involvement in eRAs

Disruptive technologies like eRAs change the interactions between the buyers and sellers. The problems often center on pricing or agreed upon customer services that are part of contractual agreements (Lancioni, 2005). Perceptions of inequity play an important role as changes in business processes usually force buyers and sellers to reevaluate the existing relationship. Both parties have inputs into the transaction arrangement and both parties expect to reap certain benefits that would be equitably distributed. The digital era of purchasing has changed the interactions between buyers and suppliers (Sambamurthy and Zmud 2000). The ability to negotiate effectively and consummate deals that are both fair and equitable has long been an issue of contention in buyer-supplier relationships.

In 2005 and 2006, corn sweeteners were manufactured by five companies: ADM Company, Cargill Inc., Corn Products International Inc., Roquette America Inc., and Tate and Lyle Ingredients Americas, Inc. (Corn Refiners Association 2006). In addition, corn sweeteners are sold through a number of firms specializing in the distribution of food ingredients. Although some suppliers view eRAs as a strategy to get the cheapest price regardless of other non-price

performance factors, others viewed it as a mechanism to reap the benefits from their scaled operations, which are well suited for large customers. The processed meats and corn refiners industry have a history that begins with the corn sweeteners being used in the product formulation instead of higher costs substitute of beet or cane. Only the carbonated beverage manufacturers use more corn sweeteners than the meat processing industry. For the supplier, eRAs represent an opportunity for non-incumbents to participate in a neutral marketplace were able to freely and independently participate in the e-marketplace (Kaplan and Sawhney 2000). In order to be included in the research, the e-marketplace must have met the condition of neutrality.

The buyer paid a fee to use an eRA application developed by CombineNet, a third-party auction provider, to help develop the RFQ. CombineNet's core technology platform, REV™ Profit Accelerator, analyzed the bids for competitiveness and provided opportunities to analyze scenarios that included some less tangible factors in the decision making process. After receiving the buyer's "Letter Of Intent" to purchase corn sweeteners, the suppliers attended a webinar hosted by CombineNet to learn how to navigate the website during the auction and to review and accept the bidding terms. Training included how to access the website, how to submit bids, definition of terms and conditions of the event. The training also covered other topics, such as, the process of awarding the winning bid or how to communicate in the event they are unable to use the software. During the training sessions the supplier received information about the annual demand and pack sizes for each location by product. The bidders were advised their last bid must be honored by them and not withdrawn for consideration up to five calendar days after the auction ended. The five-day period provided the buyer an opportunity to download the last bids into REV™ and include other bids that were not submitted electronically. Bidders could respond to the eRFQ by mailing the bids through the U.S. Postal Service or express mail system. The buyer manually placed the bids and used the tool to analyze and compare to other bids.

The nine suppliers to submit sealed bids in 2005 were contacted by the buying organization to participate in the online bidding event. Each supplier had supplied or had been approved to supply the food processor in previous years. The list included five corn refiners and four food ingredient distributors.

Results

The single-bid auction and the bundled-bid (combinatorial) auction ran simultaneously. That is, bidders had an option to place a single or a bundled bid in the same web based portal. The bidders entered into a password protected website to view the requirements for all corn sweeteners by delivery location, packaging size, and to place bids. The bidders were allowed to submit bids for the total volume or on a portion of dextrose and corn syrup solids only. Bids for liquid dextrose and liquid corn syrup were accepted only for 100% of the volume at any delivery location for food safety reasons.

Corn sweeteners provide an opportunity for bidders to combine (bundle) bids. The auction was scheduled to last four uninterrupted hours. The software would only receive bids within the timeframe of the auction. Each bidding organization input their own single bid or bundled bid into the software, listing the price it was willing to sell by location, volume and specification as

single units or in bundles. Bidders were able to see their price for a single or bundle and if their own bid was a winning bid. In real time, the buyers were able to view each bid and the bidding throughout the entire event. Bidding continued throughout the time period. A bidder who did not have a winning bid at the time could, then submit a new bid if the bidder could afford a better bid. When time expired, bidders were locked out from submitting bids more bids.

Single Bid Outcome

In the single bid portion of the auction, two bidders met the requirement of supplying entire volume of corn sweeteners, see Table 1. A total of 98 out of a possible 180 bids were placed over four-hour period. In this auction, the buyer did not select any of the single bids, when determining the winning bid. Table 2 summarizes the bidding activity, which includes the number of bids, the percent of the demand requirements covered and the number of leading bids. We expected the bidders using single bid format to create more bids resulting in more lead changes. More bids were expected because of the real-time feedback features and the opportunity for non-incumbents to participate in a neutral marketplace to freely participate in the auction.

Table 2. Single unit bid summary by supplier

	Possible # of bids by location	Actual # of bids by location and sweetener type	Percentage of total demand met by using the single-unit bid approach	Number of leading bids in the single bid option
Supplier 1	20	4	20%	4
Supplier 2	20	11	100%	2
Supplier 3	20	20	55%	0
Supplier 4	20	9	45%	0
Supplier 5	20	5	25%	0
Supplier 6	20	14	70%	11
Supplier 7	20	15	75%	1
Supplier 8	20	20	100%	1
Supplier 9	20	1	24%	0
Total	180	99		19

However, the numbers of lead bid changes were less than expected considering the large number of bids. Also, the higher number of constraints in single bid format impinged on the bidder's ability to meet the buyer's total demand requirements. Thus, creating individual bids that did not meet the buyer's volume objective.

Bundled Bid Outcome

The bundled bid auction took place during the same time period as the single bid format. There was a 54% increase in the number of bids placed, but considerably fewer bids met the total demand requirement (See Table 3). Seemingly more bids were used to cover the buyer's demand, in a way that buyers did not force suppliers into unnecessary constraints. Bidders exercised their newfound freedom and flexibility to exercise different bidding options.

Table 3. Bundled bid summary by supplier

	# of bid combinations	Total # of bids placed	% of total demand met using the bundled bids approach	# of leading bids Using the bundled bids approach
Supplier 1	100	4	4%	1
Supplier 2	100	26	26%	16
Supplier 3	100	15	15%	0
Supplier 4	100	10	10%	1
Supplier 5	100	6	6%	0
Supplier 6	100	20	20%	1
Supplier 7	100	22	22%	2
Supplier 8	100	25	25%	1
Supplier 9	100	0	0%	0
Total	900	128		22

In the bundled bid portion of the auction, a total of 128 bids were placed out of 800 possible bids. The buyer selected bids from Suppliers 2, 6, 7, and 8 from the bundled bid option.

Comparison of Combinatorial Auction Option to the Market Price

Because of expanding demand for corn for ethanol production, less was directed to corn wet milling over the trial periods. As a result, corn sweetener prices increased and were not comparable across the two-year period. In order to quantify the savings from the combinatorial auction, we measured the total purchase cost against the same basket of sweeteners at reported national prices. In 2005, when the firm used the manual process, the firm paid 1% less than it would have paid compared to nationally quoted prices. In 2006 when reverse combinatorial auction was used, the firm paid 7.5% less than it would have paid for its entire basket of corn sweeteners using nationally quoted prices. Furthermore, the manual process took several weeks to run. Tables 4 and 5 show the outcome of the manual and reverse auction format.

Table 4. Savings using the conventional bid process

Sweetener	2005 RFQ quantities	National Average Price¹	Projected cost	Actual price paid, manual bidding	Sweetener expenditures, using simple, manual auction
Dextrose	10,473	\$23.10	\$241,926	\$23.00	\$240,879
Liquid Dextrose	90,000	\$17.75	\$1,597,500	\$17.50	\$1,575,000
Corn Syrup	41,000	\$14.25	\$584,250	\$14.15	\$580,150
Corn Syrup Solid	1,100	\$24.37	\$26,804	\$26.60	\$29,260
Total	142,573		\$2,450,480		\$2,425,289
Conventional Savings					\$25,191

Table 5. Savings with the reverse auction

Sweetener	2006 RFQ quantities	National Average price¹	Projected cost²	Actual price paid, single bid auction	Sweetener expenditures, using simple, manual auction
Dextrose	21,510	\$24.10	\$518,391	\$22.65	\$487,202
Liquid Dextrose	95,000	\$17.40	\$1,653,000	\$15.40	\$1,463,000
Corn Syrup	43,000	\$14.00	\$602,000	\$13.90	\$597,700
Corn Syrup Solid	5,299	\$23.90	\$126,646	\$25.60	\$135,654
Total	164,809		\$2,900,037		\$2,683,556
Auction Savings					\$216,481

Compared to national prices, 6 show a greater savings. Savings with the combinatorial auction resulted in a 13.6% benefit to the buying organization.

Table 6. Savings using combinatorial auction

Sweetener	2006 RFQ quantities cwt.	National average price ¹	Projected cost ²	Actual price paid, combinatorial bidding	Sweetener expenditures, combinatorial auction
Dextrose	21,510	\$24.10	\$ 518,391	\$21.33	\$ 458,808
Liquid Dextrose	95,000	\$17.40	\$1,653,000	\$13.80	\$1,311,000
Corn Syrup	43,000	\$14.00	\$ 602,000	\$13.50	\$580,500
Corn Syrup Solid	5,299	\$23.90	\$ 126,646	\$29.55	\$156,579
Total	164,809		\$2,900,037		\$2,506,887
Auction Savings ¹					\$393,150

Discussion

Combinatorial auctions tackle more complex spend categories by deploying sophisticated advanced sourcing and negotiations tools capable of “optimizing” lowest total cost and highest total value, not just the lowest price. These combinatorial auctions improve purchase order efficiency and automate back-end financial management (payables, receivables) systems. It serves as a transaction facilitator (Peterson et. al 2005). Transaction facilitators generally focus on reducing complex, paper-based transactions between buyers and sellers. When tailored to a specific industry/type of purchase, these tools can be invaluable in reducing transaction costs, dispute costs resulting from errors, and other operating costs.

The findings from the study in 2006 are not only consistent with the expected field research which suggest the use of this sourcing technique can create perceptions of opportunism among participating suppliers, but provides empirical evidence of multi-attribute purchasing that can be used to address the controversies that an eRA is solely a margin- squeezing tool myopically – and perhaps opportunistically – applied. Yet Sourcing professionals typically struggle to quantify value monetarily because of ignorance of the true cost structure for their own company as well as that of their suppliers (Emiliani 2004). This leads to heavy reliance on price comparisons (Anderson et al. 2000). Hence, absent sufficient competitive quotes as a basis of price comparison, assurance of attaining the best value is difficult. Sourcing professionals are also typically risk averse (Bloch and McEwen 2002; Nelson et al. 2001), preferring “an alternative whose outcome is known with certainty over one having an equal or more favorable expected value but whose outcomes are probabilistic (Puto et al. 1985, 90).” The weighted average cost for the entire basket of corn sweeteners purchased using the manual, reverse, and combinatorial auctions methods resulted in \$17.35/cwt. \$16.90/cwt. and \$16.09/cwt., respectfully.

¹ Average Midwest corn sweetener prices. Milling and Baking News ingredient prices. March 3, 2004 to May 25, 2004; March 5, 2005 to May 30, 2005; March 14, 2006 to May 29, 2006, Sosland Publishing.

² Budgeted costs of corn sweeteners based on the forecasted volume and the most competitive price received from the auction.

Any shortcoming found by the buyer includes the go/no go decision process associated with using new technology. That is, either the eRA will be used or not. The decision to use an eRA for its appropriateness to the buyer-supplier relationship and the initial high administrative costs and ex ante transactions costs includes organizational decisions that involved senior leaders in the firm. The perception of eRAs producing higher transaction costs could dissipate after some experience is gained through program implementation. Adopting electronic trading schemes and other information technology systems, as applied to other auction settings, have shown that eRAs have the potential to lower – not raise – transaction costs in most markets.

The data in this study from 2005 and 2006 provide a before and after view of eRA's. In this empirical study, the buyer is at the crossroads of using the manual process, the burgeoning reverse auction tool, and combinatorial auction methods to reach its objective.

In 2008 and 2009, the manufacturer chose a different procurement strategy. The use of the combinatorial auction had highlighted the flexibility gains and the result of more competitive bidding. In 2008, the manufacturer, built on the sourcing gains of the previous two years and negotiated with its current suppliers risk-management-based contracts. Because of the increasing volatility of corn prices, the manufacturer negotiated a contract that allowed the food manufacturer to manage the input price risks and to pay a tolling or manufacturing agreement with the corn refiner. The food industry buyer used its own personnel to manage the corn price risk and paid the corn refiner to convert corn into the four corn sweeteners needed for its products. This demonstrates that changing conditions may call for changing sourcing strategies. Also, repeated use of CeRA may lead to discovery of ways that vendors might game the system or vendors who have not captured a winning bid, may choose not to continue to bid.

Conclusions

In this paper we evaluated eRA's and conventional method. The goals in a winning bid determination problem are to find the lowest cost scenario and to reduce the transaction cost of buying goods and services. The 2006 results from the single bid auction yielded a costs savings when compared against the national prices for corn sweeteners. In 2006, the bundled bid option yielded a 14% benefit compared to the national prices and a 4.9% advantage over the single bid option. The bidding flexibility provided in the bundled bid format allowed suppliers to bid based on their organizational capabilities. That is, it allowed suppliers to provide multiple single-unit bids and bundled bids. Furthermore, the new process allowed the buyer to evaluate both bidding formats in minutes, compared to weeks when the traditional methods were used.

After the 2006 auction, the food industry buyer adopted the combinatorial tool to help purchase corn sweeteners. The price per bushel of corn, however, increased and so did the costs for producing corn sweeteners. In 2007 the corn sweetener prices increased, but the prices paid using the combinatorial auction was less than the reported prices for corn sweeteners reported in industry publications. The combinatorial auction confirmed the food industry buyer's prices were very competitive.

The combinatorial auction format generated a significant costs savings by providing the seller more bidding flexibility. The costs savings from the event was similar to other firms using reverse auction strategies. In addition, the food manufacturer adopted a best practices procurement strategy, which reduced its time in determining the winning bid. Reverse auction speeds up the process of determining price in multi-attribute auctions. Typically, after the second or third time, the marginal benefits are less than the marginal costs of conducting the auction.

References

- Aberdeen Group 2005. Success Strategies in Advanced Sourcing and negotiations: Optimizing Total Costs and Total Value for the Next Wave in e-sourcing Savings. Benchmark, Report June 2005. www.aberdeengroup.com.
- Anderson, Shannon W., David Glenn, and Karen L. Sedatole. 2000. Sourcing Parts of Complex Products: Evidence on Transactions Costs, High-Powered Incentives and Ex-Post Opportunism. *Accounting, Organizations and Society* 25 (8): 723–49.
- Ariba 2012. Information from web page. <http://www.ariba.com>. [accessed June, 2013]
- Beall, S., C. Carter, P. L. Carter, T. Germer, S. Jap, L. Kaufmann, D. Maciejewski, D. Monczka, R. Monczka, and K. Petersen. 2003. The Role of Reverse Auctions in Strategic Sourcing. CAPS Research. *Focus Study, Tempe, AZ*.
- Caniëls, Marjolein CJ, and Erik M. van Raaij. 2009. Do All Suppliers Dislike Electronic Reverse Auctions? *Journal of Purchasing and Supply Management* 15 (1): 12–23.
- Corn Refiners 2013. Information from webpage. www.corn.org. [accessed March, 2006].
- Ding, Min, Jehoshua Eliashberg, Joel Huber, and Ritesh Saini. 2005. Emotional bidders—An Analytical and Experimental Examination of Consumers' Behavior in a Priceline-like Reverse Auction. *Management Science* 51 (3): 352–64.
- Emiliani, M. L. 2004. Sourcing in the Global Aerospace Supply Chain Using Online Reverse Auctions. *Industrial Marketing Management* 33 (1): 65–72.
- Foroughi, Abbas, Mehmet Kocakulah, and Jennifer Williams. 2008. A Framework for Electronic Reverse Auction (eRA) Research. *Journal of Internet Commerce* 6 (3): 45–74.
- Häubl, Gerald, and PTL Popkowski Leszczyc. 2004. Bidding Frenzy: Intensity of Competitive Interaction among Bidders and Product Valuation in Auctions. *Advances in Consumer Research* 31 (1): 91–93.
- Hohner, Gail, John Rich, Ed Ng, Grant Reid, Andrew J. Davenport, Jayant R. Kalagnanam, Ho Soo Lee, and Chae An. 2003. Combinatorial and Quantity-Discount Procurement Auctions Benefit Mars, Incorporated and Its Suppliers. *Interfaces* 33 (1): 23–35.

- Huang, Xiaowen, Thomas F. Gattiker, and Roger G. Schroeder. 2010. Do Competitive Priorities Drive Adoption of Electronic Commerce Applications? Testing the Contingency and Institutional Views. *Journal of Supply Chain Management* 46 (3): 57–69.
- Kaplan, Steven, and Mohanbir Sawhney. 2000. B2B E-Commerce Hubs: Towards a Taxonomy of Business Models. *Harvard Business Review* 79 (3): 97–100.
- Kaufmann, Lutz, and Craig R. Carter. 2004. Deciding on the Mode of Negotiation: To Auction or Not to Auction Electronically. *Journal of Supply Chain Management* 40 (1): 15–26.
- Kwasnica, Anthony M., John O. Ledyard, Dave Porter, and Christine DeMartini. 2005. A New and Improved Design for Multi object Iterative Auctions. *Management Science* 51 (3): 419–34.
- Lancioni, Richard. 2005. Pricing Issues in Industrial Marketing. *Industrial Marketing Management* 34 (2): 111–14.
- Moozakis, Chuck. 2001. Bargain Basement Bids. *Internet Week* 870: 19–21.
- Pearcy, Dawn, Larry Giunipero, and Andrew Wilson. 2007. A Model of Relational Governance in Reverse Auctions. *Journal of Supply Chain Management* 43 (1): 4–15.
- Petersen, Kenneth J., Gary L. Ragatz, and Robert M. Monczka. 2005. An Examination of Collaborative Planning Effectiveness and Supply Chain Performance. *Journal of Supply Chain Management* 41 (2): 14–25.
- Porter Michael, E. 1998. On Competition. *Harvard Business School*.
- Puto, Christopher P., Wesley E. Patton III, and Ronald H. King. 1985. Risk Handling Strategies in Industrial Vendor Selection Decisions. *The Journal of Marketing* 89–98.
- Sambamurthy, V., and Robert W. Zmud. 2000. Research Commentary: The Organizing Logic for an Enterprise's IT Activities in the Digital era—A Prognosis of Practice and a Call for Research. *Information Systems Research* 11 (2): 105–14.
- Sandholm, Tuomas. 2002. Algorithm for Optimal Winner Determination in Combinatorial Auctions. *Artificial Intelligence* 135 (1): 1–54.
- Sandholm, Tuomas, Subhash Suri, Andrew Gilpin, and David Levine. 2002. Winner Determination in Combinatorial Auction Generalizations. In *Proceedings of the First International Joint Conference on Autonomous Agents and Multiagent Systems: Part 1* 69–76. ACM. <http://dl.acm.org/citation.cfm?id=544760>.
- Sheffi, Yossi. 2004. Combinatorial Auctions in the Procurement of Transportation Services. *Interfaces* 34 (4): 245–52.

