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EDITOR'S NOTE

Dear Colleagues,

Welcome to the third quarterly issue of IFAMR for 2015. This is our yearly post conference edition, and I want to draw your attention to a very interesting article submitted to IFAMA's Best Paper Competition. The paper is *"Food Movements in Germany: Slow Food, Food Sharing and Dumpster Diving,"* by Meike Rombach and Vera Bitsch. The authors bring new social movement theory to the table to help us better understand the nuance of food movements. New theory is always welcomed at the IFAMR.

Authors participating in the Best Paper Competition receive many benefits that include both a simultaneous submission to the IFAMA's Research Symposium and a fast-track, double-blind peer review from the IFAMR to help them strengthen their conference presentation. In most cases, the complete submission-to-publication review process occurs in under 270 days. Articles published in our open access journal receive immediate email dissemination directly to 12k readers, and indirectly on the web through multiple cataloging services. Nice!

While attending the 2015 IFAMA World Conference in St. Paul, I was asked to give a plenary talk, briefly sharing the vision and strategy of the IFAMR with the audience. So what follows is the talk I gave this past June.

"I appreciate the opportunity to speak for a couple of minutes about the International Food and Agribusiness Management Review, the journal of IFAMA. When I think about IFAMA, I see an organization, since its founding in 1990 has had a core mission to impact the global food and agribusiness system. It has fulfilled this mission well through its numerous programs centered on talent and human resources, its wonderful annual conferences, and the subject of my comments—the IFAMR. But is the journal also making an impact on behalf of the association? Maybe that question sounds rather…academic…so ivory tower, right? Not quite. Eighteen Managing Editors, eight Guest Editors, and 280 reviewers from around the world log more than 3000 volunteer hours every year to make the IFAMR the top journal in the field of food and agribusiness management. The IFAMR team has established a platform so that authors: scholars, managers, policy makers, and students—the members and stakeholders of IFAMA may have an impact. Here are four gauges used to measure the value of the IFAMR platform.

1)   The IFAMR is the most cited on google scholar, # 1 among its 18 peers. That means other scholars use the work of IFAMR authors, many of you sitting here in this room, to advance the science and practice of food and agribusiness management, which is the mission of IFAMA. Scholars from around the globe acknowledge IFAMA's contribution by citing the article, by name in their published work.

2)   Those volunteer hours have paid off as researchers, managers, and policymakers from around the world download over 12k articles every month, ranking # 2 among our peers. That is 17 articles every hour influencing the food and agribusiness system. What an amazing return on investment from our editors and reviewers.

3)   The gold standard for journal impact is Thomson Reuters ISI®. It is known worldwide, hard to get, and hard to be successful. We received ours in 2012, only two of the 19 food and agribusiness management journals have an Impact Factor. Who wins? Our authors, our members and our stakeholders, because the greater the impact of the journal, the greater the prestige of their scholarly work, the greater respect they have among peers and the faster their careers advance through the promotion and tenure process. Ultimately, advancing the important issues influencing the global food and agribusiness system. Achieving high impact is like sales to a salesman, and the IFAMR has impact. Our prestige and impact then drive submissions and demand for the IFAMR and IFAMA. Submissions are up 500% since 2008.

4)   Finally, scholars use the IFAMR platform as a pulpit to produce and distribute special issues of the journal that raise awareness and allow active discourse on highly relevant topics. Why do Guest editor teams want to use the IFAMR and IFAMA to produce special issues? Because they want to have voice. They want access to 12k global readers and influencers, they want the legitimacy of the leading scholarly journal in the field, they want to build their brand, and they want their efforts actively downloaded and referenced on Google. The IFAMR gives our members and stakeholders a voice; it is a legitimizing voice as IFAMA and IFAMR are honest brokers. Recently industry and academics came together to spearhead a special issue on African entrepreneurship—think about that, when or where have you read about such an important topic? We've also published special issues on the obesity epidemic, the global poultry trade and raised global awareness concerning the talent and human resource gap occurring in the food and agribusiness sector. Upcoming special issues of the IFAMR have industry and academics discussing smallholder inclusion in African value chains; dairy markets and policy; and tangible applications of Big Data in agriculture.