Smeltzer, Larry R., and Amelia S. Carr. 2003. Electronic Reverse Auctions: Promises, Risks and Conditions for Success. *Industrial Marketing Management* 32 (6): 481–88.

USDA—Economic Research Service. Information from web page. <http://www.corn.org/publications/statistics/food-industrial-uses/#sthash.7ue9qZAM.dpuf>. [accessed June 1, 2013].



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

An Assessment of Market Strategies for Small-Scale Produce Growers

Man-Keun Kim^a, Kynda R. Curtis[ⓑ], and Irvin Yeager^c,

^a*Assistant Professor, Department of Applied Economics Utah State University,
4835 Old Main Hill, Logan, Utah 84322-4835, USA*

^b*Associate Professor, Department of Applied Economics Utah State University,
4835 Old Main Hill, Logan, Utah 84322-4835, USA*

^c*Graduate Research Assistant, Department of Applied Economics Utah State University,
4835 Old Main Hill, Logan, Utah 84322-4835, USA*

Abstract

This study examines marketing strategies for small-scale producers by comparing the risk and return properties of direct (farmers' markets) and wholesale marketing channels. Farmers' market prices for fresh produce were collected at sixteen markets in Utah and Colorado. San Francisco terminal market prices were used to represent wholesale prices. A simulation model combined price, yield, and market risk to construct probability distribution functions showing the likelihood of differing levels of profit for eleven marketing options. The results show that risk-averse producers prefer a combination of channels (40% direct/60% wholesale), while risk neutral producers prefer to market exclusively through farmers' markets.

Keywords: risk, return, direct markets, wholesale, fresh produce, small farms

[ⓑ]Corresponding author: Tel: + 1 435.797.0444

Email: K.R. Curtis: kynda.curtis@usu.edu

M.K. Kim: mk.kim@usu.edu

Introduction

Direct marketing of fresh produce has greatly expanded in the U.S. as evidenced by the growth in the number of farmers' markets from 1755 in 1994 to over 8000 in 2013 (USDA 2014). The Intermountain West has seen some of the highest growth, where 38% of farmers' markets have been in existence less than five years. Although direct markets, such as farmers' markets provide local growers market access and premium pricing, their ability to sustain local production comes into question when an estimated 80% of producers earn \$5,000 or less per market season (Ragland and Tropp 2009).

Wholesale markets, a form of intermediate marketing where one or more middlemen is used (Hand 2010), are an established marketing channel in the U.S., accounting for 99.2% of all food purchases (Martinez et al. 2010). Locally-grown fresh produce, although typically associated with direct markets, is also sold through wholesale channels and available at restaurants and grocery retail outlets, such as Wal-Mart and Kroger¹. Wholesale markets actually account for the majority of local produce revenues, but are supplied primarily by larger farms, defined by USDA as those grossing more than \$250,000 annually (Low and Vogel 2011). Through economies of scale, larger growers are able to provide quantities and pricing suitable for wholesalers looking to fill large grocery store and dining establishment orders. More recently, increased consumer demand for local foods has given smaller growers the opportunity to offer their produce to wholesale customers, looking to meet this demand. However, these markets also come with challenges, such as meeting quality and food safety requirements (Gunter et al. 2012). Wholesale markets are attractive to producers due to lower marketing costs, transparent pricing, and less expected risk overall. Choosing between direct markets and wholesale opportunities represent a complex decision for small-scale producers.

Choosing the level of involvement in wholesale and direct markets represents a strategic tradeoff between the higher pricing and revenue uncertainty of farmers' markets as compared to the more predictable, but lower revenues of wholesale markets. Involvement in both channels may serve as a risk management tool, allowing producers to optimize revenue and predictability to meet their needs. However, the preferred level of involvement in each channel with respect to risk and profit maximization will vary due to production capabilities and producer risk tolerance levels.

This study attempts to shed light on this question by using a simulation model based on prices received by fresh produce growers in the region and expected costs of utilizing farmers' market and wholesale channels. The simulation model incorporates non deterministic elements and allows a variety of situations to be considered by combining price, yield, and sales risk, to produce a large number of potential outcomes. These outcomes, summarized by a probability distribution, show the likelihood of differing levels of profit, and provide the framework for comparing marketing decisions. The results will provide insight in to marketing strategies and associated considerations for small-scale producers in the Intermountain West.

¹Larger grocery chains, such as Wal-Mart, Kroger (Smiths in the West), and Supervalu have incorporated local foods into their long-term strategies. Wal-Mart plans to increase the share of locally grown produce to 9% in the US and 30% in Canada by 2015 and Supervalu buys between 25 and 40% of its produce from local suppliers.

Literature Review

As Lev and Gwin (2010) conclude, the profitability of small-scale producers using direct markets, such as farmers' markets, is not well understood. Several studies discuss the potential profitability of using direct markets citing premiums for fresh produce and the need to produce a variety of high value or specialty crops (Kambara and Shelley 2002, Govindasamy et al. 2003, Kebede and Gan 1999, Conner et al. 2011). Other studies compare producer returns and potential profits between direct and other marketing channels. For example, Park and Lohr (2006) find that producers who diversify marketing channels (direct, direct to retail, and wholesale) or use a single channel (not limited to direct marketing) tend to have higher earnings relative to producers who overlook these marketing options. The study uses an econometric model analyzing the 2001 nationwide Organic Farm Research Foundation's survey data.

LeRoux et al. (2010) evaluate marketing channel options for small-scale producers in Central New York and compare price, sales volume, costs and market risk of alternative marketing channels. They conclude that a combination of different marketing channels is needed to increase overall performance. However, they do not provide a rigorous test or method to choose the marketing channel. Instead, they develop an index for labor required, sales volume and average profit of alternative marketing channels and calculate the weighted average to assist producer decision making.

Other studies use an estimated cost and return based approach to compare profitability potential across marketing channels, often limiting the analysis to either a point estimate or examine of several scenarios (sensitivity analysis) (Rayburn 2012). For example, Hardesty and Leff (2010) compare marketing costs and returns across alternative marketing channels. They found that wholesale was the most profitable marketing channel, while farmers' markets were the least profitable. The authors attributed this result, in part, to the low labor-to-revenue ratio in wholesale markets from savings in transportation, sales, and administration. The authors also found profits decreased by 53% with only a 20% decrease in produce sold when exclusively using farmers' markets, and thus, recommended their use as a marketing and risk management tool to sell surplus produce. Conversely, Ward et al. (2011) found that utilizing farmers' markets was more profitable than wholesale markets for producers utilizing high tunnels on one acre to produce a double crop of tomatoes and summer squash.

Donnell et al. (2011) through the analysis of five crops typically sold at farmers' markets confirmed that production and marketing risk are significant factors for direct marketers. They use sales levels of 50%, 75% and 100% of production to assess potential revenues. The results show that break-even prices were very sensitive to the amount sold. Finally, Gunter et al. (2012) examined the feasibility of small-scale production in Northern Colorado using three scenarios based on varying levels of investment in production, storage, and distribution. The first scenario, exclusively utilizing wholesale markets, was unsustainable based upon the first three years of production. The authors concluded that risk for each option varied due to differing levels of commitment to capital and labor.

While the comparison of asset risk and return properties is common when choosing financial investments, as well as in decisions-making regarding crop choice and land use in agriculture

(Bishop et al. 2010, Williams et al. 2010), this approach has yet to be used in the published literature on direct market profitability. Risk, or the “exposure to a proposition in which one is uncertain” (Holton 2004, 22) is customary in agriculture due to continual political, economic, and social change, as well as exposure to weather and market variation. Studies by Lin et al. (1974) and Halter and Mason (1978) suggest that producers consider the additional risk they face and find that producers were generally risk averse by using Arrow-Pratt Absolute Risk Aversion Coefficients (ARAC). Harwood et al. (1999) discuss the various sources of risk in agriculture and state that, “Understanding risk is a starting point to help producers make good management choices in a situation where adversity and loss are possibilities” (p.2). Hence, when choosing the level of involvement in wholesale and direct markets, small-scale producers need to understand the risk involved, or the tradeoff of higher pricing, but uncertain sales in direct markets as compared to more predictable sales volumes, but lower pricing in wholesale markets.

Small-scale producers are often unfamiliar or uncertain about expanding their markets to include wholesale outlets. For example, Curtis et al. (2012) found that only 19% of the producers surveyed at farmers’ market in Utah, Nevada, and Idaho also used wholesale markets. Hence, this study compares the risk and return properties of fresh produce sales through direct and wholesale marketing channels to provide an example and aid the producer decision-making process.

Methods

Simulation models, which incorporate stochastic elements, are commonly used to assess production, market, and price risk in traditional agriculture (Richardson et al. 2007a, Richardson et al. 2007b, Watkins et al. 2008, Clark et al. 2010, Curtis et al. 2010). Simulation allows for a variety of situations to be considered by combining price, yield, and sales risk to produce a large number of outcomes. These outcomes, summarized by a probability distribution, show the likelihood of differing levels of profit, and provide the framework for comparing marketing decisions.

Stochastic variables are defined as variables the decision maker, in this case fresh produce marketers, cannot control (Richardson 2006). The simulation model considers yield, price received from farmers’ markets and wholesale markets, and the level of sales at farmers’ market as stochastic. Let y indicate produce yield and production (q_i) is defined as follows:

$$1) \tilde{q}_i = a_i \tilde{y}_i,$$

where i = subscript for produce, \tilde{q}_i = (stochastic) production of produce i , a_i = (fixed)² planted acreage for produce i , and \tilde{y}_i is the (stochastic) yield per acre for produce i . Note that the tilde

²We assume that $a_i = 0.2$ acres for each produce item, and thus $\sum a_i = 1$ acre. It is based on the assumption that the producer does not currently have a contract with a wholesaler, i.e., has unknown demand for each produce item. Hence the producer will minimize production and marketing risk by growing a variety of products in the case of having to rely on farmers’ markets exclusively (Conner et al. 2011).

on variables denotes stochastic variables. The producer can choose what level of involvement in each of the channels³ (farmers' market or wholesale) and that decision can be written as:

$$2) \tilde{s}_{i,FM} = \tilde{\theta}\alpha\tilde{q}_i \text{ and } \tilde{s}_{i,W} = (1 - \alpha)\tilde{q}_i,$$

where \tilde{s}_i = the level of sales of i th produce in j th channel, $j = FM$ and W ; FM = farmers' market, W = wholesale, and $\tilde{\theta}$ denotes the probability of the level of sales in farmers' market that is uncertain to the producer who decides the level of α or marketing strategy where that is $0 < \alpha < 1$. When $\alpha = 1$, all the produce is marketed through farmers' markets and when $\alpha = 0$, the producer sells exclusively wholesale. The net return (π) from marketing is given by:

$$3) \tilde{\pi} = \sum_j \sum_i \tilde{p}_{i,j} \cdot \tilde{s}_{i,j} - \sum_j M_j - C,$$

where $\tilde{\pi}$ = stochastic net return, \tilde{p}_{ij} = stochastic price of i th produce in j th channel, M_j = marketing cost in j th channel; subscript FM = farmers' market, W = wholesale, and C = production and harvesting cost. Costs M_j and C are fixed as these costs can be readily recognized by farmers fairly accurately in advance and are expected to be somewhat similar for small producers.

Sales, price, and yield risk are incorporated into equation (3) by utilizing stochastic simulation by drawing random prices, yield, and the level of sales from given statistical distributions. Random prices used in equation (3) are generated as follows:

$$4) \tilde{p}_{ij} = \bar{p}_{ij} + \tilde{v}_{ij},$$

where \bar{p}_{ij} is the mean of the (historical) price of produce i and \tilde{v}_{ij} is the pure stochastic part or pure price disturbance⁴. The random disturbances, \tilde{v}_{ij} , in equation (4) are generated as correlation was found in prices (see Data Overview) and is treated as described in equation (5) established by Richardson et al. (2000) which allows for the prices to maintain a simultaneous price relationship where ε 's are independent disturbances from normal distributions with mean zero and standard deviation, $\tilde{\varepsilon} \sim iid N(0, \sigma_s^2)$ from the historical data. \tilde{v}_{ij} 's are correlated disturbances and ρ 's are correlation coefficients.

³The marketing decision is normally made prior to harvest, as wholesale contracts and farmers' market booth applications must be completed in advance. Thus, the marketing decision is rigid, but not completely so as diverting produce sales to restaurants and/or local grocery outlets may be an option for some producers.

⁴A chi-squared quantiles correlation test was performed to see whether \tilde{v}_{ij} in equation (4) and \tilde{w}_i in equation (5) are distributed multivariate normally. Test results indicate that both \tilde{v}_{ij} and \tilde{w}_i are multivariate normally distributed. P-values are 0.95 (price) and 0.84 (yield), respectively.

$$5) \begin{bmatrix} \tilde{v}_{1,FM} \\ \tilde{v}_{2,FM} \\ \vdots \\ \tilde{v}_{5,FM} \\ \tilde{v}_{1,W} \\ \tilde{v}_{2,W} \\ \vdots \\ \tilde{v}_{5,W} \end{bmatrix} = \begin{bmatrix} 1 & \rho_{1FM,2FM} & \cdots & \rho_{1FM,5FM} & \rho_{1FM,1W} & \rho_{1FM,2W} & \cdots & \rho_{1FM,5W} \\ & 1 & \cdots & \rho_{2FM,5FM} & \rho_{2FM,1W} & \rho_{2FM,2W} & \cdots & \rho_{2FM,5W} \\ & & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \\ & & & 1 & \rho_{5FM,1W} & \rho_{5FM,2W} & \cdots & \rho_{5FM,5W} \\ & & & & 1 & \rho_{1W,2W} & \cdots & \rho_{1W,5W} \\ & & & & & 1 & \cdots & \rho_{2W,5W} \\ & & & & & & \ddots & \vdots \\ & & & & & & & 1 \end{bmatrix} \begin{bmatrix} \tilde{\epsilon}_{1,FM} \\ \tilde{\epsilon}_{2,FM} \\ \vdots \\ \tilde{\epsilon}_{5,FM} \\ \tilde{\epsilon}_{1,W} \\ \tilde{\epsilon}_{2,W} \\ \vdots \\ \tilde{\epsilon}_{5,W} \end{bmatrix},$$

The GRKS distribution⁵ which allows simulation with limited data (Richardson, 2006; Evans and Stalman, 2006) will be assumed for the level of farmers’ market sales, $\tilde{\theta}$, in equation (2). Partially based on the approach used by Donnell et al. (2011), we presume the level of sales is a minimum of 25%, a maximum 75%, with an average of 50%, or $\tilde{\theta} \sim GRKS(min, avg, max)$.

The yield, \tilde{y}_i , in equation (1) is simulated using historical data in similar fashion with prices. The stochastic yield is generated using the following equation:

$$6) \tilde{y}_i = \bar{y}_i + \tilde{w}_i,$$

Where \bar{y}_i is the mean of the yield and \tilde{w}_i is the disturbance. Like the stochastic prices, all of the random disturbances, \tilde{w}_i , in equation (6) are generated considering correlation among yields such that:

$$7) \begin{bmatrix} \tilde{w}_1 \\ \tilde{w}_2 \\ \vdots \\ \tilde{w}_5 \end{bmatrix} = \begin{bmatrix} 1 & \rho_{12} & \cdots & \rho_{15} \\ & 1 & \cdots & \rho_{25} \\ & & \ddots & \vdots \\ & & & 1 \end{bmatrix} \begin{bmatrix} \tilde{\mu}_1 \\ \tilde{\mu}_2 \\ \vdots \\ \tilde{\mu}_5 \end{bmatrix},$$

where μ ’s are independent disturbances from normal distributions with mean zero and standard deviation, $\tilde{\mu} \sim iid N(0, \sigma_{\mu}^2)$ from the historical yield data.

The producer is given the choice of involvement level in each market channel. This study uses eleven representative options to choose from where α is the decision variable in this practice ($0 < \alpha < 1$).

- M1. All to farmers’ market, i.e., $\alpha = 1$
- M2. 90% to farmers’ market, 10% to wholesale, i.e., $\alpha = 0.9$
- M3. 80% to farmers’ market, 20% to wholesale, i.e., $\alpha = 0.8$
- M4. 70% to farmers’ market, 30% to wholesale, i.e., $\alpha = 0.7$

⁵The GRKS (Gray, Richardson, Klose and Schumann) distribution is similar to triangular distribution. It was developed to simulate “subjective probability distribution” with minimal data (Richardson 2006, 5-3). The GRKS distribution has the following useful properties: 50% of observations are less than the midpoint; 95% of the simulated values are between the minimum and the maximum; 2.2% of the simulated values are less than the minimum and more than maximum (Evans and Stallmann 2006, pp.175).

- M5. 60% to farmers' market, 40% to wholesale, i.e., $\alpha = 0.6$
- M6. 50% to farmers' market, 50% to wholesale, i.e., $\alpha = 0.5$
- M7. 40% to farmers' market, 60% to wholesale, i.e., $\alpha = 0.4$
- M8. 30% to farmers' market, 70% to wholesale, i.e., $\alpha = 0.3$
- M9. 20% to farmers' market, 80% to wholesale, i.e., $\alpha = 0.2$
- M10. 10% to farmers' market, 90% to wholesale, i.e., $\alpha = 0.1$
- M11. All to wholesale, i.e., $\alpha = 0$.

Data Overview

Farmers' market produce prices were collected during the regular season (June to September) 2011 in Utah and Colorado by Utah State University and Colorado State University Cooperative Extension. Five produce items were selected for analysis based on the price availability and consistency of a like product: tomatoes, cucumbers, green peppers, potatoes, and summer squash. Yield data for the five products were provided by USDA NASS⁶. Terminal market prices provided by USDA NASS over the same time period were used as representative wholesale prices as local data were unavailable.

Cost of production data for each item was taken from various studies (Carlson et al. 2008, Mayberry 2000, Molinar et al. 2005, Rutgers University 2008, and Stoddard et al. 2007). Table 1 provides descriptive statistics for each produce item including mean yield in hundred-weight per acre (cwt), standard deviation, and the minimum and maximum yield per acre. It should be noted that each item has similar coefficient of variations (CV) suggesting somewhat similar production risk for each item although green peppers are somewhat higher than the others and show a relatively large range of production yield.

Table 1. Yield statistics (cwt/acre)

	Tomatoes	Cucumbers	Squash	Potatoes	Green Peppers
Mean	295.50	189.77	147.55	374.25	295.43
Std. Dev	14.14	11.60	7.82	21.10	20.28
CV(%)	4.79	6.11	5.30	5.64	6.87
Min	268.00	171.81	136.40	335.97	257.00
Median	299.00	190.03	146.90	382.30	297.00
Max	311.00	208.57	160.44	403.85	329.00

Figure 1 displays historical yield data demonstrating the consistent production yields across time with green peppers and potatoes showing a slight upward trend. Figure 2 displays the average weekly prices for the five produce items for both the wholesale and farmers' market channels. Farmers' market prices are typically more variable, especially for cucumbers and tomatoes.

⁶Yield data used in the analysis are aggregated at the state level which may underestimate the true yield risk for an individual producer.

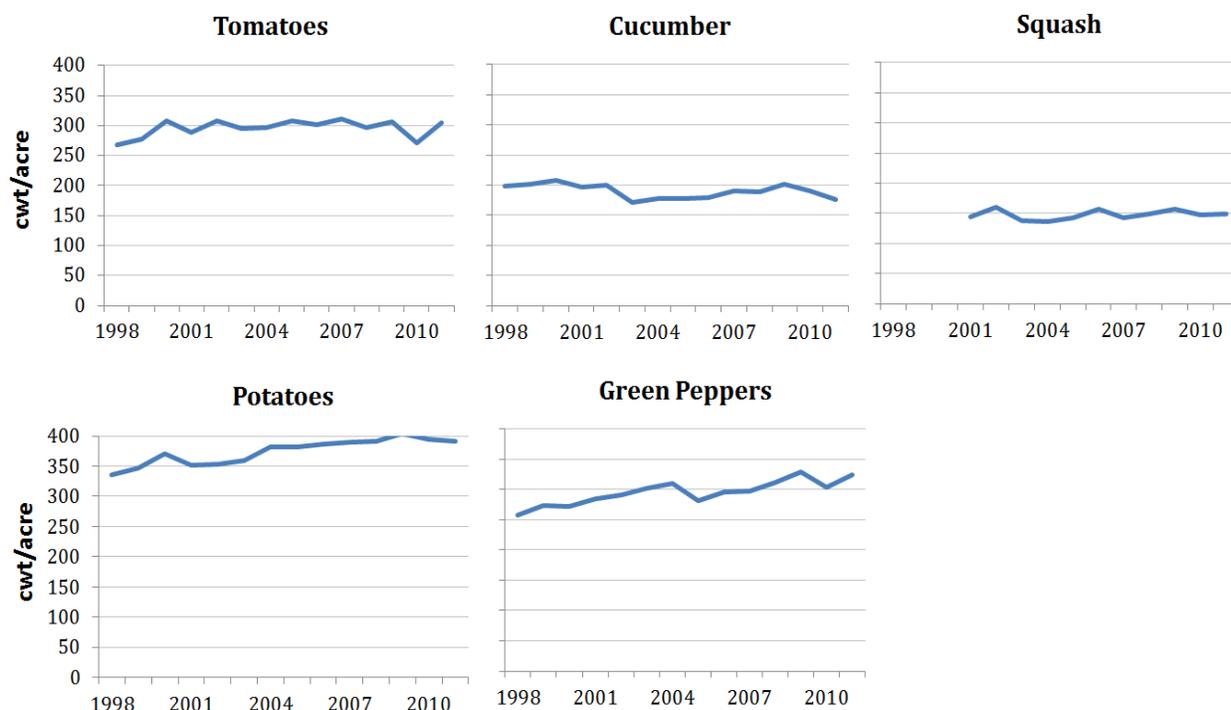


Figure 1. Historical yields 1998-2011 (cwt/acre)

Table 2 describes marketing costs associated with each channel. Marketing costs were based on those reported by fresh producer growers in Utah in a survey conducted in 2011. Costs taken into account were markets fees, labor, transportation, and other inputs. It should be noted that the higher costs to market at farmers’ markets as compared to wholesale markets represents an important consideration for producers.

Table 2. Marketing costs by channel (\$)

	Farmers’ Market	Wholesale
Labor	2,560	320
Fuel	250	250
Tables	150	-
Signs	50	-
Marketing	225	200
Containers	150	150
Total	3,385	920

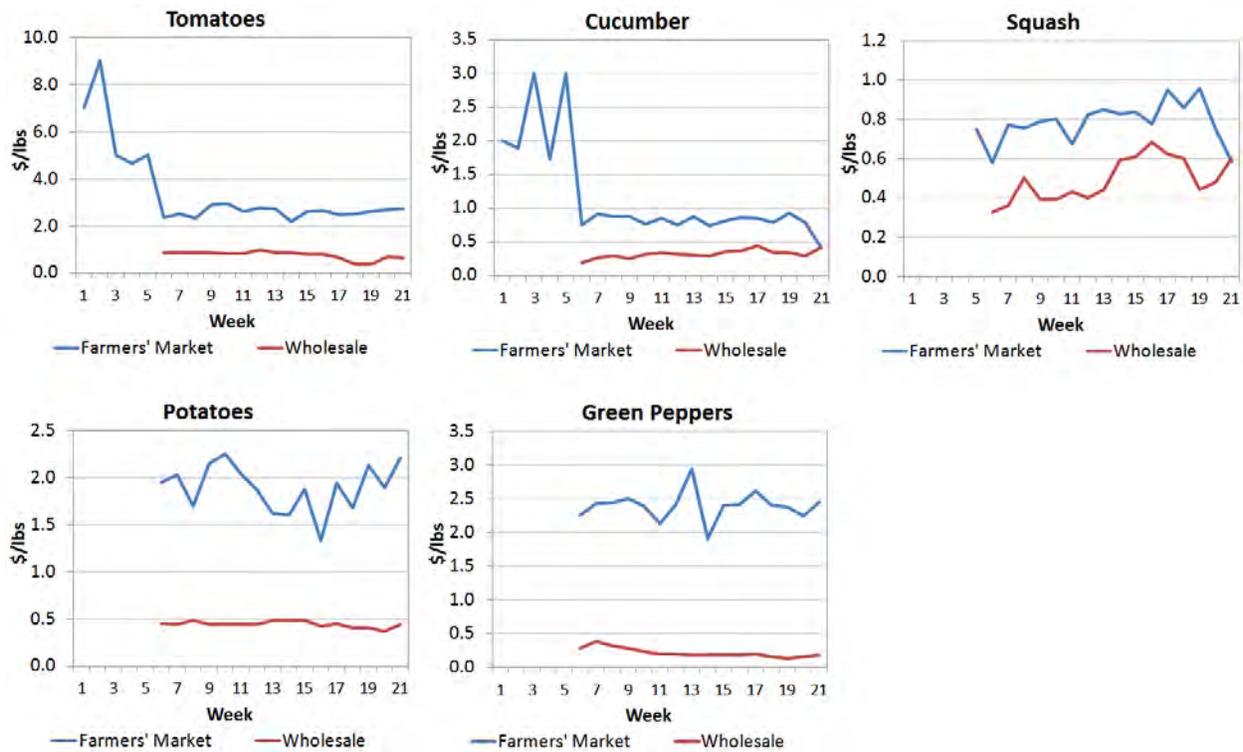


Figure 2. Farmers’ market and wholesale produce prices

The coefficient of variation of price for each produce item by market was found. An important part of the decision making process for producers is understanding the variability in prices at each market, as it indicates of how well income can be predicted. Figure 3 shows price variability and as expected, price variation was greater for farmers’ markets for three items, with tomatoes and cucumbers particularly high.

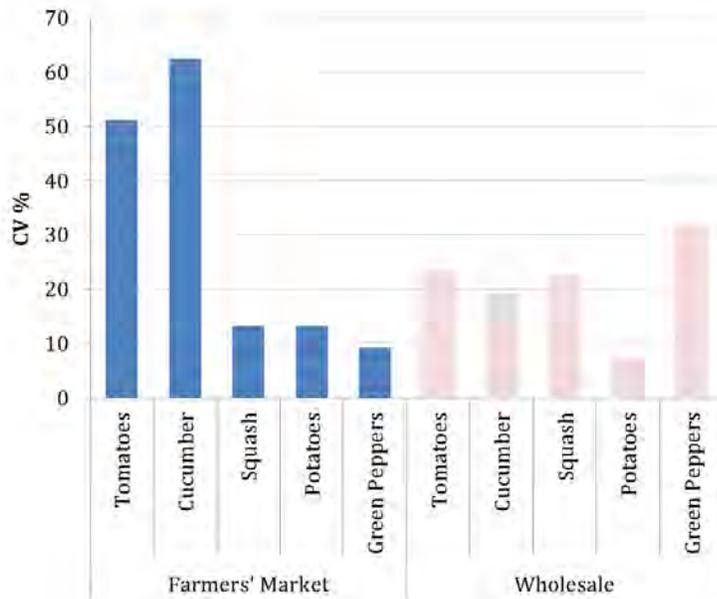


Figure 3. Coefficient of variation in price

The higher variability suggests less predictable revenues for producers, but a higher profit ceiling. Wholesale produce prices, which generally have lower CV's, may offer producers more stable revenues. The level of involvement in each market represents an important tradeoff as producers have different attitudes toward risk, preferences, and resources. The following section will address level of involvement based on producer attitudes toward risk.

Results and Discussion

All stochastic variables were simulated 1000 times to compute the net return in equation (3) and generate the probability distribution function (PDF) for the net return (Figure 4 and Table 3). Although a simple visual comparison of marketing strategies found in Figure 4 would provide producers with a readable answer, Table 3 provides insight into the consequences of each decision, for example, M1 which has the highest mean profit also has the largest simulated loss (minimum).

The comparison of mean net returns for each strategy does not include the risk or variability in net returns. Ranking risky alternatives can be done in several ways, such as comparing standard deviations, maximin, certainty equivalences (Hardaker 2000), or applying stochastic dominance (Meyer 1977). Stochastic efficiency with respect to a function (SERF) approach was chosen based on discussions in Hardaker et al. (2004), which is superior to other approaches as it allows for a comparison of all the alternatives simultaneously. SERF ranks risky alternatives in terms of certainty equivalents⁷ (CE) for a specified range of risk aversion coefficients with a predetermined utility function based on the following rules:

- 8) $F(\pi)$ preferred to $G(\pi)$ at $ARAC$ if $CE_F > CE_G$
 $F(\pi)$ indifferent to $G(\pi)$ at $ARAC$ if $CE_F = CE_G$, or
 $G(\pi)$ preferred to $F(\pi)$ at $ARAC$ if $CE_F < CE_G$,

where $F(\pi)$ and $G(\pi)$ are cumulative distribution functions (CDF) of net returns from two risky alternatives, CE indicates the certainty equivalences, and $ARAC$ is the *absolute risk aversion coefficient* assuming a negative exponential utility function⁸ (Figure 4).

⁷Certainty Equivalent (CE) is the value someone would accept rather than taking a chance on a higher, but uncertain return (Varian 1992).

⁸ Negative exponential utility function is given by $U(\pi) = 1 - \exp(-ARAC \cdot \pi)$, where $ARAC > 0$ (Hardaker et al. 2004, p.103). Negative exponential utility function exhibits constant absolute risk aversion (CARA), which is given by $ARAC$. This function has been used extensively in decision analysis. Note that this function can be estimated from a single CE, and it is particularly useful in analysis where the distribution of returns is normal (Hardaker et al. 2004, p.103). The certainty equivalent (CE) of a risky prospect is the sure sum with the same utility as the expected utility of the prospect. In other words the CE over risk aversion coefficient is given by $CE(\pi, ARAC) = U^{-1}(\pi, ARAC)$. The CE depends on the type of utility function. The CE for negative exponential utility function is calculated as $CE(\pi, ARAC) = \ln\left[\left(\frac{1}{n} \sum \exp(-ARAC \cdot \pi_i)\right)^{\frac{1}{ARAC}}\right]$ (Hardaker et al. 2004, pp. 257, eq (3)).

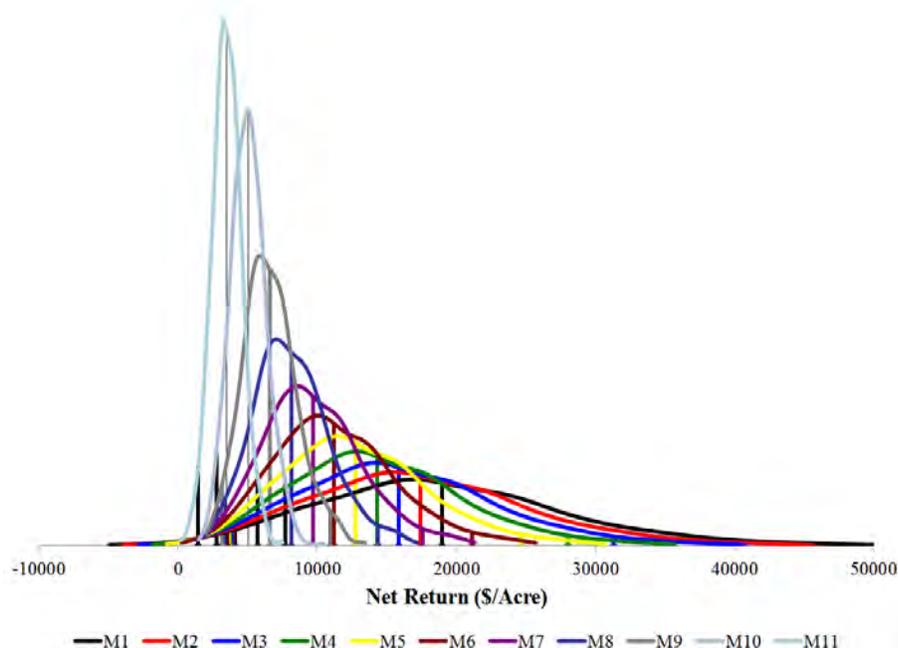


Figure 4. Simulated net returns probability density function

Note. Vertical axis (not presented with numbers) is the probability and the area under the PDF presents the probability of the interval of net returns. Mathematically, $Pr[a \leq \text{net return} \leq b] = \int_a^b f(x) dx$. Roughly speaking, the average net return is found around the peak of the distribution and the variance is represented by the spread of the distribution. For example, M1 has a high average net return (\approx \$20k) and a large variance of the net return, i.e., high risk, while M11 has a low average net return (\approx \$5k) and a low variance of the net return, i.e., low risk.

Table 3. Summary of net returns from simulation (\$/acre)

	Mean	Std. Dev.	CV (%)	Min	Max
M1. All to Farmers’ Market (FM)	18,954	8,727	46.0	-4,936	50,690
M2. 90 to FM and 10 to W	17,409	7,851	45.1	-3,899	45,690
M3. 80 to FM and 20 to W	15,865	6,997	44.0	-2,863	40,691
M4. 70 to FM and 30 to W	14,320	6,105	43.0	-1,827	35,692
M5. 60 to FM and 40 to W	12,775	5,238	41.0	-790	30,693
M6. 50 to FM and 50 to W	11,230	4,376	39.0	246	25,694
M7. 40 to FM and 60 to W	9,685	3,525	36.4	1,283	21,300
M8. 30 to FM and 70 to W	8,140	2,694	33.1	1,823	17,174
M9. 20 to FM and 80 to W	6,595	1,911	29.0	2,044	13,429
M10. 10 to FM and 90 to W	5,050	1,267	25.1	1,470	10,470
M11. All to Wholesale (W)	3,505	1,057	30.2	164	7,512

Note. Numbers in M1 – M11 represent the percentage of produce to each marketing channel, for example, M2. 90 to FM and 10 to W indicates that farmers ship 90% of their produces to farmers’ markets and 10% to wholesalers. Numbers in Mean, Std. Dev., Min, and Max are net returns in \$/acre. CV is the coefficient of variation of net returns in %.

When $ARAC = 0$, the decision maker is risk neutral and higher values of $ARAC$ imply risk averse decision makers. We select relative risk aversion coefficients from 0 to 3 as suggested in Anderson and Dillon (1992) and convert the absolute risk aversion coefficients using standard

deviation of net return as suggested in McCarl and Bessler (1989), ranging from 0 to 0.00114⁹. In other words, an *ARAC* greater than 0.00114 indicates the decision maker is very risk averse (Figure 5).

Using *CE* in equation (8), each strategy appeals to producers on risk preference. A risk neutral producer (*ARAC* = 0) would prefer M1 (all to farmers’ markets) which has the highest *CE*, while an extremely risk averse producer would be expected to prefer strategy M7 or M8. It should be noted that other marketing strategies used depend on producer attitudes toward risk (Figure 4). Based on the results, the M11 strategy, marketing solely wholesale is a poor option for any producer (Figure 5). M2, marketing 90% to farmers’ markets, has appeal to risk neutral producers, but not for risk averse producers¹⁰.

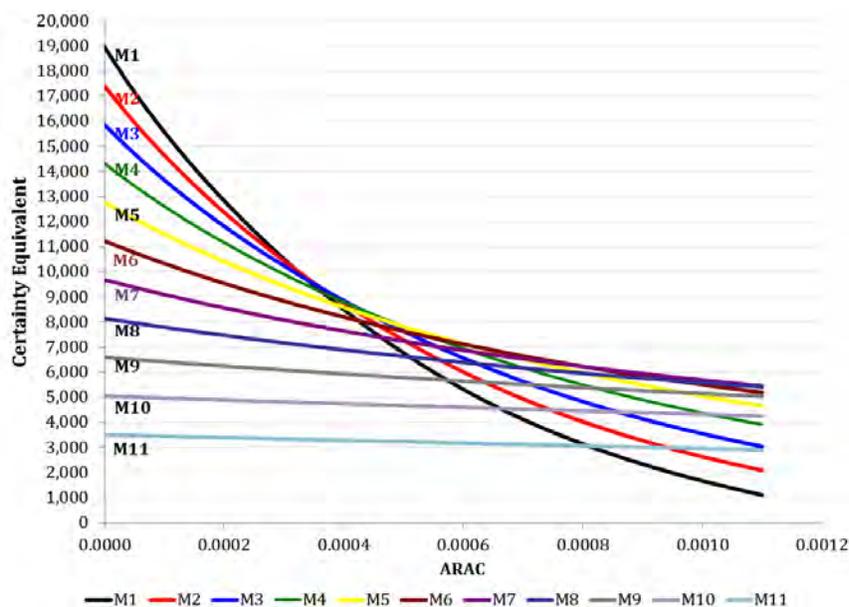


Figure 5. Stochastic Efficiency with Respect to a Function (SERF)

Note. 1. The vertical axis represents the certainty equivalent (CE) and the horizontal axis the absolute risk aversion coefficient (ARAC). The CE is the amount of money producers would accept rather than taking a chance on higher but uncertain net return. The CE varies over the producer’s ARAC.