IFAMA and the team at the IFAMR have a platform standing ready for you to make a difference as an author, guest editor, reviewer, managing editor, sponsor, and advertiser. We are electronic, open access, and actively present in the fast-growing, emerging markets. The leading journal in terms of impact; downloaded over 12k times every month,

distributed to over 12k readers six times per year, with global readership across six continents.

Come join us and use the platform IFAMA has created to effect the direction of the global food and agribusiness system."

Enjoy the issue.

Peter Goldsmith, Executive Editor, IFAMR

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Food Movements in Germany:
Slow Food, Food Sharing, and Dumpster Diving

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Abstract

The study investigates the motivation to participate in food movements, as well as the activities and knowledge regarding food waste of active food movement members in Germany. The study builds on theories of social movements. A total of 25 in-depth interviews with activists of the Slow Food organization, the Food Sharing organization, and with dumpster divers were recorded, transcribed, and analyzed through qualitative content analysis. Participation in the movements rests upon instrumental, ideological, and identificational motivations. The knowledge of food waste differs between the three movements. Sharing, food waste, and tendencies of anti-consumerism play a strong role in all movements.

Keywords: activism, food waste, in-depth interviews, qualitative content analysis, social movements

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Introduction

In Germany, food waste occurs in agricultural production, post-harvest, processing and private households (Gustavsson et al. 2011). Food waste is estimated at 11 million tons per year; about 65% of which are avoidable and partly avoidable. The term avoidable refers to food waste that is still safe for human consumption at the time of disposal. Partly avoidable relates to consumer habits such as cutting off bread crust or apple peal. The amount of avoidable and partly avoidable food waste results in approximately 21.6 million Euro per year (Kranert et al. 2012). Governmental and political initiatives address food waste through awareness campaigns and targeted projects (Kranert et al. 2012, Lebersorger and Schneider 2014). In addition, individuals and non-governmental groups aim to reduce food waste. Food movements targeting the reduction of food waste include the Slow Food organization, Food Sharing, and dumpster diving.

In 1987, Slow Food was founded as a countermovement against fast food in Italy to preserve local Italian food traditions and regional food products. Over time the local organization developed into an international organization with 100,000 members in about 130 countries around the world. Membership is organized in local sections, which are coordinated at the international headquarter in Italy (Sassatelli and Davolio 2010). In Germany, Slow Food started in 1992 and currently has 12,000 members organized in 80 local sections (Slow Food 2015). In each country, Slow Food advocates the production of sustainable local food and small-scale business. Further goals include the preservation of biodiversity and the reduction of food waste. The organizational mission states that food should be good, clean and fair (Jones et al. 2003, Sassatelli and Davolio 2010). Slow Food is criticized to be affordable only by wealthy members of the society, since it focuses on expensive gastronomic products (Chrzan 2004, Laudan 2004) and presents rurality in a nostalgic and romantic view (Jones et al. 2003).

Food sharing occurs in various forms, for instance in underground restaurants, or within an organization called Food Sharing. In both cases, it involves using a social network or an online platform to distribute food items among registered users (Kera and Sulaiman 2014, Ganglbauer et al. 2014). In Germany, Food Sharing has approximately 28,000 registered members, exchanging food items through a platform without paying fees (Ganglbauer et al. 2014). Shared food items are leftover foods from private households, as well as groceries donated by local retailers or growers (Lubeck 2014). Ganglbauer et al. (2014) explain that the food is collected by volunteers that offer the items on the platform. Exchange with members requesting the items takes place mainly in person. The offering side is free to accept or decline a food request. Retailers and producers have legal agreements with the organization that the consumption of the donated food is the personal risk of the Food Sharing member (Lubeck 2014). In Germany, the organization has been active since 2012. It resulted from two independent initiatives against food waste. The idea of an internet platform to share food was developed by in the context of the movie "Taste the Waste," while at the same time a student group together with a journalist developed a similar idea. Both initiatives collaborated and the Food Sharing organization and platform were realized through crowdfunding (Food Sharing 2015).