2. In the graph, the producer prefers the higher CE, for example, when ARAC = 0 (risk neutral), M1 (black line) is most preferred because it has the highest CE. When ARAC = 0.001 (risk averse), M1 is least preferred because it has the lowest CE.

3. SERF graphs are generated assuming negative exponential utility such that

$$CE(\pi, ARAC) = \ln\left[\left(\frac{1}{n} \sum \exp(-ARAC \cdot \pi_i)\right)^{\frac{1}{ARAC}}\right]$$

⁹Upper bound of ARAC, 0.00114 is determined based on equation (18) in McCarl and Bessler (1989), which is given by $ARAC \leq 5.14 / \text{St Dev of net return}$. An average of the standard deviation of net returns from all eleven marketing strategies is used.

¹⁰The analysis here focuses on small farms where the farm operator may have off-farm employment. Off-farm employment and income is likely to affect their attitude towards risk (producers’ ARAC) and the time available for marketing farm products.

Table 4 summarizes the rank of each strategy based on the SERF approach and other approaches, e.g., mean only, CV, minimum only and minimax. M1, which is preferred by risk neutral producers, may have the best mean ranking, but has poor rankings for standard deviation and CV, showing there is high risk relative to the other options. M3 presents a fairly consistent option as it ranked third in mean, standard deviations, and CV, and is particularly attractive to risk averse producers as it predicts the highest relative returns in a worse-case scenario. M11 ranks poorly as its highest ranking has the lowest mean and profit levels in best and worst-case situations, but ranks first in CV.

Although the results recommend strategies M5-M7 for risk averse producers, considerations regarding financial obligations and goals, production skills and capabilities, market access, and lifestyle choice must be made. For example, a risk averse producer may prefer a strategy similar to M7, but may have to rely heavily on farmers' markets until they are able to secure an appropriate contract with a restaurant or grocer.

Table 4. Summary of rankings

	Mean Only	CV	Min Only	Max Only	Risk Neutral	SERF	
						Risk Rather Risk Averse	Risk Averse
M1. All to Farmers' Market (FM)	1	11	11	11	1	7	11
M2. 90 to FM and 10 to W	2	10	10	10	2	6	10
M3. 80 to FM and 20 to W	3	9	9	9	3	4	8
M4. 70 to FM and 30 to W	4	8	8	8	4	2	7
M5. 60 to FM and 40 to W	5	7	7	7	5	1	5
M6. 50 to FM and 50 to W	6	6	5	6	6	3	3
M7. 40 to FM and 60 to W	7	5	4	5	7	5	1
M8. 30 to FM and 70 to W	8	4	2	4	8	8	2
M9. 20 to FM and 80 to W	9	2	1	3	9	9	4
M10. 10 to FM and 90 to W	10	1	3	2	10	10	6
M11. All to Wholesale (W)	11	3	6	1	11	11	9

Note. 1. Rankings - Mean only: largest mean; CV: smallest CV; Minimum only: largest minimum; Minimax: smallest range between mean and minimum; Risk Neutral: ARAC = 0; Rather Risk Averse: ARAC = 0.0005; Risk Averse: ARAC = 0.0011

2. Numbers in the table represent a ranking with the various procedures for selecting the best strategy. Number "1" indicates the best strategy under each decision making criterion. For example, with Mean Only alternative procedure, the marketing strategy M1 is the best, with SERF and risk averse the marketing strategy M7 is the best.

Conclusions

In conclusion, local farmers' market produce prices and marketing costs, combined with historical yield data, were used in a simulation model to compare mean profit and variation in profit between wholesale and farmers' market marketing channels. Eleven options were chosen based upon varying levels of involvement in each channel. Simulation results were used to produce a probability distribution function and descriptive statistics that provide basic information about the expected consequences of each option. The results were then analyzed using SERF methods and ARAC coefficients, to rank each option based on a producer attitudes towards risk.

The results find that M7 (marketing 40% of output through farmers' markets and 60% through wholesale channels) is the most attractive option for risk averse producers as it was consistent in mean expected profit, minimum, and variation in profit. Marketing strictly to farmers' markets, or M1, was the most attractive option for risk neutral producers as it had the highest possible return and highest mean return, but also high variability. Marketing strictly wholesale was consistently a poor choice as it had the lowest mean, but it should be noted that it ranked third in variability. The results are consistent with previous studies, such as Gunter et al. (2012) who found exclusively marketing wholesale was unprofitable for small producers. The results also suggest a mixed marketing strategy is the optimal choice, as in Hardesty and Leff (2010).

Although the analysis recommended strategy M7 for risk averse producers, small-scale producers may still prefer a more risk neutral strategy, or marketing a larger percentage through farmers' markets. This outcome likely due to past experience marketing through direct markets and/or the lack of importance of farming income due to off-farm employment. Current strategies show smaller scale producers (5 acres or less) in the region marketing approximately 80% of their produce through direct markets and the remaining 20% to restaurants (Curtis et al. 2012). Larger producers (70-100 acres) currently use a 50/50 direct/wholesale approach (Olsen and Curtis 2012).

Risk neutral producers selling primarily through direct markets should determine the feasibility of completing the number of transactions at their expected dollar value required to reach profit goals. Risk averse producers should consider the likelihood and time involved in establishing contracts, as well as managing supplies to meet both market requirements. Hardesty and Leff (2010) recommend using farmers' markets as a tool to make contacts with potential wholesale buyers, as well as establish positive recognition with end consumers to help create demand for their product.

Further studies in pricing, optimal mix of produce offered, and level of sales from farmers' markets can better inform producers. As direct marketing becomes more popular in the U.S. and attractive to small-scale producers, the level of involvement in farmers' markets and wholesale marketing channels represents a significant decision for producers. This study frames the marketing decision using a risk management perspective by quantifying and combining market and production realities specific to the Intermountain West. The results allow producers to directly compare potential marketing strategies and then consider the needs of their operation.

References

- Anderson, J.R. and J.L. Dillon. 1992. *Risk analysis in dryland farming systems*. Rome, Italy: Food and Agriculture Organization of the United Nations Farming Systems Management Series No. 2.
- Bishop, C., K.R. Curtis, and M. Kim. 2010. Conserving water in arid regions: exploring the economic feasibility of alternative crops. *Agricultural Systems* 103 (8): 535-542.
- Bond, J.K., D. Thilmany, and C. Bond. 2009. What influences consumer choice of fresh produce purchase location? *Journal of Agricultural and Applied Economics* 41 (1): 61-74.

- Carlson, H.L., K.M. Klonsky, and P. Livingston. 2008. *Sample costs to produce potatoes fresh market: Klamath Basin in the Intermountain region*. A.E. Ext. University of California, Davis, PO-IR-08-1.
- Clark, J.L., R.N. Weldon, C.M. Adams, and F.F. Wirth. 2010. Risk assessment of a shrimp aquaculture investment in Florida. *Aquaculture Economics and Management* 14 (4): 332-357
- Conner, D.S., K.B. Waldman, A.D. Montri, M.W. Hamm, and J.A. Biernbaum. 2011. Hoophouse contributions to economic viability: nine Michigan case studies. *HortTechnology* 20 (5): 877-884.
- Curtis, K.R., I. Yeager, B. Black, and D. Drost. 2012. Potential benefits of extended season sales through direct markets. *Journal of Food Distribution Research* 43 (1): 133.
- Curtis, K.R., M.W. Cowee, M-K. Kim, and T.R. Harris. 2010. Incorporating risk into quality characteristic evaluation: a cold season grass production example. *Journal of Agribusiness* 28 (1): 1-18
- Dimitri, C. and C. Greene. 2002. *Recent growth patterns in the US organic foods market*. Agriculture Information Bulletin No AIB-777, Economic Research Service/USDA.
- Donnell, J., J.T. Biermacher, and S. Upson. 2011. Economic potential of using high tunnel hoop houses to produce fruits and vegetables. Paper presented at Southern Agricultural Economic Association (SAEA) Annual Meeting, Corpus Christi, TX, February.
- Evans, G.K. and J.I. Stallmann. 2006. SAFESIM: the small area fiscal estimation simulator. In *Community policy analysis modeling*, edited by Johnson, T.G., D.M., Otto, and S.C. Deller, 167-180. Blackwell Publishing, Ames, Iowa.
- Gifford, K. and J. Bernard. 2004. The impact of message framing on organic food purchase likelihood. *Journal of Food Distribution Research* 35 (3): 19-28.
- Govindasamy, R., J. Italia, M. Zurbruggen, and F. Hossain. 2003. Producer satisfaction with returns from farmers market related activity. *American Journal of Alternative Agriculture* 18 (2): 80-86.
- Gunter, A., D. Thilmany, and M. Sullins. 2012. What is the new version of scale efficient: a values-based supply chain approach. *Journal of Food Distribution Research* 43 (1): 27-34.
- Hardaker, J.B. 2000. Some issues in dealing with risk in agriculture. Working paper, Graduate Department of Agricultural and Resource Economics, University of New England.
- Hardaker, J. B., R.B.M. Huirne, J.R. Anderson, and G. Lien. 2004. *Coping with risk in agriculture*. Wallingford, Oxfordshire, UK: CABI Publishing.

- Hardesty, S. and P. Leff. 2010. Determining marketing costs and returns in alternative marketing channels. *Renewable Agriculture and Food Systems* 25 (1): 24-34.
- Harwood, J., R. Heifner, K. Coble, J. Perry, and A. Somwaru. 1999. *Managing risk in farming: concepts, research and analysis*, Agricultural Economic Report No. 774, Market and Trade Economics Division and Resource Economics Division, Economic Research Service, U.S. Department of Agriculture.
- Halter, A.N. and R. Mason. 1978. Utility measurement for those who need to know. *Western Journal of Agricultural Economics* 3 (2): 99-110.
- Hand, M. 2010. Local food supply chains uses diverse business models to satisfy demands. *Amber Waves* 8 (4): 18-23.
- Holton, G.A. 2004. Defining risk. *Financial Analysts Journal* 60 (6): 19-25.
- Kambara, K. and C. Shelley. 2002. *The California agricultural direct marketing study*, USDA-AMS and California Institute of Rural Studies, Davis, CA
- Kebede, E. and J. Gan. 1999. The economic potential of vegetable production for limited resource farmers in south central Alabama. *Journal of Agribusiness* 17 (1): 63-75.
- LeRoux, M., D. Streeter, M. Roth, and T. Schmit. 2010. Evaluating marketing channel options for small-scale fruit and vegetable producers. *Renewable Agriculture and Food Systems* 25 (1): 16-23.
- Lev, L. and L. Gwin. 2010. Filling in the gaps: eight things to recognize about farm-direct marketing. *Choices* 25 (1).
- Lin, W., G.W. Dean, and C.V. Moore. 1974. An empirical test of utility vs. profit maximization in agricultural productions. *American Journal of Agricultural Economics* 56 (3): 497-508.
- Loureiro, M.L. and S. Hine, 2002. Discovering niche markets: a comparison of consumer willingness to pay for local (Colorado Grown), organic, and GMO-free products. *Journal of Agricultural and Applied Economics* 34 (3): 477-487.
- Low, S.A. and S. Vogel. 2011. *Direct and intermediated marketing of local foods in the united states*. Economic Research Report No ERR-128, Economic Research Service, U.S. Department of Agriculture.
- Martinez, S., M.S. Hand, M. Da Pra, S. Pollack, K. Ralston, T. Smith, S. Vogel, S. Clark, L. Tauer, L. Lohr, S.A. Low, and C. Newman. 2010. *Local food systems: concepts, impacts, and issues*. Economic Research Report No ERR-97, Economic Research Service, U.S. Department of Agriculture.

- Mayberry, K. 2000. *Sample cost to establish and produce bell peppers – Imperial County 2000*. A.E. Ext. University of California Cooperative Extension and Imperial County Circular 104-V, University of California, Davis, <http://coststudies.ucdavis.edu/files/bellpeppers.pdf> [accessed June 7, 2012].
- McCarl, B.A. and D.A. Bessler. 1989. Estimating an upper bound on the Pratt risk aversion coefficient when the utility function is unknown. *Australian Journal of Agricultural Economics* 33 (1): 56-63.
- Meyer, J. 1977. Choice among distributions. *Journal of Economic Theory* 14: 326-336.
- Molinar, R.H., M. Yang, K.M. Klonsky, and R.L. De Moura. 2005. *Sample costs to produce summer squash*, U.C. Small Farm Program, University of California Cooperative Extension. <http://sfp.ucdavis.edu/crops/coststudieshtml/BpSquashSummerSJV20042/> [accessed June 7, 2012].
- Olsen, S. and K. Curtis. 2012. Wasatch front mixed vegetable production costs and returns, 2012. Utah State University Fact Sheet, Applied Economics/2012-13pr. http://extension.usu.edu/files/publications/publication/AppliedEconomics_2012-13pr.pdf [accessed May 15, 2014].
- Park, T. and L. Lohr. 2006. Choices of marketing channels by organic producers: accounting for selectivity effects. *Journal of Agricultural and Food Industrial Organization* 4 (1): 1-26.
- Ragland, E. and D. Tropp. 2009. *USDA national farmers market manager survey 2006*. Agricultural Marketing Service, U.S. Department of Agriculture. <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5077203> [accessed June 15, 2012].
- Rayburn, E. 2012. *Enterprise budgets*. West Virginia University Extension Service. <http://www.caf.wvu.edu/~forage/enterprise/enterprise.htm> [accessed July 12, 2012].
- Richardson, J.W., B.K. Herbst, J.L. Outlaw, and R. Chope Gill II. 2007a. Including risk in economic feasibility analyses: the case of ethanol production in Texas. *Journal of Agribusiness* 25 (2): 115-132.
- Richardson, J.W., J.L. Lemmer, and J.L. Outlaw. 2007b. Bio-ethanol production from wheat in the winter rainfall region of South Africa: a quantitative risk analysis. *International Food and Agribusiness Management Review* 10 (2): 181-204.
- Richardson, J.W. 2006. *Simulation for applied risk management*. Unnumbered Staff Report, Department of Agricultural Economics, Agricultural and Food Policy Center, Texas A&M University, College Station, Texas.

- Richardson, J.W., S.L. Klose, and A.W. Gray. 2000. An applied procedure for estimating and simulating multivariate empirical (MVE) probability distributions in farm-level risk assessment and policy analysis. *Journal of Agricultural and Applied Economics* 32 (2): 299-315.
- Rutgers University. 2008. *Conventional production practices: table 28: costs and returns for cucumber, per acre*, Crop Rotational Budgets, A.E. Ext. Rutgers New Jersey Agricultural Experiment Station. <http://aesop.rutgers.edu/~farmmgmt/net/budgets/conv/cucumbers.html> [accessed June 15, 2012].
- Stoddard, C.S., M. Lestrangle, B. Agerter, K.M. Klonsky, and R.L. De Moura. 2007. *Sample costs to produce fresh market tomatoes – San Joaquin valley*. A.E. Ext. TM-SJ-07, University of California Cooperative Extension. <http://coststudies.ucdavis.edu/files/tomatofrmktsj07.pdf> [accessed June 1, 2012].
- Stevens-Garmon, J., C.L. Huang, and B. Lin. 2007. Organic demand: a profile of consumers in fresh produce market. *Choices: The Magazine of Food, Farm, and Resource Issues*, <http://www.choicesmagazine.org/2007-2/grabbag/2007-2-05.htm> [accessed August 29, 2013].
- U.S. Department of Agriculture (USDA). 2014. National count of farmers market directory listing graph: 1994-2013. <http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateS&navID=WholesaleandFarmersMarkets&leftNav=WholesaleandFarmersMarkets&page=WFMFarmersMarketGrowth&description=Farmers%20Market%20Growth&acct=frmrdirmt> [Accessed May 15, 2014].
- Varian, H.R. 1992. *Microeconomic analysis*. Third Edition, Norton, New York.
- Ward, R., D. Drost, and A. Whyte. 2011. Assessing profitability of selected specialty crops Grown in high tunnels.” *Journal of Agribusiness* 29: 41-58.
- Watkins, K.B., J.L. Hill, and M.M. Anders. 2008. An economic risk analysis of no-till management and rental arrangement in Arkansas rice production. *Journal of Soil and Water Conservation* 63 (4): 242-250
- Williams, J.R., R.V. Llewelyn, D.L. Pendell, A. Schlegel, and T. Dumler. 2010. A risk analysis of converting conservation reserve program acres to a wheat-sorghum-fallow rotation. *Agronomy Journal* 102 (2): 612-622.
- Zepeda, L. and C. Leviten-Reid. 2004. Consumers’ views on local food. *Journal of Food Distribution Research* 35 (3): 1-6.



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Happy Growers! Relationship Quality in the German Organic Apple Chain

Katrin Zander^{①a} and Philip Beske^b

^aSenior Researcher, Thünen-Institute of Market Analysis, Bundesallee 50, D-38116 Braunschweig, Germany

^bAssistant Professor, University of Kassel, Department of International Management, Steinstrasse 19, D-27213 Witzenhausen, Germany

Abstract

Relational factors between supply chain actors have been acknowledged to contribute significantly to competitiveness. With the example of the German market for organic apples the suitability of the concept of the Relational View for explaining competitiveness was investigated. Structured interviews were conducted with selected actors of the supply chain. Actors at all levels of the supply chain proved to be highly committed and described their business relations as satisfying and trustful. Strong vertical and horizontal collaboration was found. Thus, the Relational View proved to be highly suitable to explain competitiveness in the market for organic apples.

Keywords: Supply chain management, organic food and farming, competitive advantage, relational view.

^①Corresponding author: Tel: + 49.531.5965325

Email: K. Zander: katrin.zander@ti.bund.de

Introduction

The success of actors in markets is known to depend on various factors, such as the relation between supply and demand, the market structure (i.e., the number of suppliers and customers and their corresponding market shares), the degree of market transparency, the existence of market barriers and the degree of business integration (e.g. Knieps 2008, Treyer 1996). Earlier research emphasized technical aspects of markets such as supply and demand quantities or access to physical resources as well as cost relations when analyzing firms' or sectors' competitiveness. The focus has changed and various authors acknowledge the high impact of the quality of relationships within the whole supply chain on the success of market interactions and on competitiveness (Gellynck et al. 2011, Hunt and Arnett 2006, Naudé and Buttle 2000). Particularly, relational factors affecting the interaction of actors have been recognized to contribute significantly to competitiveness (e.g. Dyer and Singh 1998, Fischer et al. 2009).