Dumpster diving is an activity that occurs in many developed countries, for instance in parts of Europe, in the U.S., and in Australia (Fernandez et al. 2011). Dumpster diving involves opening

commercial garbage containers and collecting food items. Despite considered unmarketable by the owners, dumpster divers perceive many food items as still suitable for human consumption. Dumpster diving is often socially marginalized and a result of poverty. Depending on the country and its legislation, the activity can be a punishable offence. In Germany, dumpster diving is illegal (see German Criminal Code §123, §242, §244, and §303). Nevertheless, the situation is handled differently in practice. Dumpster divers are either not reported, since retailers fear negative media attention or courts treat it as neglectable. Hours of community service were so far the hardest punishment in Germany; the majority of cases were dropped due to pettiness (Noack et al. 2014). Dumpster divers collect food either as individuals or in groups. Dumpster diving can be considered as a form of anti-consumption (Nguyen et al. 2014), and as an act to reduce food waste and to oppose current food systems (Fernandez et al. 2011). The phenomenon of dumpster diving is likely to have been present in developed countries all along, but since the mid-2000s it is receiving public and scientific attention (Eikenberry and Smith 2005, Edward and Mercer 2007).

Food movements are a form of social movements. Social movements are defined by their shared normative orientation, collective identity, orientation toward change of political or cultural conditions, and shared actions related to their change program (James and Van Seeters 2014). One of the common denominators of the three movements analyzed is aiming at the reduction of food waste. The study investigates what motivates members to become active in their respective movement, how active members of each movement perceive their contribution to the reduction of food waste, as well as their knowledge about food waste and about other movements. As food movements and their activities are gaining popularity in Germany, managers in agrifood chains will benefit from understanding the movements, since they are impacting consumer trends relevant to value chains in the agrifood industry, as well as their image in the society. This understanding will be useful in developing strategies and addressing current trends and media critique.

Literature Review

Social movement theories explain that people participate in social movements based on three main motivations, namely instrumental motivation, identificational motivation, and ideological motivation (Klandermans 2004). Motivation refers to the accomplishment of goals. It includes an impetus or an inspiration to extend efforts to reach that goal. Motivation theory distinguishes the level of motivation and the orientation of motivation. The orientation of motivation refers to the underlying attitudes and goals, which explains how people are driven to act (Ryan and Deci 2000).

Social movements and, in particular, activities being organized through the movements, depend on member commitment. Commitment theory distinguishes between three types of commitment, namely continuance commitment, affective commitment, and normative commitment. Affective commitment is based on emotional attachment to an organization or movement. It implies a member's wish to be a part of the movement. Identification with the goals and values is likely. Continuance commitment implies a fear of loss, and considers advantages and disadvantages of being part of a movement. The fear of loss can relate to monetary, as well as social aspects.

Normative commitment relates to an obligation to be part of a movement. The three types of commitment affect participation, and are not mutually exclusive (Allen and Meyer 1990).

The existing body of literature on the three food movements analyzed concentrates on political and organizational aspects. Only a small number of studies focus on members, their interests, motivations, and activities (see Figure 1). Germov and Williams (2008) researched visitors' experience with Slow Food during an annual Slow Food festival in Melbourne (Australia). They conducted in-depth interviews with 33 Slow Food members, which they analyzed through qualitative content analysis. Interviewees associated Slow Food with good, healthy, local, and fresh produce, and hand-made production processes. All interviewees considered the Slow Food mission as very important, and some even incorporated components in their daily routines. Interviewees engaged in food production highlighted the Slow Food network as main motivation to join the organization. In addition, they mentioned economic and social benefits.
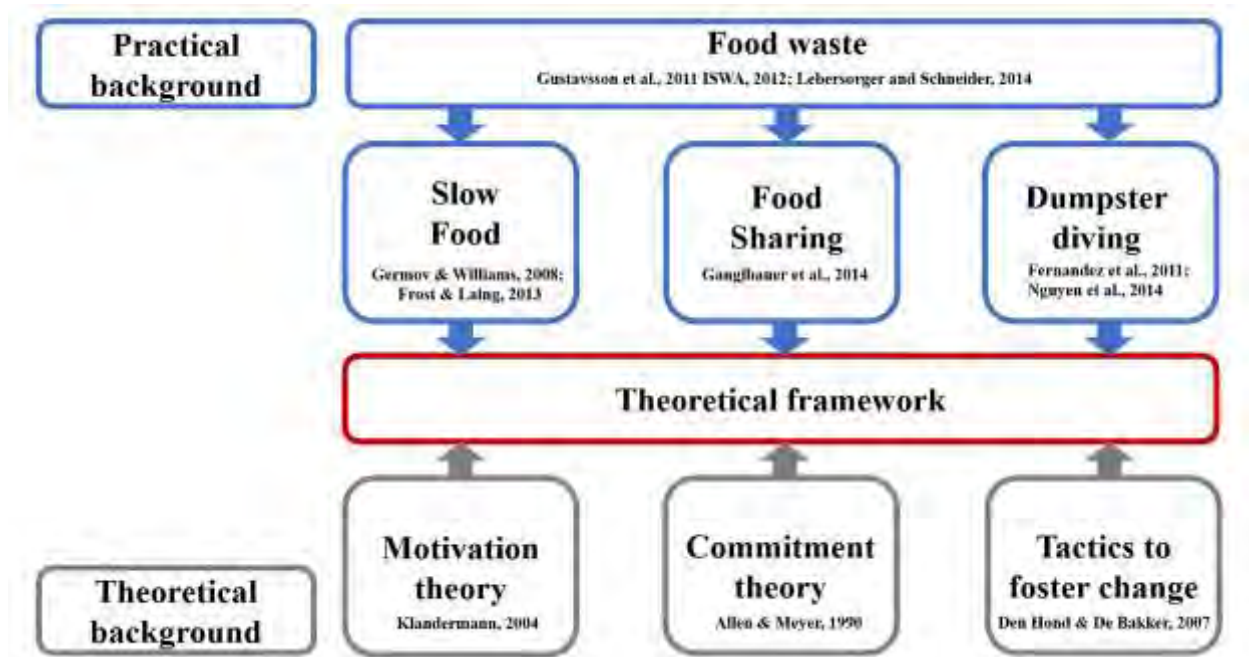
Figure 1. Theoretical Framework of the Study

With respect to the benefits, the Slow Food network plays an important role since it facilitates consumer-producer interaction and members feel valued and belonging to the community. For Italy, Leitch (2003) emphasized the Slow Food network, since it unites consumers and producers due to its unique principles of consumption, environmentalism, and social activism. However, Germov and Williams (2008) showed that the Australian interviewees had little interest in social and political activism, even if part of their interests was to change the prevailing consumption practices. These findings confirm a study by Gaytan (2003) who found a lack of interest in political activism among Slow Food members in Northern California.

Frost and Laing (2013) investigated the nature of Slow Food events in Italy, Australia, and New Zealand. Their multiple case study focused on five Slow Food events, namely Salon del Gusto, Terra Madre, Barossa Slow, Festa della Vendemmia, and Marchfest. The websites of the events were analyzed through a discourse analysis approach. The events showed characteristics of activities performed in social movements. The movement character is highlighted through the use of political or evocative language to promote the link between politics, food, and their regional identity. Also, the use of political imagery, for instance, people associated with uprising, such as Che Guevara, indicates the desire to promote change. Further evidence of the movement character is provided through the promotion of the events by Carlo Petrini, the founder of Slow Food, or well-known locals. The champions are meant to have an exemplary function and represent the change. The use of a champion is common practice within social movements. Considering food waste, the Slow Food website (2015) states that the organization is particularly concerned about food waste. Up to now, this claim has not been substantiated by scientific papers. Food waste related activities of Slow Food, including the members' perception of those, as well as the knowledge of food waste, and of other food movements addressing the issue are so far unexplored.