Similar to conventional fruit and vegetable markets, competitiveness on organic markets has increasingly become a question of prices, and in many organic fruit and vegetable markets generally import shares are increasing (Hamm et al. 2010). In contrast to this development, import shares on the German organic apple market are slightly decreasing. In 2006 it was reported to be 52 % (ZMP 2008) but has been declining to 45% by 2008 (ZMP 2009). Reasons explaining this development can be found in improved storage facilities and the strong preference of German consumers for domestic products (ZMP 2008). Apples can be stored almost year round using modern storage technologies. However, this is also the case for other produce such as e.g. carrots, onions and potatoes. For carrots the sales quantities have increased by 22 % between 2007 and 2011 while the acreage used for carrot production increased only by 10% indicating an augmenting import share (AMI 2013). While producer prices remained relatively stable during 2007 and 2012 for products such as carrots, onions and potatoes, producer prices for organic apples increased by about 8% (AMI 2013).

Against this background, the objective of this study is to identify the reasons for the relative high competitiveness of the German organic apple sector. By applying the theoretical concept of the Relational View on the whole organic apple supply chain (Dyer and Singh 1998) the focus is laid on the quality of business relations. We used a qualitative case study approach based on in-depth interviews with various actors of the supply chain.

This article is structured as follows. Section Two discusses relationship quality in the light of the Relational View (RV). Section Three describes the structure of the supply chain of organic apples in Germany. Next, the methodological approach and research design are described. In the fifth section, the results of the study are presented. Topic of the following chapter is the discussion of the results against the background of earlier research. The implications of our results on other product markets and the limitations of our study are outlined in the conclusions.

Business Relations and Relational View

Traditionally, competitive advantage was understood as being mainly a matter of different access to resources. According to the Resource Based View (RBV), companies differ in the endowment with resources which are only imperfectly mobile (Barney, 1991; Spiller et al. 2005; Gold et al.

2010). Competitive advantage arises through the firms' control of these valuable and scarce resources. This perspective has broadened in recent years. The question of competition has shifted from the individual firm level to the supply chain level. Supply chains are characterised by consisting of numerous companies (Lambert and Cooper 2000, Zuh et al. 2008, Fischer et al. 2009) which are 'directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer' (Mentzer et al. 2001:4f).

Dyer and Singh (1998) first proposed to integrate the concept of relationship quality into the analysis of supply chains' competitiveness and called this perspective Relational View (RV) (s. a. Chen and Paulraj 2004). The RV poses that the resources which contribute to a company's competitiveness need not necessarily be controlled by the company itself. Instead, resources can span firm boundaries or can even be embedded in the inter-firm relationships. In consequence, the competitiveness of a firm no longer only relies on its own resources but also on those of its partners. The RV explicitly considers knowledge, information and relationship quality as resources which might be used jointly based on sound inter-organisational communication (Dyer and Singh 1998, Paulraj et al. 2008). Such relationship-specific resources and competences are often developed over a long period and are socially complex. Therefore, they are difficult to imitate and may be the driver of a sustained competitive advantage, e.g. by being an effective market entry barrier. Such a competitive advantage based on relationship quality can be measured in relational rents (Duschek 2004). Crucial factors for realising high relational rents are the existence of relation-specific assets, knowledge-sharing routines, complementary resources and capabilities and effective governance (Dyer and Singh 1998). These 'soft' resources are assumed to have a strong impact on the competitiveness of the whole supply chain (Gold et al. 2010, Teece 2007, Adams and Goldsmith 1999).

As the intensity of relationships grows, so does mutual dependency, and opportunistic behaviour becomes a greater threat to individual partners. This threat can be mitigated by effective self-enforced supply chain governance (Gold et al., 2009). Such self-enforced governance can be divided into two categories. The first is formal self-enforced governance (e.g., in the form of financial or investment needs). The second is informal self-enforced governance, which relates to reputation, goodwill and trust (Dyer and Singh, 1998; Duschek, 2004). The more the partners are able to use (informal) self-enforced governance, the higher the possible relational rent due to low transaction and control costs. At the same time, this form of governance mechanism is especially difficult to imitate.

The ability to gain above normal relational rents is of course dependent on the quality of the relationships. Relationship quality is a complex construct which is based on mutual trust, satisfaction, commitment, coordination, communication, joint problem solving, goal congruence, close personal relationships, joint investments and power and profits (Fischer et al. 2009, Naudé and Buttle 2000: 359, Paulraj et al. 2008, Qin et al. 2008) with close interactions between each other. Consequently, the quality of business relations is often operationalised by the dimensions of trust, satisfaction and commitment (s.a. Diller and Ivens 2004, Lages et al. 2005).

Trust is a multi-dimensional construct which includes contractual, competence and goodwill trust. Contractual trust involves respect for contracts and promises. Competence trust has to do with a firm's confidence in its partners' capabilities, and goodwill trust is related to the

preparedness of the partners to cooperate and 'to do more than expected' (Batt 2003: 67). Trust needs time to develop and thus requires long-term engagement in relationships (Batt 2003, Fritz and Fischer 2007, Gold et al. 2009, Skjoett-Larsen 1999, Wilson and Kennedy 1999) and can be understood as 'an investment in a relationship' (Adams and Goldsmith 1999: 242). Particularly under pronounced information asymmetry and/or uncertainty, trust is of major relevance (Grant and Baden-Fuller 2004; Welpé 2008, Wilson and Kennedy 1999). Both factors are inherent to organic apple production: Information asymmetry is frequently encountered between growers and their customers and uncertainty results from unstable yields which tend to hinder fixed long-term arrangements.

Satisfaction is the degree to which expectations align with reality. It is a cumulative evaluation of past experiences and a prerequisite for the formation of committed business relationships (Batt 2003, Gerlach et al. 2007, Spiller et al. 2005). However, satisfaction is not sufficient to tie business partners in the long-run (Naudé and Buttle 2000), additionally commitment is also a necessary factor in this regard. Commitment includes dedication and faith in common values and joint goals of business partners. Deep insights and willingness to invest into the quality of existing relationships without any immediate benefit characterise commitment. Grant and Baden-Fuller (2004: 62) describe commitment to reach a common goal by pooling resources to be typical for 'strategic alliances'. Such a commitment and close interaction offer firms the opportunity to realise higher benefits compared to conducting business without developing these relationships (Blankenburg Holm et al. 1999). Investments in relationships also create social ties which serve as effective exit barriers (Naudé and Buttle 2000).

Different levels of trust, satisfaction and commitment within business relations result in different forms of cooperation and collaboration (Naudé and Buttle 2000). Both require voluntary close interaction with other enterprises to realise mutual benefits. In contrast to cooperation, which usually is contract- and asset-based (Murphy 2004), collaboration is less formal and more flexible, long-term-oriented and not necessarily defined by written contracts (Weaver 2009). As with cooperation, horizontal and vertical collaboration exist with different intensities. Driving factors in collaboration are joint and mutually compatible goals and advantages which are not achievable individually (Murphy 2005, Vachon and Klassen 2006). Both, cooperation and collaboration have the potential to markedly improve the economic performance and competitiveness of the businesses involved (Abatekassa and Peterson 2011, Hansen and Morrow 2003, Reynolds et al. 2009, Weaver 2009) by reducing costs (Beamon 2008) and uncertainty (Carter and Rogers 2008). Because collaboration is not based on fixed contracts, a much higher degree of trust is needed than for cooperation. At the same time, collaboration builds trust (Gold et al. 2009, Rademakers 2000, Wilson and Kennedy 1999). Vachon and Klassen (2008) call for a collaborative paradigm (also Chen and Paulraj 2004) that fosters inter-organisational learning (Duschek 2004, Knoppen et al. 2010). Collaboration can be understood as an expression and a consequence of high relationship quality and largely determines the relative negotiation power of actors and therefore the competitiveness of enterprises.

The German Market for Organic Apples

Apples are an important product within the German organic fruit industry and account for approximately 23 % of the market for organic fresh fruit (AMI 2013). In addition to German

organic apples, organic apples from other parts of Europe (mainly Italy/South Tyrol and Austria) and from overseas (mainly Argentina, Chile and New Zealand) are traded on the German market. Organic apples produced in Germany are generally pooled by different types of sales organisations, such as producer organisations according to the European Regulation (1234/2007), private traders or marketing cooperatives (Figure 1). These sales organisations usually are responsible for sorting, storage, packaging and marketing. Some of the growers run their own storage and sorting facilities and thus take part in marketing more actively. A smaller share of organic apples is marketed directly to organic food wholesalers or retailers.¹ The sales organisations are then selling the organic apples to organic food wholesalers and organic retailers, as well as to traditional wholesalers and traditional retailers². Traditional wholesalers are of minor relevance in this market, with few exceptions they market organic apples only in years and situations of high supply. In the period from 2008 to 2011, due to high domestic demand, only very small quantities were exported. For this research only distribution channels printed in black are of relevance.

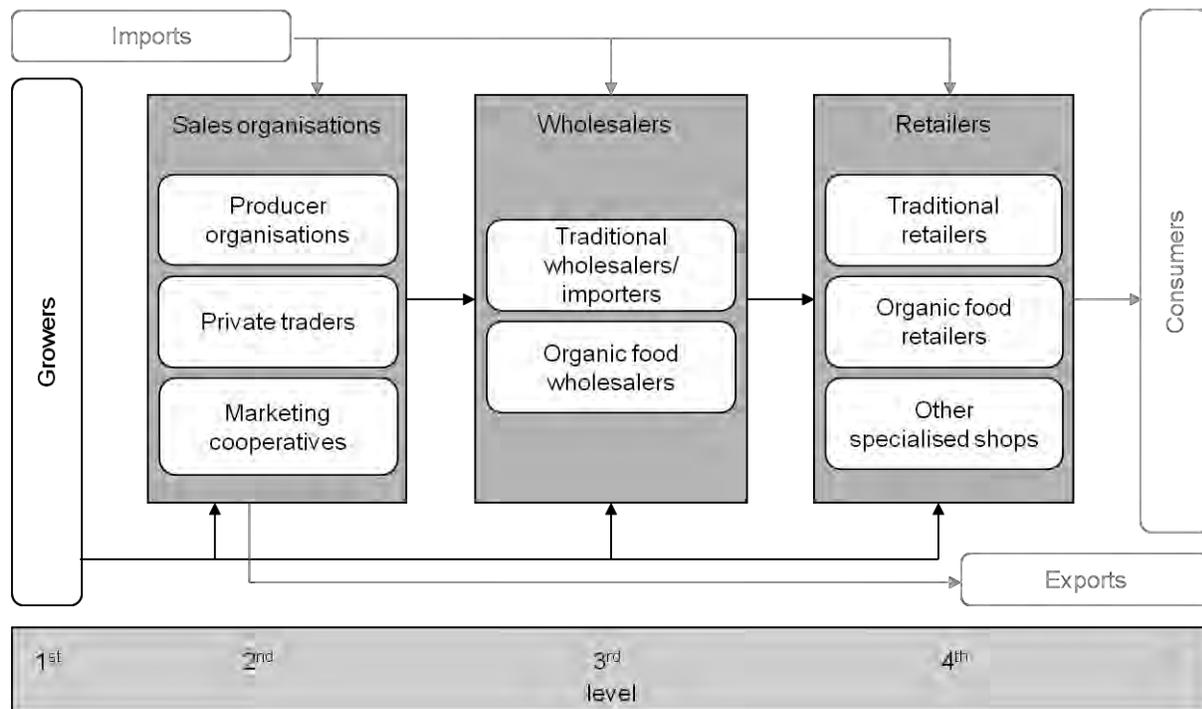


Figure 1. Flow of organic apples in the German market

Source. Own presentation

Apple production in Germany mainly takes place in regional production clusters around Lake Constance, Niederrhein and Niederelbe regions. These regional clusters enable sales

¹ Table apples marketed directly to consumers were not part of this research.

² The term ‘traditional’ in this respect refers to entities which mainly trade conventional food and which have only recently added organic food to their product range.

organizations to bundle large amounts of produce at relatively low transportation costs. Actors may realise economies of scale in storage, sorting and packaging. Thus, traders are able to offer a large variety of different gradings, each in quantities big enough to satisfy the requirements of wholesalers and retailers.

In all regional production clusters, growers (1st level) and sales organisations (2nd level) face various marketing opportunities; they can market to organic and/or traditional wholesalers as well as to retailers. At the third level of the supply chain, wholesalers also have several potential customers. Supply shortages between 2007 and 2010 resulted in demand exceeding supply; a fact that had put suppliers in a rather favourable situation.

Methods and Research Design

Data basis of this research was a qualitative survey among the actors in the German organic apple supply chain. The analyses used a case study approach and concentrated on the supply chain of organic apples intended for table consumption. They excluded direct sales from growers to consumers.

Qualitative research generally does not aim at representativeness. Instead, its strength lays in the identification of ‘salient characteristics’ (Ritchie et al. 2003, 82). This specific objective determines the sample design. A ‘stratified purposive sampling’ identifies rather homogenous groups which vary with regard to particular aspects and takes interviewees out of all groups (Patton 2002, Ritchie et al. 2003). This approach was chosen to show the variation of perceptions at different levels of the supply chain.

Interviews with experts are generally useful during the exploratory phase of research because they can shorten long observation processes or generate theories and/or hypotheses. Experts are seen as representatives of other actors and can provide a quick overview of the central aspects of the research topic under question. Experts are often highly motivated to participate in interviews, particularly when they are interested in the research process themselves (Bogner and Menz 2005).

By means of in-depth telephone interviews, German organic apple growers and wholesalers were asked about their experiences with their suppliers and customers in order to deduce on the relationship quality within this supply chain. The focus of our research was on B2B relations, therefore consumers who in principle are also part of the supply chain, were excluded from this research. This study used a qualitative case study approach in order to explore the organic apple market and its related supply chains. Instead of statistical representativeness thematic representativeness was aimed at.

The perspectives of all levels of the supply chain were taken into account (with the exception of consumers) by interviewing representatives of growers (1st level), sales organisations (2nd level), organic wholesalers (3rd level) and retailers (4th level) (Table 1). In all enterprises, the persons responsible for apple trading were identified and interviewed. The experts were chosen in a two-

step manner: First, lists of all relevant actors at each level (except producers because of lack of availability) were compiled³. Second, potential interview partners were identified. Some participants were proposed by project partners, others were approached personally during a fair, others were just called by phone. Interest in the research topic and willingness to participate of potential interviewees were finally decisive for selection. So, the selection was purposive or criterion based which is typical for qualitative research not aiming at statistical representativeness. According to the concept of theoretical saturation additional interviews become redundant if new interviews no longer render new insights (s.a. Lamnek 2010). This point was reached at all levels. In total, 18 telephone interviews were conducted between March and May 2011, each of which lasted between 45 and 90 minutes. The total number at each level might seem to be low. It should be considered that the interviews at different levels of the supply chain were not independent from each other - repeatedly, information given at the supply side was confirmed by the customer side and vice versa. The number of interviews with retailers was limited by the actors' willingness to participate.

Table 1. Interviewees according to the level within the supply chain

Level	Supply chain actor	Number	Total number
1	Growers	5	n.a.
2	Sales organizations (producer organizations, private traders, marketing cooperatives)	6	9
3	Organic wholesalers	4	~ 20 ¹⁾
4	Retailers	3 ²⁾	~ 20
Total		18	n.a.

n.a. - not available

1 Additionally, there exist some smaller organic wholesalers.

2 Two traditional retailers and one organic retailer.

In order to obtain comparable results between supply chain levels, the interviews were based on a structured questionnaire, which included both closed and open-ended questions. It was adapted to the requirements of different actors in the supply chain. The topics of the questionnaire were supply and distribution, number of business partners, requirements concerning business partners, collaboration behaviour as well as contracting and relationship quality.

For analysing the relationship quality the interviewees were asked to use 'free association' to name those three expressions that best describe their business relations with suppliers and customers. The concept of trust was directly referenced with the question 'Would you describe your relationship with your partner as trustful?' and 'How could it be improved?' Additionally, the interviewees' free associations describing business relations were used to deduct on the degree of trust within the relationships.

The construct satisfaction with suppliers was broken down into the dimensions satisfaction with product prices, with product quality, with varieties and gradings, with supply continuity and

³ Because of close interconnectedness in some cases the exact numbers of all potentially relevant actors within each field is not available.

flexibility and with the general business policies of suppliers. Satisfaction with customers was disaggregated in satisfaction with product price, terms of payment, ordering behaviour, compliance with purchase promises and general business policies of customers. The interviewees indicated their degree of satisfaction on a scale from '1' (very good) to '5' (poor) satisfaction.

In order to draw inferences about the degree of commitment, again some of the freely associated expressions, such as 'personally', 'reliable', 'fair' or 'like in a partnership' were used. Additionally, goal congruence, the duration of business relations and the inclination to change business relations were taken as indicators of the degree of commitment.

The interviews ended with questions about specific activities to realise market adjustments, perceptions regarding the current situation and further perspectives regarding the organic apple market in Germany.

The answers of the interviewees were analysed using 'thematic coding': A technique which builds on the researchers' expertise in the extraction of the information relevant to the research question (Kuckartz 2007).

Results

This section starts with an overview over expressions the interviewees frequently used when asked to characterise their relationships with business partners. In the following, the results on trust, satisfaction and commitment as well as on cooperation and collaboration will be analysed in-depth.

When asked to freely associate relevant terms to describe the relationship with the customers all growers mentioned 'reliability'. Further attributes were 'competence', 'trust', 'friendliness', 'honesty', 'continuity' and 'correctness'. No negative expressions were used. The representatives of the sales organisations spontaneously described the relations with suppliers as 'trustful' with one exception. Other terms frequently used were 'friendly', 'continuous', 'reliable', 'fair', 'like in a partnership' and 'successful'. The relations with customers similarly were specified as being 'trustful', 'fair' and 'honest'. 'Long-term oriented' and 'steady' were other expressions frequently used.

At the wholesalers' level, terms such as 'trustful' and 'personally' mostly were used. Other expressions were 'continuous', 'engaging', 'reliable' and 'successful' regarding suppliers. With respect to customers again terms such as 'trustful', 'personal' and 'fair' were employed. At this level some difficulties were also mentioned by several interviewees: customers were sometimes judged to be 'independent', 'increasingly difficult' and 'unstable'. In contrast, retailers described the relation with their suppliers with terms such as 'reliable', 'fair', 'trustful', 'steady', and 'secure' but also with 'market oriented in a positive sense'.

Trust, Satisfaction and Commitment

This subsection answers the question on trust, satisfaction and commitment within the supply chain, by analysing different closed and open questions. Almost all interviewees described the

relationship with their suppliers as being trustful. Consistently, the question ‘Would you characterise the relationship with your suppliers/customers as being trustful?’ was answered by all actors with ‘yes’. When asked how to improve the relationship, most of the interviewees stated that they could not think of any improvement. Others stated ‘you could always improve something’ without giving any specific information in which respect they would expect this improvement. There was no difference between various levels of the supply chain. And, although some of the wholesalers described the relationship with their customers as becoming more difficult, they did not go so far as to classify the relationship not to be trustful.

The concept of satisfaction was divided into several aspects with regard to customers and suppliers (see Section 4). Satisfaction with customers generally was high regarding all specific aspects and at all levels of the organic apple supply chain (Table 2). Although the presentation of average scores might be unusual in qualitative research with a very small number of observations, the numbers help to understand relative assessments of different aspects. Additionally, deviations in the answers were low, e. g. the lowest score for price satisfaction was ‘3’ and the highest ‘1.5’. Satisfaction with ordering behaviour scored least at all levels of the supply chain. It was described as sometimes being too short-term. Interestingly, the satisfaction with product prices was on average ‘good’, there was only one grower who stated his satisfaction to lay somewhere in the centre of the 5-point Likert scale. All other interviewees were generally satisfied. Repeatedly, satisfaction was lower with regard to business partners from the traditional (non-organic) sector: This referred to the business policy and the ease of negotiations and fairness.

The interviewed actors majorly were quite satisfied with their customers’ compliance with purchase promises. This is notable because there are mostly no written contracts on quantities. Also growers were quite satisfied with their customers’ compliance with purchase promises, although they were identified to be the ones bearing the risk - according to this inquiry. Obviously, growers can trust in that their customers take all their produce at satisfying prices. They are able to rely on their experiences from previous years, so that they face rather high security in decision making on production and investment.

Table 2. Average satisfaction with customers at different levels of the supply chain¹⁾

	1st level	2nd level	3rd level
	Growers	Sales organizations	Wholesalers
	N = 5	N = 6	N = 4
Product prices	2.1	2.1	1.8
Terms of payment	1.9	2.2	2.0
Ordering behavior	2.7	2.5	2.5
Purchase promises	1.5	2.3	2.0
Business policy of customer	2.0	2.2	2.3

1 Numbers indicate the degree of satisfaction measured on a scale from 1 to 5, with ‘1’ ‘very good’ and ‘5’ ‘poor’ satisfaction.

2 Average scores need to be interpreted with caution due to low number of observations.

Regarding the **satisfaction with suppliers** different indicators were used as well (Table 3). The answers of the interviewees show that also satisfaction with suppliers was generally good and almost all ratings were in the range of ‘good’ satisfaction. Satisfaction with product prices was not asked for at sales organisations since prices are usually set by the customer and not by suppliers/growers. Particularly retailers but also wholesalers seemed to be very satisfied with supply continuity. Supply flexibility was rated worse by sales organisations, a fact which is due to the very nature of some of the sales organisations (i.e. producer organisations) who need to accept and to market all quantities produced by their associated growers. Wholesalers were less satisfied with the range of varieties and gradings offered.

Table 3. Average satisfaction with suppliers at different levels of the supply chain ¹⁾

	2 nd level Sales organizations N = 6	3 rd level Wholesalers N = 4	4 th level Retailers N = 3
Product prices	---	1.7	2
Product quality	1.8	1.8	1.7
Varieties and gradings	1.8	2.7	1.7
Supply continuity	1.9	1.3	1.0
Supply flexibility	2.1	1.5	1.7
Business policy of supplier	1.8	1.8	1.7

1 Numbers indicate the degree of satisfaction measured on a scale from 1 to 5, with ‘1’ ‘very good’ and ‘5’ ‘poor’ satisfaction.

2 Average scores need to be interpreted with caution due to low number of observations. .

Three indicators were used to capture the degree of **commitment**: the existence of joint business goals (goal congruence), the inclination to change business partners and the duration of business relations. The latter are closely related to each other. Additionally, the expressions the respondents had freely associated with their business relations were utilised to infer on commitment.

Most of the interviewees reported far-reaching goal congruence. The joint goals of growers and sales organisations were as follows: the provision of high quality products, increase of turnover, joint development and sustainable and reliable business relations. Common goals at the subsequent levels of the supply chain varied only slightly. For some of the organic actors ‘fostering the concept of organic food’ was also an important issue. At all levels, long-lasting business relations exist. These relations were mostly initiated at the beginning of producing or marketing organic apples. Close relationships exist between growers and ‘their’ sales organisations; indeed, quite a few of the sales organisations, i.e. private traders are spin-offs of first-generation organic apple growers. These sales organisations are still closely connected with the growers on a personal level.

Changes of business partners only occur when additional partners are acquired for the purpose of augmenting marketed quantities or to amplify the range of products offered. Interviewees had difficulties to answer the question on alternative suppliers or customers. Although alternatives

were theoretically available, none of the interviewed actors could think of any advantages of replacing his current business partners. Establishing new business relations and developing them until being comparable with previous ones would require significant effort and time. Business relations were described as 'personal', 'friendly', 'amicable', 'cooperative', a fact that proves a high degree of personal commitment at all levels of the supply chain.

These long-lasting business relations and limited supply were the reasons why traditional retailers have had difficulties in listing German organic apples. They entered the market for organic food only around 2000, when most domestic business relationships had already been established. Particularly in cases of supply shortage these actors have difficulties sourcing domestic apples.

Collaboration and Cooperation

Collaboration and cooperation were described to be an outcome of business relations of high quality with high degrees of satisfaction, trust and commitment (Naudé and Buttle 2000). Thus, the intensity of collaboration or cooperation within the supply chain may serve as another indicator for the quality of business relations.

According to the outcome of the interviews, stakeholders in the German organic apple chain intensively collaborate with their colleagues and business partners. Collaboration without fixed contracts is notably more common than classical contract- and/or asset-based cooperation. In some cases written contracts exist for general trading agreements. Written or non-written: The specific nature of apple production with high year by year fluctuations does not allow for long-lasting binding agreements on quantities. Instead, suppliers and customers need to rely on their trustful and satisfying relationships. In year by year negotiations on prices all partners are aware of the actual harvest of organic apple quantities and qualities, so that they are communicating on a level playing field.

Horizontal collaboration is wide spread within the supply chain of organic apples. Growers collaborate by exchanging labour force for field work and by jointly using sorting and storage facilities. At the level of sales organisations (producer organisations, private traders and marketing cooperatives) horizontal collaboration includes storage, sorting and distribution also at the interregional level. In case of product shortages, suppliers exchange produce with their competitors to meet their specific customer needs. Various interviewees of the second level stated that they felt responsible for the provision of their customers with varieties and grading they ask for. Organic food wholesalers collaborate horizontally via joint product acquisition to realise better prices and conditions and to improve the availability of information: Some of the organic wholesalers founded joint purchase associations to achieve these aims. The exchange of contacts with growers between wholesalers helps to secure the future supply and supports growers to find markets for all their produce. However, these strategies are not specific to the organic apple market; indeed, they were reported to be similar for most organic fruit and vegetable markets.

Forms of vertical collaboration are extension services for growers by the sales organisations. This is understood as a means of quality management as well as a means of management of

quantities by the traders. Additionally, the sales organisations provide their suppliers with general information on the organic apple market on a regular basis. The representatives of the sales organisations stated that they need to maintain good relationships with their suppliers, since growers may also sell to other organisations. That is why according to the interviewees sales organisations usually also have the financial needs of the growers in mind when negotiating on prices. Responsibility for the economic viability and ability to invest at the growers' side was also acknowledged at the following levels of the supply chain by organic wholesalers and conventional and organic retailers. This reflects not only in the price negotiations but also in the general business behaviour.

Another form of vertical cooperation is the joint planning of the offered varieties by retailers, wholesalers and growers. Production planning in apples is particularly challenging because apples are a perennial crop. In times of surpluses, actors of all levels of the supply chain jointly plan offers for consumers in retail stores.

Vertical and horizontal cooperation also takes place within the 'European Forum of Organic Fruit' (EBF). The EBF is a union of large European fruit growers (first level) and sales organisations (second level) and is organised as a registered association. They meet regularly and exchange information on production, storage and distribution quantities. Experts estimate that the share of European production covered by these numbers is approximately 65 % to 70 %.⁴

Implications for the Management of Food and Agribusiness Firms

According to the Relational View inter-firm relationships are major drivers for competitiveness (Dyer and Singh 1998, Paulraj et al. 2008). The quality of inter-firm relationships depends to a large extent on constructs such as trust, satisfaction and commitment (Fischer et al. 2009, Naudé and Buttle 2000: 359, Paulraj et al. 2008, Qin et al. 2008). The practical relevance of this concept was demonstrated using the case of the German organic apple sector. High degrees of trust and of satisfaction with business relations as well as high commitment were found at all levels of the supply chain. These specific properties of inter-firm relationships result in far-reaching collaboration activities, horizontally as well as vertically. Typical for the organic apple supply chain is collaboration without written contracts. Fischer et al. (2009) reported on the important role of implicit instead of formal, written contracts among small and medium sized enterprises, particularly when quality orientation is a stated object. Indeed, marketing organic apples of high quality was an important aim within the whole supply chain. Collaboration, even with competitors – as being the case in the organic apple chain - requires a high level of knowledge, information sharing and mutual trust. Our findings thus may serve as evidence for the relevance of the 'collaborative paradigm' (Chen and Paulraj 2004, Qin et al. 2008) which identifies 'strategic collaboration as a crucial source for competitive advantage' (Gold et al. 2010: 239). These authors observed strategic collaboration to be even more important in supply chains which include environmental or social aims (Gold et al. 2010).

⁴ Personal communication Peter Rolker, Vice President of EBF and Dr. Egon Treyer, Marktgemeinschaft Bodenseeobst.

Horizontal collaboration at the levels of growers and of sales organisations in form of mutual exchange of produce in case of shortages brings forward customer loyalty with their suppliers. Customers stated to clearly prefer to rely on 'old' suppliers instead of looking for new ones. Typical for the underlying philosophy were statements which referred to the organic apple chain to be a small family, without lone fighters. Networking was perceived to be important and the actors felt like 'sitting in the same boat'. This phenomenon of strong loyalty was referred to as an efficient form of self-enforced governance (Duschek 2004, Dyer and Singh 1998).

Organic apple production takes place in strong regional production clusters. Advantages of proximity refer to the physical dimension of short transportation distances but also to the personal dimension. They may facilitate information flow and market transparency. Close personal relationships and social networks among different stakeholders and high market transparency were found in the organic apple production clusters. This fosters horizontal and vertical collaboration. Although Gereffi et al. (2005) argue that high relationship quality may also exist and work well in spatially dispersed contexts this research follows Dyer and Singh (1998) who identified this proximity to be a supporting factor for high-quality relationships.

Our results also proved the relevance of personal relationships between business partners for building trust which has been found earlier by (Batt 2003, Fischer et al. 2009). Personal relationships are particularly strong between some of the growers and 'their' private sales organisations (second level) which are spin-offs of first-generation organic apple growers. Close personal relationships imply that many transactions are not market- and commodity-based; rather, they rely on long-term bonds. Such de-commoditisation is exactly what the RV calls for a source of advantage over the usual market-oriented business models (Dyer and Singh 1998).

The relevance of long-term relationships was highly stressed by our interview partners. They result in a very low propensity to replace one trading partner with another. The importance of long-term relationships for the retention of high market shares and for the expectation of high returns was stressed earlier by Batt (2003). The relevance of long-term relationships may be increased by the peculiarities of the perennial crop apples. On the one hand growers cannot easily switch to another crop in case of unfavourable market conditions and on the other hand customers would not be able to replace produce in the short-run. Since supply is short and setting-up of new plantations need time and specific know-how. Thus, business partners are mutually dependent and benefit from long lasting decisions.

These strong and binding structures build an efficient market barrier for new actors, particularly for traditional wholesalers and retailers. They only have access to German organic apples in case of noticeable over-supply. This phenomenon was referred to theoretically by various authors (s.a. Williamson 1985, Dyer and Singh 1998, Gold et al. 2010). It is particularly the described type of asset specific, human relationships in the organic apple chain which forms an effective barrier against new competitors seeking to access the market (Porter 2008) and which may create an important competitive advantage (e.g. Dyer and Singh 1998, Qin et al. 2008). Nevertheless, it has to be considered that demand in most years exceeds supply so that organic apple growers generally are in a rather favourable position.

Market transparency proved to be an important factor within the organic apple chain. It was perceived to be high at all levels of the supply chain. In this respect the 'European Forum of Organic Fruit' is of high relevance. Such transparency and information sharing is known to be a decisive determinant of competitiveness and is integral to the RV (Dyer and Singh 1998).

Conclusions

Business relations between actors in the supply chain for organic apples generally are of high quality. These relationships are characterised by a high degree of satisfaction and trust and by high commitment. All of these factors are of great importance from the RV. The actors in question share the goal of providing the German market with high-quality organic apples from local or domestic production at prices that ensure economic sustainability for all partners. Regional production clusters foster the bundling of produce and enhance information flow. They also help to create integrated networks of growers, independent of membership in different organic farmers' organisations.

There is evidence of the four factors that are essential in generating high relational rents: relationship-specific assets, knowledge-sharing routines, complementary resources and capabilities, and effective governance (Dyer and Singh 1998). The combination of these factors yields pronounced collaborative activity, both horizontally and vertically. Thus, our case study research fully supports the empirical relevance of the relationship quality for competitiveness and confirms the assumptions of the Relational View.

Within the supply chain of organic apples growers are mostly satisfied with the level and the only slightly varying product prices they receive. This stability allows growers to invest in production and storage technology, which helps to reduce annual fluctuations in production and improve product quality. Thus, growers can fulfil customer requirements regarding the quality and availability of local or domestic apples. Wholesalers and retailers thus have reliable business partners on the production side.

It can be assumed that the intense horizontal and vertical collaboration as well as market transparency in the supply chain for organic apples significantly limits the price wars that commonly disfavour (also organic) producers. The high willingness to collaborate, also among growers, is supposed to be fostered by the specific characteristic of apples as a permanent crop, which requires high investments and specific knowledge.

However, the success of the organic apple supply chain is not exclusively due to high relationship quality. Part of this success is caused by the nature of apple cultivation. Apples are a permanent crop that requires specific production technology and know-how, which generates path dependencies. This dynamic enhances willingness to collaborate and increases the commitment of growers. Furthermore, apples can be stored relatively easily and thus are available (almost) year round. Apples are also particularly well-perceived by consumers because they have a long tradition of consumption. A pronounced preference for local and domestic produce exists and at least some consumers have a good knowledge of apple varieties. The term 'Kulturgut' (cultural good) may help to better understand the particular relationship between consumers and the apple.

Due to these specific attributes of the product apple, the results of this research are not generalizable to all other product markets. However, there is evidence of the central relevance of high relationship quality and trustful collaboration between growers and traders. The provision of high quality German produce for the German market rather than the realisation of individual goals should become joint objectives of German growers and wholesalers in other product markets, too. Quality and taste, rather than price considerations, must be the focus of production and trade. Domestic growers competing with foreign producers may find that providing specific varieties which are particularly suitable to the taste of German consumers will ease the task of product differentiation.

The research regarding relationship quality was based on in-depth interviews with actors in the supply chain, who participated as experts in the research. The relatively low number of 18 interviews (which is typical for qualitative research) may question sector-specific and overall validity of the results. According to the concept of theoretical saturation, the share of repetition in the opinions of the stakeholders increased with the number of interviews and was high with the last interviews conducted. Therefore, the major issues concerning the organic apple industry are supposed to be covered by this research. The number of only three interviewed retailers is low. The reason for this low number was limited willingness to participate. However, this weakness does not question the general reliability of our results: the impact of retailers at the very end of the supply chain (consumers were excluded from this research) must be assumed to be rather similar in all product markets. Retailers thus may have only small impact on the peculiarities of the organic apple market.

The analysis presented here aimed at B2B relations. It therefore did not consider the views of consumers, although consumers are part of the complete supply chain. Because retailers are expected to react according to consumer requirements, our results may also indirectly reflect the point of view of consumers. Nevertheless, future research should also consider consumer perspectives.

This research demonstrated in which way high quality relationships may impact on a sector's competitiveness. Future research should consider comparative studies on relationship quality in different markets, e.g. the organic and conventional apple market or between different organic product markets to investigate and to prove if the relationship quality really differs between sectors.

Acknowledgements

The authors greatly appreciate the helpful comments of two anonymous reviewers. We would also like to thank Professor Ulrich Hamm for his support and comments on an earlier version of this manuscript, as well as the University of Kassel for hosting this research. We gratefully acknowledge the financial support for this research provided by the German Bundesanstalt für Landwirtschaft und Ernährung (BÖLN Project number 08OE110).

References

- Abatekassa, G. and C.H. Peterson. 2011. Market access for local food through the conventional food supply chain. *International Food and Agribusiness Management Review* 14(1): 41-60.
- Adams, C.L. and P.D. Goldsmith. 1999. Conditions for successful strategic alliances in the food industry. *International Food and Agribusiness Management Review* 2(2): 221-248.
- AMI (Agrarmarkt Informations-Gesellschaft). 2011. *Marktbilanz Öko-Landbau 2011*. Bonn.
- AMI (Agrarmarkt Informations-Gesellschaft). 2013. *Marktbilanz Öko-Landbau 2013*. Bonn.
- Barney, J.B. 1991. Firm resources and sustained competitive advantage. *Journal of Management* 17: 99-120.
- Batt, P.J. 2003. Building trust between growers and market agents. *Supply Chain Management: An International Journal* 8(1): 65-78.
- Beamon, B.M. 2008. Sustainability and the future of supply chain management. *Operations and Supply Chain Management* 1(1): 4-18.
- Blankenburg Holm, D., E. Erikson, K. and J. Johanson. 1999. Creating value through mutual commitment to business network relationships. *Strategic Management Journal* 20(5): 467-486.
- Bogner, A. and W. Menz. 2005. Expertenwissen und Forschungspraxis: die modernisierungstheoretische und die methodische Debatte um die Experten. Zur Einführung in ein unübersichtliches Problemfeld. In *Das Experteninterview*, edited by A. Bogner, B. Littig, B. and W. Menz, 7-30. Wiesbaden.
- Carter, C.R. and D.S. Rogers. 2008. A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution & Logistics Management* 38(5): 360-387.
- Chen, I.J. and A. Paulraj. 2004. Towards a theory of supply chain management: the constructs and measurements. *Journal of Operations Management* 22(2): 119-150.
- Diller, H. and B.S. Ivens. 2004. Beziehungsstile im Business-to-Business-Geschäft. *Zeitschrift für Betriebswirtschaft* 74(3): 249-271.
- Duschek, S., 2004. Inter-firm resources and sustained competitive advantage. *Management Review* 15: 53-73.
- Dyer, J.H. and H. Singh. 1998. The relational view: cooperative strategy and sources of interorganizational advantage. *Academy of Management Review* 23: 660-679.