Ganglbauer et al. (2014) researched the online interaction of Food Sharing members. Their media analysis covered 3,242 comments from members active on Facebook and on the Food Sharing homepage. The qualitative content analysis brought up frequently discussed topics, such as dumpster diving, agriculture, gardening, food sharing experiences, food, and food waste. The researchers identified social, ecological, and economic motivations to participate in Food Sharing. The social and ecological motivations are mainly related to responsibility, for instance supporting people in need or preventing food from being wasted. Members perceive their actions, e.g., sharing of food and avoiding food waste, as a contribution to society and the environment. Few members admitted to economic motivations, stating that Food Sharing is needed to sustain their living. Olson (1965) argued that people will participate in a social movement, if they know their contribution is valuable for the movement or if they can benefit from the efforts of others (free riding). In contrast to other organizations or movements, free riding is not perceived as negative among Food Sharing members (Ganglbauer et al. 2014). They accept the use of the network to access food without contributing. In this context, Ganglbauer et al. (2014) underlined the social motivations of Food Sharing participants.

The topics discussed by Food Sharing members, e.g., dumpster diving, indicate knowledge of other food movements. The organization's motto "Food sharing instead of wasting" implies that members are knowledgeable with respect to food waste. Due to the absence of classical free riding, the organizational activities show the underlying characteristics of a social movement, fostering change. Ganglbauer et al. (2014) do not provide explicit information on activities, knowledge of food waste, and other food movements, since their paper focused solely on online interactions.

Fernandez et al. (2011) researched dumpster diving as a part of an anti-consumption movement in New Zealand, and found strong economic motivations. The study was based on 14 in-depth interviews and two participatory observations of dumpster diving activities. The participating divers were recruited via online communities. Fernandez et al. (2011) found the following main

motivations to dumpster dive. Survival and earning or saving money were presented as economic motivations. Ideological motivations included a hero identity, since participants believed their activity is a beneficial contribution to the society, because it reduces food waste. Further ideological motivations were resistance to the market system, the avoidance of employment, and not contributing to the market. Psychological motivations were participation in the community, enjoyment, and surprise. The economic motivations are in line with previous findings by Eikenberry and Smith (2005) who researched dumpster diving by low income groups and homeless people. Differently, Fernandez et al. (2011) included participants from various social status groups.

Also, Nguyen et al. (2014) investigated activities of dumpster diving groups in the U.S. The study was based on a mixed method approach. Methods of investigation included participatory observation of dumpster diving activities, interviews, and text analysis. Besides dumpster diving as an activity, the study also analyzed diving dinners. Diving dinners are meals prepared with food collected from dumpsters. The study identified themes of anti-consumption, the estheticization of trash, resource reversal, and the importance of sharing. The estheticization of trash includes the cleaning and processing of food coming from dumpsters, in order to let it appear as regularly purchased food. The underlying reasons are either shame or pride. Some divers want to present their activities since they are proud that they can prepare full meals from collected food items; other divers want to hide their activities, since they fear negative reactions and stigma from their social environment (Nguyen et al. 2014). Resource reversal had a deep meaning for dumpster divers who participated in the study. The society regards food items coming from dumpsters as not valuable. In contrast, dumpster divers consider this food as means of living that still provides pleasure and nutrition. Therefore, they reuse the items as an act against waste and unnecessary disposal. The aspect of sharing is closely connected. Since dumpster divers perceive the items as still good for consumption, they share the "reclaimed" groceries with friends and family, or donate them to soup kitchens (Nguyen et al. 2014). In general, sharing represents an act of solidarity (Belk 2014, Kera and Sulaiman 2014, Nguyen et al. 2014).

Judging from the previous studies discussed, motivations to participate in food movements reflect the categorization made by Klandermans (2004), differentiating instrumental, identificational, and ideological motivations. Psychological and economical motivations of dumpster divers (Fernandez et al. 2011) can be summarized as instrumental motivation, since individuals have pragmatic interests to be part of the movement. With respect to Food Sharing members, motivations are similar, but the context is different (Ganglbauer et al. 2014). Intrinsic motivation represents a form of ideological motivation, since members wish to comply with social values. The need to sustain a living is an instrumental motivation. In addition, evidence is presented that Slow Food, Food Sharing, and dumpster diving are food movements and related activities are in line with activities in social movements fostering change. Since this evidence is not sufficient to evaluate whether members engage in the activities to fulfill their individual needs, or as a form of social activism, a typology of interaction tactics, developed by Den Hond and De Bakker (2007), is applied in order to identify the nature of activities.