- Fischer, C., M. Hartmann, N. Reynolds, P. Leat, C. Revoredo-Giha, M. Henchion, L.M. Albisu and A. Gracia. 2009. Factors influencing contractual choice and sustainable relationships in European agri-food chains. *European Review of Agricultural Economics* 36(4): 541-569.
- Fritz, M. and C. Fischer. 2007. The role of trust in European food chains: theory and empirical findings. *International Food and Agribusiness Management Review* 19(2): 141-164.
- Gellynck, X., B. Kühne and R.D. Weaver. 2011. Relationship quality and innovation capacity of chains: the case of the traditional food sector in the EU. *International Journal of Food System Dynamics* 2(1): 1-22.
- Gereffi, G., J. Humphrey and T. Sturgeon. 2005. The governance of global value chains. *Review of International Political Economy* 12(1): 78-104.
- Gerlach, S., A. Spiller and C. Wocken. 2007. Supplier relationship management in the German dairy industry. In *Quality management in food chains*, edited by L. Theuvsen, A. Spiller, M. Peupert and G. Jahn. 449-462. Wageningen.
- Gold, S., S. Seuring, and P. Beske. 2010. Sustainable supply chain management and inter-organizational resources: a literature review. *Corporate Social Responsibility and Environmental Management* 17(4): 230-245.
- Grant, R.M. and C. Baden-Fuller. 2004. A knowledge accessing theory of strategic alliances. *Journal of Management Studies* 41(1): 61-84.
- Hamm, U., F. Buder, M. Janssen, S. Pläßmann and K. Zander. 2010. Bio-Marktentwicklung in Deutschland – Differenzierung im deutschen Bio-Markt unter besonderer Berücksichtigung des Bioland-Warenzeichens. Presented at Bioland-Fachtagung Baden-Württemberg, Zeulenroda, May.
- Hansen, M.H. and J.L. Morrow. 2003. Trust and the decision to outsource: affective response and cognitive processes. *International Food and Agribusiness Review* 6(3): 40-69.
- Hunt, S.D. and D.B. Arnett. 2006. Does marketing success lead to market success? *Journal of Business Research* 59(7): 820-828.
- Knieps, G. 2008. *Wettbewerbsökonomie*. Berlin, Heidelberg.
- Knoppen, D., E. Christiaanse and M. Huysman. 2010. Supply chain relationships: Exploring the linkage between inter-organisational adaptation and learning. *Journal of Purchasing & Supply Management* 16: 195-205.
- Kuckartz, U. 2007. *Einführung in die computergestützte Analyse qualitativer Daten*. Wiesbaden.
- Lages, C., C.R. Lages and L. Lages. 2005. The RELQUAL scale: A measure of relationship quality in export market ventures. *Journal of Business Research* 58: 1040-1048.

- Lambert, D.M. and M.C. Cooper. 2000. Issues in supply chain management. *Industrial Marketing Management* 29(1): 65–83.
- Lamnek, S. 2010. *Qualitative Sozialforschung*. Weinheim, Basel: Beltz.
- Mentzer, J.T., W. DeWitt, J.S. Keebler, S. Min, N.W. Nix, C.D. Smith and Z.G. Zacharia. 2001. Defining supply chain management. *Journal of Business Logistics* 22(2): 1-25.
- Murphy, E. 2004. Recognising and promoting collaboration in an online asynchronous discussion. *British Journal on Education Technology* 35(4): 421-431.
- Naudé, P. and F. Buttle. 2000. Assessing relationship quality. *Industrial Marketing Management* 29: 351-361.
- Patton, M.Q. 2002. *Qualitative research and evaluation methods*. Thousand Oaks: Sage.
- Paulraj, A., A. Lado and I. Chen. 2008. Inter-organizational communication as a relational competency: Antecedents and performance outcomes in collaborative buyer–supplier relationships. *Journal of Operations Management* 26(1): 45-64.
- Porter, M.E. 2008. The five competitive forces that shape strategy. *Harvard Business Review* 1: 23-41.
- Qin S., S. Yong-Tao, L. Zhao and D. Ji-Xiang. 2008. The impact of supply chain relationship quality on cooperative strategy. *Journal of Purchasing and Supply Management* 14(4): 263–272.
- Rademakers, M.F.L. 2000. Agents of trust: business associations in agri-food supply systems. *International Food and Agribusiness Management Review* 3: 139-153.
- Reynolds, N., C. Fischer and M. Hartmann. 2009. Determinants of sustainable business relationships in selected German agri-food chains. *British Food Journal* 111(8): 776-793.
- Ritchie, J., J. Lewis and G. Elam. 2003. Designing and selecting samples. In *Qualitative research practice*, edited by J. Ritchie and J. Lewis, 77-108. London.
- Skjoett-Larsen, T. 1999. Supply chain management: a new challenge for researchers and managers in logistics. *International Journal of Logistics Management* 16(2): 41-53.
- Spiller, A., L. Theuvsen, G. Recke and B. Schulze. 2005. *Sicherstellung der Wertschöpfung in der Schweineerzeugung: Perspektiven des Nordwestdeutschen Modells*. Göttingen.
- Teece, D.J. 2007. Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal* 28(13): 1319–1350.
- Treyer, E. 1996. Marktstrukturpolitik in der Agrar- und Ernährungswirtschaft. Stuttgart.

- Vachon, S. and R.D. Klassen. 2006. Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management* 26(7): 795–821.
- Vachon, S. and R.D. Klassen. 2008. Environmental management and manufacturing performance: The role of collaboration in the supply chain. *International Journal of Production Economics* 111(2): 299–315.
- Weaver, R.D. 2009. Microeconomics of collaboration and network configuration. *British Food Journal* 111(8): 726-761.
- Welpe, I.M. 2008. Die Entstehung von Vertrauen im Kontext von Unsicherheit und Informationsasymmetrie. *Zeitschrift für Betriebswirtschaft* 78(12): 1251-1284.
- Williamson, O.E. 1985. *The economic institutions of capitalism: firms, markets, relational contracting*. Free Press, New York.
- Wilson, P.N. and A.M. Kennedy. 1999. Trustworthiness as an economic asset. *International Food and Agribusiness Management Review* 2(2): 179-193.
- Zhu, Q., Sarkis, J. and K. Lai. 2008. Confirmation of a measurement model for green supply chain management practices implementation. *International Journal of Production Economics* 111(2): 261-273.
- ZMP (Zentrale Markt- und Preisberichtsstelle). 2008. *Ökomarkt Jahrbuch 2008*. Bonn.
- ZMP (Zentrale Markt- und Preisberichtsstelle). 2009. *Ökomarkt Jahrbuch 2009*. Bonn.



International Food and Agribusiness Management Review
Volume 17 Issue 3, 2014

Using Event Sponsorship to Cross the Chasm between Consumer Perceptions of Agriculture and On-farm Realities

Industry Speaks

Catherine Keogh^a and Aidan J. Connolly^b

^a *Vice President and Chief Marketing Officer, Alltech, Nicholasville, Kentucky, USA*

^b *Vice President Corporate Accounts, Alltech, Nicholasville, Kentucky, USA*
and Adjunct Associate Professor of Marketing, UCD Michael Smurfit Graduate Business School, Dublin, Ireland

Abstract

Terms such as ‘genetically modified organisms’ and ‘growth promoting antibiotics’ continue to surface in media, leaving consumers struggling to trust agriculture. On the other side of the story, farmers want to share how the agricultural landscape has changed in the last 50 years. For Alltech - a B2B biotechnology agribusiness firm- both perspectives needed to be heard and addressed.

Knowing how the 2010 World Equestrian Games had brought these audiences together, Alltech desired to facilitate a genuine connection between both farmers and consumers by sponsoring the 2014 Games in Normandy, France. This article describes how Alltech used this sponsorship to open dialogue about the current state of agriculture and where the industry is heading.

Keywords: Corporate sponsorship, agriculture, consumer messaging

①Corresponding author: Tel: ^a +1 859.887.5149

^b +1 859.885.9613

Email: C. Keogh: ckeogh@alltech.com

A. J. Connolly: aconnolly@alltech.com

Introduction

Cheese is from plants, tomatoes are grown underground, and pasta comes from meat. These are just a few of the alarming responses from a recent poll conducted by the British Nutrition Council¹. Unfortunately, this lack of agricultural knowledge is only furthered by negative media attention and ‘undercover’ videos highlighting out of context and out of the ordinary practices. Take Chipotle’s recent web series, *Farmed and Dangerous*², as an example. Chipotle used this series to paint big agriculture as an underworld of scheming business people doing anything and everything to cover up the truth (such as, say, feeding petroleum pills to cows). This webisode went so far as to show a farmer at a photo shoot in front of a fake background while a voiceover asserts, “They pay us to fix their image, not their cattle.” In a less dramatic way, Silk’s TV spot titled *Moo*³, discredited animal agriculture when the idea of milk coming from the udder of a cow is summed up in one word, ‘Ugh.’

With all these messages in popular media, it’s no surprise that consumers struggle to trust agriculture. Between phrases like genetically modified organisms (GMOs) and growth promoting antibiotics (GPAs), the world of industrial agriculture can begin to sound more like a science experiment than the source of healthy foods. Perhaps this is why surveyed consumers tend to agree that commercial farms and national food companies are more likely to put their own interests ahead of those of consumers’⁴.

On the opposite side of the discussion are farmers. Consumers want to think of farming as an industry frozen in time where machines are unheard of and chemicals are unseen. However, just as citizens today don’t live like their great grandparents did, farming has grown up too. The average farm today feeds 155 people⁵. In 1960, that number was only 25.8⁶. With this surge in demand and stagnant land and water resources, innovations and technology are what have kept farmers profitable and sustainable in a market with downward pressure on prices and rising costs of production⁷.

An example of these agricultural success stories has been the global broiler industry. Broiler meat is healthy, nutritious and a convenient product available at a price % lower than it was 50 years ago.⁸

Broilers have the best feed conversion ratio of any domesticated land-based animal. In the US the broiler industry has evolved from millions of small backyard flocks of dual-purpose (eggs and meat) chickens in the early 1900s to less than 40 highly specialized, vertically integrated agribusiness firms. Until 1920, chicken meat was considered a luxury reserved for special

¹ British Nutrition Foundation 2013

² Blackmore 2014

³ Moo 2014

⁴ The Center for Food Integrity 2013

⁵ Farm Journal Foundation

⁶ Center for Food Integrity

⁷ Wang & Ball 2014

⁸ http://www.nass.usda.gov/Publications/Trends_in_U.S._Agriculture/Broiler_Industry/index.asp

occasions. Chickens were strictly a by-product of egg production, as cockerels and unproductive hens were culled from the laying flock. Scientists developed ways to meet the nutritional needs of chickens kept in protective environments, making large-scale, year-round production possible. Broiler production emerged in the 1930's as a separate industry that operated year-round and in the 1950's and 60's vertical integration became common, with a single company involved in every process, stabilizing the rapidly changing relationships between inputs, production, and marketing segments. Havenstein compared feeding genetics from the 1950's to a 2001 bird and demonstrated 2/3 less feed, energy and other inputs were required also produced 2/3s less emissions and waste into the environment⁹. Vertical integration allowed the modern broiler industry to take advantage of new production and processing techniques in order to become more efficient, responsive, and safe.

Misconceptions like these are a major concern to animal nutrition companies such as Alltech. Alltech is engaged and invested in the future of farming, which means that both customer perceptions and producer challenges are directly relevant and vitally important. Take a look at some of the perceptions of surveyed consumers in Table 1 (see Appendix)¹⁰:

This growing disconnect and the seemingly conflicting needs of farmers and consumers create a challenge for B2B agriculture companies. As such, Alltech, an animal nutrition company, was faced with a dilemma: How can a company put consumers' minds at ease about the quality and safety of food produced by their farming customers while at the same time providing those farmers with solutions that will make them more efficient and profitable? Recognizing that much of consumers' distrust originates in a lack of transparency¹¹, bridging the proverbial gap between the consumer and farmer had to begin with communication and education.

For many years, Alltech has worked under the philosophy of marketing through education. The company has strategically positioned itself through its symposia, lecture tours, and relationships with academia to connect on an educational platform and tell its brand story. Traditionally, the targets for this message have been the customer mills that produce the animal feed. More recently, however, the company has used sponsorship as a vehicle to expand the reach of its message, targeting both the farmer and the consumer.

Discovering the Need

When Alltech initially sponsored the Alltech FEI World Equestrian Games 2010 in Kentucky, an event area called the Alltech Pavilion was designed as a place where attendees could learn about what Alltech does across its many divisions including crop science, feed ingredients, beverages, and life sciences in the many markets where it operates (128 countries)¹². Through a variety of media including exhibits manned by scientists, videos, and demonstrations, attendees could explore the realities of farming using all of their senses. The company seized the opportunity to showcase agriculture as a whole with its 'farm to fork' story. The Alltech Pavilion provided a

⁹ 2003 Poultry Science Association

¹⁰ Connolly & Phillips Connolly 2011

¹¹ The Center for Food Integrity 2013

¹² Alltech

forum for 511,000 visitors over a two week period¹³ to discover the latest agricultural innovations and natural technologies being used all over the world. And, Alltech introduced the ACE principle¹⁴, which demonstrated how the future of agriculture depends on solutions that are safe for the **A**nimal, **C**onsumer and **E**nvironment through the responsible use of limited land and water resources. Featuring a futuristic model of farming in 40 years, an interconnected energy and food production system called *Farm of the Future* was displayed¹⁵. It depicted a sustainable farming community with integrated processes such as algae production, solid-state fermentation, cellulosic ethanol production, and aquaculture, beef, and dairy operations. In the model, these technologies worked together to limit waste, maximize productivity, and minimally impact the environment.

Throughout the two weeks of the Games, Alltech watched as a showcase of innovation quickly transformed into a celebration of all things agriculture. Wishing to expose more consumers to this message, the company invited North American based agriculture companies to join in on telling the story of the farmer. As groups quickly agreed to help in this endeavor, the resulting endowment provided funds for bussing over 50,000 children from local schools to the event for tours and presentations by scientists and nutritionists on the realities of modern farming.

Alltech realized that bringing farmers and consumers together for meaningful interactions was a very unique opportunity. Instead of letting this special event become a one-and-done occurrence, they decided to sponsor the 2014 FEI World Equestrian Games™ to be held in Normandy, France¹⁶, where they would take this concept and use it to engage the farmers of the world. Additionally, they used the concept of the Pavilion as a foundation for a much larger campaign to reach a wider audience with a longer lasting impact.

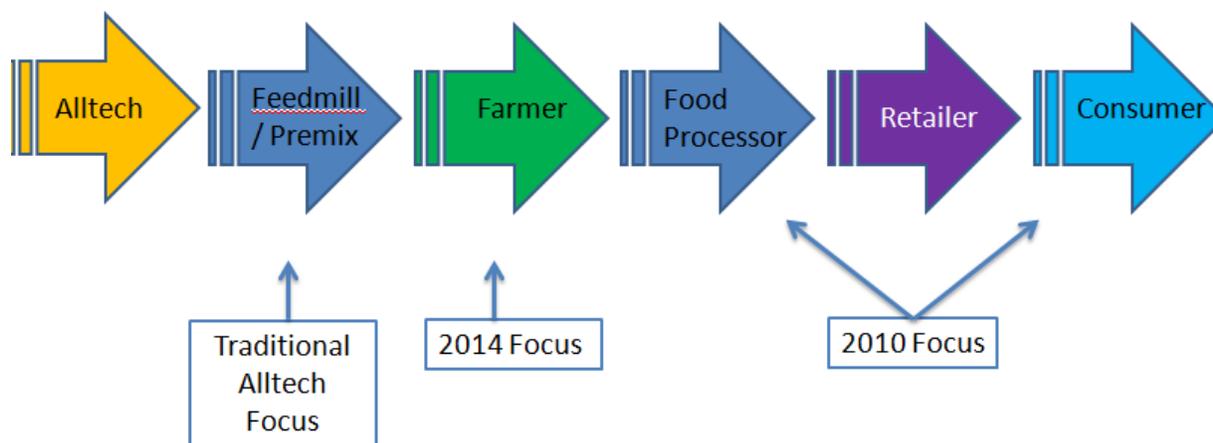


Figure 1. Alltech FEI World Equestrian Games Target Audiences

Table 2 highlights some examples of metrics used to measure the value of Alltech's sponsorship of the 2010 Games. Each segment of attendees was impacted slightly differently.

¹³FEI 2011

¹⁴ Alltech

¹⁵ Alltech

¹⁶ Eurodressage 2011

Table 2.Examples of 2010 Alltech Games metrics: Impact by segment (ADMAP 2011)

Audience	Who	Sample of Results
Internal	Employees and others directly involved with Alltech	<ul style="list-style-type: none"> ▪ 400 (of 2500) employees participated directly in the Games ▪ 128 articles published by staff¹ ▪ 33% drop in employee turnover.
Customers	Organizations that purchase Alltech's products: feed; pet food; food; beverages; crop solutions	<ul style="list-style-type: none"> ▪ Sales to equine customers doubled ▪ Sales to 'Partners of the 2010 Games'² doubled ▪ Pet food sector sales increased 400% ▪ B2C sales, including food and beverages increased tenfold
Suppliers	Of products or services to Alltech, eg ingredients, equipment, financial services, etc	<ul style="list-style-type: none"> ▪ Better trading terms³ ▪ Inclusion by main banks in their 'top-30 client' list
Co-suppliers	Companies offering products and services that complement what Alltech offers	<ul style="list-style-type: none"> ▪ Increased participation in industry association boards, which are by invitation. ▪ Increase in requests to do business ▪ Relationship building from key supplier attendance at the Games
Competitors	Companies that offer substitute services or products to Alltech's technologies	<ul style="list-style-type: none"> ▪ Job applications doubled ▪ Tenfold increase in visits to website
Influencers	People or organizations who influence Alltech's business environment	<ul style="list-style-type: none"> ▪ Access to leaders in business and government/regulatory bodies ▪ Local support for growth initiatives ▪ Presence on industry boards increased ▪ Coverage in mass-market media (CNN, NBC etc) valued at \$31m⁴

¹ Alltech put out a call to staff through the weekly internal newsletter; approximately 1,000 staff members contributed to one or more of the articles.