As activities in social movements are meant to foster change (James and Van Seeters 2014), action tactics can be based on damage or gain as the intended outcomes. Damage and gain refer to the disturbance or support of the operations of decision makers, e.g., governmental authorities or firms. Further distinctions are symbolic versus material damage or gain. Material damage and gain refer to resources or technologies, whereas symbolic damage and gain refer to dominant meanings, ideologies, and discourses. Symbolic damage includes writing protest letters, rallies, petitions, and negative publicity. Symbolic gain refers to voluntary action and positive publicity. Examples of material damage are sabotage, lawsuits, and boycott. Intended purchase in one shop over another (so called "buycott") and cooperation are examples of material gain (Den Hond and De Bakker 2007).

Methods

The study follows a qualitative research approach and is of an explorative nature. Qualitative research approaches allow an in-depth exploration of new research topics, and to develop theory and propositions for later studies (Bitsch 2005). Up to now there is a very limited number of studies on German food movements. Although there are several studies on the amount and composition of food waste, food waste and food movements have not been put in context, yet.

In line with the qualitative approach, in-depth interviews allow the exploration of a phenomenon from the point of view of the research participants. In-depth interviews are often used if the perception and experience of individuals are researched. In addition, in-depth interviews are considered useful if a sensitive topic is discussed (Hsieh and Shannon 2005). Since the study focuses on the experience and opinions of food movement members, in-depth interviews are suitable. For illegal activities, such as dumpster diving, few other data collection methods are available. In addition, the method allows interviewees to freely express themselves based on their own perspective (Neves et al. 2013). Using a quantitative tool, e.g., a survey questionnaire, participants must choose from a pool of prepared answers, which would be a drawback in this context. According to Bitsch and Yakura (2007) in-depth interviews as a qualitative research tool, allow to provide rich and detailed information, which are a requirement for a study being framed in social realities and cultural context.

In 2014, twenty-five in-depth interviews were conducted in Germany. Of the ten Slow Food members interviewed, five were actively involved in leading roles, up to the board of directors. The interviewees with leading roles were between 30 and 50 years old and came from different professions, including the computer industry, film industry, finance, education, and gastronomy. Another five interviewees were part of the Slow Food Youth movement and between 20 and 40 years old. Three interviewees were students; two came from education and gastronomy. Slow Food Youth members lived in larger cities in Germany. Of the fifteen dumpster divers interviewed, five also were active volunteers at Food Sharing. They participated in dumpster diving on a regular basis, as individuals or in groups. The dumpster divers interviewed came from urban, as well as rural areas. They were between 20 and 30 years old. Among the interviewees were students, professionals, as well as unemployed and homeless people. The dumpster divers who were also Food Sharing volunteers were predominantly skilled workers or from lower social classes.

Interviewees were recruited through social networks on the internet, and through the personal networks of the researchers. All interviewees of the Slow Food and Food Sharing organizations were recruited through social networks, such as Facebook. As both the Slow Food and Food Sharing organizations rely heavily on social networks and on their online presence, this type of recruiting seems appropriate. Since dumpster diving is considered illegal in Germany, interviewees were recruited through the researchers' networks and subsequent snowball sampling. Alternative ways of sampling would not have been possible, since the total number and composition of German dumpster divers and active Food Sharing participants remains unknown.

Each interview lasted 45 to 90 minutes, and took place face-to-face or over the phone, depending on the interviewees' preferences. Fifteen face-to-face interviews took place in neutral quiet locations, such as offices or the university library, or in private rooms of the interviewees. The other ten interviews were held over the phone. A semi-structured interview guide, outlining the topics of discussion, was used in each interview. As an example, the set of questions used for Food Sharing members is provided in the Appendix. Topics were addressed through open-ended questions, and were discussed following the conversational flow of the interviews. The questions asked were adjusted to the individual case during each interview. The first author, as well as two trained students conducted the interviews.