² 'Partner' sales are sales with companies who signed up to be partners to the Alltech 2010 games partnerships, including both equine and other species business.

³ 'Better trading terms' refers to better prices, longer payment cycles, applying 'favored nation' clauses, etc.

⁴ Coverage tracked by PR firm; value based on estimated cost of buying an equivalent amount of advertising. Examples include more than 7,500 press clippings and more than 1,000 feature stories in general market media (newspapers, magazines); hundreds of pages of articles in agricultural publications; 23,000 downloads by media outlets of Alltech audio clips; more than 20 hours of on-air coverage on Eurosport, 8.5 hours of coverage on NBC sports (with virtually every shot including an Alltech logo).

Unsung Heroes

Keeping in line with this desire to make a genuine connection with both farmers and food consumers, Alltech decided to follow the principles of Last Generation Sponsorship, a phrase coined by Kim Skildum-Reid who says, “*Last Generation Sponsorship is about nurturing a brand’s connection with a target market, nurturing their needs, not brand needs, first.*” Skildum-Reid describes Last Generation Sponsorship as a “Win-Win-Win.” It’s a win for the sponsor, the sponsorship seeker, and, most importantly, for the target market¹⁷. Alltech knew its sponsorship of the Games had to connect with farmers, adding value to their businesses. Beyond that, Alltech wanted its brand to be a part of farmers’ stories, creating a community where farmers sought to be affiliated with the Alltech story, and not the other way around. This idea of realizing a benefit for the target market first and for Alltech second led to the concept of the *Unsung Heroes* campaign.

With the increasing disconnect between the consumer and the farmer, Alltech identified the need to celebrate those people working tirelessly in often thankless roles. Beginning with dairy producers, Alltech began the effort to showcase those people quietly feeding the world behind the scenes. With milk production more than doubling in the last 50 years¹⁸, demand has caused dairy farmers to become some of the most innovative and progressive food suppliers in the agricultural industry, and as the global population surges beyond seven billion, this trend is set to continue¹⁹.

Social Media

Alltech created the Alltech Dairy Heroes Facebook page²⁰, where followers were given an opportunity to celebrate dairy workers who go the extra mile every day. The call for stories stated it like this: “Whether it’s your mum, your child or a member of your farm team, tell us about their passion for the dairy farming lifestyle.”²¹

One by one, stories began to trickle in. Then, the trickle became a flood. With over 30,000 likes, the Alltech Dairy Heroes Facebook page features posts about everything from ‘felfies (farmer selfies)²²’ to information on a facility powered solely by cow and pig manure²³. The Facebook page was followed up by local advertising that celebrated the Dairy Heroes in their communities as well as recognition for them at the Games events.

Highlighting individual producers in this way has had a notably positive effect. The *Unsung Hero* campaign created a platform for farmers to network among themselves, while also providing a window into the industry for consumers. Through both the sponsorship of the

¹⁷ Hurt 2013

¹⁸ Gyles 2010

¹⁹ Worldometers

²⁰ Alltech Dairy Heroes

²¹ Alltech

²² Farmer Selfies

²³ Fair Oaks Farms

Games and the *Unsung Heroes* campaign, Alltech has been able to gain invaluable access to its customers and its customers' customer—the consumer. As a B2B company, this ability to reach the end consumer with a message is a powerful connection.

From Seed to Feed to Farm to Food

Building on the success of the Alltech Pavilion at the 2010 Games, the company began planning for the 2014 Games. A focus on agriculture was a natural fit for Normandy, a leading agricultural region of France, where agribusiness accounts for 15% of employment in the region.²⁴

As a celebration of agriculture, the plans for the 2014 Games included highlights of the food chain from seed to feed to farm to food. Pavilion elements featured everything from harnessing nature's soil microbes to feeding the animal to its true genetic potential; from aquaculture and sustainable DHA-enrichment to life sciences and how we can eat our way to a healthier life. Sponsoring this event and hosting the Pavilion gave Alltech the ideal platform to showcase the agriculture industry and gain quality face-to-face, hands-on access to customers and consumers.

This venue opened dialogue about the current state of agriculture and where the industry is heading. With the sometimes overwhelming amount of information and misinformation available on the topic, the Alltech Pavilion strives to be a source of factual, science-driven education for consumers. There were two main messages that needed to be delivered. The first was that despite what is sometimes presented in the media, the large majority of farmers take great pride in what they do and make decisions based on what is best for their land and animals, and therefore, the consumer. After all, animals perform better when they're healthy and happy and land produces higher yields when it's nourished and protected.

The second message was that farmers feel pressure to meet the needs of a continuously growing world population—and on decreasing amounts of arable land. To do this, they must embrace current technologies and utilize them efficiently on their farms. Today, 1 in 7 people wake up not knowing how to find food for their families, and farmers want to be part of the solution to that problem²⁵. The Alltech Pavilion at the 2014 Games educated consumers and producers alike on how to partner to meet global demands for nutritious food.

Finding Synergies

While the Alltech Pavilion was a key piece of activating this sponsorship, to look at it as a contained opportunity within the Games is to miss valuable opportunities. To fully realize the potential of this sponsorship, the company determined that its annual dairy and beef producer meeting, Alltech's *Global Dairy and Beef* (traditionally held in the U.S.), would be held in the heart of Normandy this year during the Games. This was a natural decision since the Normandy

²⁴ (Deshayes 2013)

²⁵ (Sheeran 2011)

region is at the center of the European ruminant industry, with over 830,000 dairy and beef cattle residing on 18,300 different units.²⁶

Holding this meeting for leading world farmers in France in coordination with the Games enabled the company to offer value first to the target market in the form of education, and then in turn offered Alltech the benefit of making genuine connections with farmers while also establishing itself as a thought leader in the industry.

As a lead-up to the *Global Dairy and Beef* meeting, Alltech launched a nine-month on-farm campaign in 22 countries based on the E=P+S equation (efficiency=profitability+sustainability)²⁷ under the slogan “Your Farm, Your Future.” Across Europe, a trial was conducted where over 100 farmers were identified and visited to have their operations’ EPS ratings analyzed. After the initial analysis, these farmers began the EPS program, which they will follow among 21,000 cows continuously for six months. At the end of that time, the same tests will be run again and results documented and measured. These results will be available for release during the Games in Normandy. Significant increases in each farm’s efficiency are expected, which points to more profitable, more sustainable farms. These EPS farmers were the center of a case study debuted at the *Global Dairy and Beef* meeting. In addition to the focus on these results, meeting attendees had the opportunity to tour several of the most efficient, profitable, and sustainable farms in the region.

Table 3 (see Appendix) outlines samples of metrics Alltech will use for measuring the success of the 2014 Games in Normandy. The company will be looking for impact on much more than the bottom line. The three main objectives are to: a) increase brand awareness and enhance reputation; b) increase business on farm; and c) build the equine side of business, including relationships with partners.

Beyond Sponsorship of the 2014 Alltech World Equestrian Games

Maximizing sponsorship through activities designed to celebrate agriculture and the people whose efforts feed the world is an example of how sponsorship, when used effectively, provides a platform for the growth of both sales²⁸ and brand equity.²⁹ It also establishes the sponsor, Alltech, as a thought leader. By combining the sponsorship of the Games with features like the Alltech Pavilion, on farm relationships, the *Unsung Heroes* campaign, and the annual *Global Dairy and Beef* meeting, Alltech has begun to see gains beyond the value of each individual piece of the equation, and the event hasn’t even begun.

Through the Games in Normandy, the company continued to challenge the traditional idea of sponsorship. With far reaching activation efforts, this sponsorship was more than placing a logo on every available venue surface. The decision to sponsor the 2010 World Equestrian Games was based on a multitude of factors, not the least of which was Alltech’s relationship to horses,

²⁶ Alltech 2013

²⁷ Efficiency, Profitability, Sustainability

²⁸ Connolly, Keogh, & Bradley

²⁹ Phillips Connolly & Connolly

Kentucky, and performance. That first sponsorship demonstrated that new connections had been made with new audience groups such as consumers and food companies. And, Alltech learned from the 2010 event that there is a real need to bridge the communication gap between farmers, agriculture, and consumers. Although sponsorships are not typically used by B2B or B2F organizations, Alltech recognized that it could be a great vehicle for clearing up misconceptions, building consumer brands, and delivering the real story of food around the world.

Sponsorship can be a means to facilitating these important conversations and inspiring new ways of thinking about feeding people healthy, safe, and wholesome food. With a hand in every part of the food chain from seed to feed to farm to fork, Alltech is uniquely positioning itself to make a true difference, and sponsorship of the Games is just the start.

References

- Alltech. ACE. <http://www.alltech.com/feeding-the-world/ace>
- Alltech Facebook. Dairy Heroes. <https://www.facebook.com/DairyHeroes>. [accessed March 31, 2014]
- Alltech. Dairy Heroes. Website. <http://www.alltech.com/dairy/heroes>. [accessed March 31, 2014]
- Alltech. Future of Farming. <http://www.alltech.com/future-of-farming> [accessed March 31, 2014]
- Alltech. 2013. Alltech Blog: <http://www.alltech.com/blog/posts/global-500-event-travels-normandy>. [accessed March 31, 2014]
- Alltech. (n.d.). Efficiency, Profitability, Sustainability. Website. <http://www.alltech.com/dairy/eps> [accessed March 31, 2014]
- Alltech. Locations. Website. <http://www.alltech.com/about/locations>. [accessed March 31, 2014]
- Blackmore, W. 2014. This New Web Series About Factory Farming Is Brought to You by Chipotle. <http://www.takepart.com/article/2014/01/27/chipotles-upcoming-comedy-series-factory-farming>. [accessed February 12, 2014].
- British Nutrition Foundation. 2013. Cheese comes from plants and fish fingers are made of chicken. United Kingdom. <http://www.nutrition.org.uk/nutritioninthenews/pressreleases/healthyeatingweek>
- Center for Food Integrity. (n.d.). Farmers Feed Us. Fun Farm Facts: <http://www.farmersfeedus.org/fun-farm-facts/> [accessed February 12, 2014].
- Connolly, A., and K. Phillips Connolly. 2011. Jump from B2B to B2C with event sponsorship. *ADMAP Magazine* March:10-12.

- Connolly, A., and K. Phillips Connolly. 2014. B2B Event Sponsorship: Generating Value through Strategy and Metrics. *Journal of Brand Strategy* 3 (1) 51-8.
- Connolly, A., C. Keogh and S. Bradley, S. 2013. Getting Closer to the Customer: A Case Study of how Alltech uses Sponsorship in its marketing strategy. *IMR Publications*.
<http://www.imrpublications.com>
- Deshayes, F. 2013. September 4). *Regional Focus: Normandy*. Retrieved March 31, 2014, from UBIFRANCE: <http://www.ubifrance.com/ie/Posts-7010-regional-focus-normandy>
- EPA. (n.d.). Ag 101. <http://www.epa.gov/oecaagct/ag101/demographics.html> [accessed April 15, 2014].
- Eurodressage. 2011. Alltech Signs for Title Sponsorship of 2014 World Equestrian Games. <http://www.eurodressage.com/equestrian/2011/07/08/alltech-signs-title-sponsorship-2014-world-equestrian-games>. [accessed March 31, 2014]
- Fair Oaks Farms. (n.d.). Website. <http://fofarms.com/about-us>
- Farm Journal Foundation. (n.d.). Farmers Feeding the World from Agweb.com. Farming Matters! http://www.agweb.com/farmersfeedingtheworld/farming_matters.aspx [accessed March 28, 2014]
- Farmer Selfies. (n.d.). Retrieved from <http://www.felfies.com/> [accessed March 28, 2014]
- FDA. (n.d.). Animal Feed Regulations. <http://www.fda.gov/AnimalVeterinary/ResourcesforYou/AnimalHealthLiteracy/ucm191891.htm> [accessed April,15, 2014].
- FEI. 2011. Record Interest in Hosting FEI World Equestrian Games in 2018. <http://www.fei.org/news/record-interest-hosting-fei-world-equestrian-games%E2%84%A2-2018>. [accessed April,15, 2014],
- Gyles, C. 2010. Industrial farm animal production. *The Canadian Veterinary Journal* 51(2):125-128.
- Halvestein, G.B. 2003 Poultry Science Association. <http://ps.oxfordjournals.org/content/82/10/1509.long>
- Hurt, J. 2013. Time for Your Conference Sponsorship to Grow Up. [accessed March 31, 2014], from Velvet Chainsaw's Midcourse Corrections:
<http://jeffhurtblog.com/2013/01/10/time-for-your-conference-sponsorship-grow-up/>
- Sheeran, J. 2011. Ending hunger now. TED Talks.
www.ted.com/talks/josette_sheeran_ending_hunger_now

- The Center for Food Integrity. 2013. *2013 Consumer Trust in the Food System Research*. Gladstone, MO. www.foodintegrity.org/research
- Wang, S. L., and E. Ball. 2014. Agricultural Productivity Growth in the United States: 1948-2011. *United States Department of Agriculture.ERS*. <http://www.ers.usda.gov/data-products/agricultural-productivity-in-the-us/findings,-documentation,-and-methods.aspx#.VATtdWP4KPI>
- Wilcox, C. 2011. Mythbusting 101: Organic Farming > Conventional Agriculture. *Scientific American Blog*. July 18. <http://blogs.scientificamerican.com/science-sushi/2011/07/18/mythbusting-101-organic-farming-conventional-agriculture/> [accessed April,15, 2014].
- Worldometers. (n.d.). Worldometers. <http://www.worldometers.info/world-population/> [accessed March 28, 2014].

Appendix

Table 1.

Consumer Perception	Farmer Response
Farms are all large, overly industrialized, and crowded factory-type settings owned by large corporations.	96% of farms are family owned ³⁰ . While these farms range significantly in size, all farms are held to housing standards to ensure overcrowding does not occur.
Farmers are cold and abusive towards their animals, seeing them only as an object and a path to profits.	Being cruel to livestock would be counterproductive. Animals perform best when they are healthy and happy. Farmers tend carefully to their animals and strive to keep them at harmony with their environment.
Farmers are money hungry and would do anything to make a dollar, even at the expense of human health.	Farmers care about both their animals and the consumer and they take huge pride in what they do. Cutting corners wouldn't be beneficial to anyone involved. Do they worry about the bottom line? Of course. Who could afford to work for free?
Farmers use harsh chemicals, unnecessary hormones and excessive antibiotics to grow animals faster than nature intended, resulting in harm to the animal and potentially the consumer.	Just as with human health, there are strict standards as to what is appropriate to include in animal feed and at what levels ³¹ . Farmers use a holistic nutritional program to ensure their animals are healthy AND efficient while also providing the consumer with a safe, high quality protein source.
Farmers create significant amounts of pollution, causing long term problems for everyone.	Farmers are very conscious of their effect on the environment and make a focused effort to make their practices more sustainable. They view themselves as stewards of the land, and most hope to be able to hand down the farm to their children one day, then their children's children, and so on.
Organic farmers are the most responsible producers, providing fresher, more natural and sustainable food products.	Contrary to popular belief, organic production is unsustainable and supplies food with the same (or some suggest marginally worse) nutritional value than that produced through conventional farming. In fact, given the same area of land, organic farmers can only produce 80% of a conventional farm's output, with some estimates being as low as 50%. ³²

³⁰ (EPA)

³¹ (FDA)

³² (Wilcox 2011)

Table 3. 2014 Alltech Games: Sample Metrics³³

	Objectives	New Metrics
Equine	<ul style="list-style-type: none"> ▪ Awareness of Alltech as digestive health leader ▪ Build connection with horse owners ▪ Increase equine feed range sales 	<ul style="list-style-type: none"> ▪ Increase brand awareness by 33% compared to 2010 market research study ▪ 40,000 Facebook likes for Equine Heroes social media campaign ▪ Social media based competitions for tickets to the Games ▪ Achieve 40 higher quality global partnerships, with a goal of creating customized blends in 90% of partners horse feeds. ▪ Increase sales with partners by at least 25% (already surpassed) Interactive “Equisphere” experience in Games village, experiencing the world from the horse’s perspective; Demonstrations in 2 arenas during the Games ▪ Increase Lifeforce(1) sales by 500% in 2014
Dairy	<ul style="list-style-type: none"> ▪ Build Alltech brand on-farm ▪ Increase on-farm sales in nine important markets ▪ Create brand recognition ▪ Develop sales 	<ul style="list-style-type: none"> ▪ Increase membership in online dairy community to 25,000 by end of 2014.² ▪ Bring 1000 farmers, from nine specific European markets, to the Global Dairy and Beef meeting.³ ▪ Fourfold increase in awareness of Alltech brand by Dairy farmers in those nine main markets, as measured through a survey. ▪ EPS with 21,000 cows in 22 countries
Megabrand	<ul style="list-style-type: none"> ▪ Build Alltech reputation in key markets ▪ Keep employee motivation and retention high ▪ Maximize media / press coverage of the Games ▪ Increase website presence in target markets 	<ul style="list-style-type: none"> ▪ 100% brand awareness on farm of Alltech in nine important markets, measured by survey ▪ Comparison of pre and post-Games employee satisfaction surveys with those from 2010 Games ▪ 33% reduction in employee turnover in Europe during 2014 and 2015 ▪ 20% increase in target television impressions (viewership) ▪ 20% increase in media coverage ▪ 20% increase in earned media by target list of international business media ▪ 300% increase in website visits/hits in target markets

¹ Lifeforce is a new product that is just being introduced, combining multiple Alltech solutions in a single package, so the Games sponsorship is an important part of the strategy for engaging customers.

² Launched in 2013, the community is at 20,043 as of 1st February, 2014.

³ The Global 500 meeting started in 2008 and has grown to be the largest meeting of its type; 600 top farmers, from 42 countries, attended the 2013 event in Dublin, Ireland.

³³ Connolly & Phillips Connolly 2014.

IFAMA Business Office • 1155 15th Street NW, Suite 500 • Washington DC, 20005, USA
Tel: 1-202-429-1610 • Fax: 1-202-530-0659 • E-mail: ifamr@ifama.org • Web: <http://www.ifama.org>

The IFAMR (ISSN #: 1559-2448)