Interviews were audio-recorded, transcribed verbatim, and analyzed through qualitative content analysis. Qualitative content analysis can be seen as a process that allows transforming and pooling raw text into categories and themes based on inference and interpretation. The analysis is based on inductive reasoning, where ultimately themes arise from the data through constant comparison. Steps of the analysis included open coding and establishment of categories, and finally, the identification of motivations and action patterns for individual interviewees. Furthermore, within movements and between movements results were compared and contrasted.

During the process of open coding, labels that describe the key thought of a statement have been assigned to text fragments. Therefore, the transcripts were carefully read word by word several times. Afterwards, the codes were reconsidered and renamed, in a manner that they represent also the underlying meaning, and not only the key thought. In the next step, the codes were grouped together in categories with respect to their meaning, links, and relationships. For both steps, the software package Atlas.ti was used. Atlas.ti allows analyzing the raw text in a systematic and structured manner since it provides tools to code, annotate, and retrieve text. Each code and category was defined, and supported with original statements coming from the raw data. Categories and statements served for further interpretation. Table 1 shows three examples of categories, including their definition, and an interview excerpt as an example.

Table 1. Examples of Coding for Motivations to Participate in Food Movements

Category	Definition	Statement
Instrumental motivations	Motivations of members to participate in their respective movement are in line with economic and psychological benefits. These benefits are of a pragmatic nature for the individual members.	*"As a student, of course you are not blessed with a high budget. So, it is lucrative if you eat well, but you pay nothing [...]" (Dumpster diver, Munich, male, 20-30 years old, student).*
Ideological motivations	Motivations of members are in accordance or in contrast to social norms and values; includes political and social viewpoints with respect to the market system, consumption, and food waste.	*"I eat every day (laughs). So that's an existential human thing that you just have to eat something. And, somehow, nobody wants that one's means of satisfaction bring harm to others. And that is otherwise unfortunately often the case" (Slow Food Youth member, Düsseldorf, female, 20-30 years old, student).*
Identificational motivations	Intrinsic motivations of members are in line with the goals and principles of their respective movement.	*"But this is such a big amount of food. We need to distribute every-thing. In shared flats, to my friends, acquaintances, on the road sometimes directly to the citizens or to the homeless, to the beggars. I walk around and really distribute it directly to the people, to make them aware. That is an impressive experience [...]" (Food Sharing member, Stuttgart, male, 20-30 years old, actor).*

Results and Discussion

The result section consists of four parts. The first part discusses motivations to participate in food movements. The findings are compared to and contrasted with prior studies, and presented according to the classification into instrumental, ideological, and identificational motivations. The second part focuses on members' knowledge of food waste and other food movements, which addresses a research gap. The third part presents activities to reduce food waste. The last part analyzes the nature of activities carried out by members of food movements in the context of social movements, and fostering change.

Motivations to Participate in Food Movements

Slow Food members highlight health, pleasure, good food, and concerns about agricultural production practices and animal welfare as motivations to participate in Slow Food. In addition, they have an interest in the organization's activities, seek for social activism, and have a strong

interest in reducing food waste. Further motivations are to promote local food, to change the value of food within the German society, to reduce over-consumption, and get away from a "hectic" lifestyle. These findings are in line with the existing body of literature, and with the organization's goals and principles (Leitch, 2003, Sassatelli and Davolio 2010, Germov et al. 2011, Frost and Laign 2013). Different from Germov and Williams (2008), interviewees show high interest in activism. The statements below exemplify the motivations of interviewees to be actively engaged in Slow Food, and in particular, involved in activities to reduce food waste.

"I would like that more people are aware of this issue. The fact that we have to act, that we do not face the situation, where I have the option to say, I cannot do anything. This is perhaps a bad situation, but retreat is not a solution. It is also not an excuse to say politics takes time to do something. I think food is a political act everyone does several times a day, and so I get involved politically. So, I can do something" (Slow Food Youth member, female, Regensburg, 20-30 years old, teacher).

"In order to make people more aware of what is thrown away. I think food waste actually arrived in many people's minds. So many people know this, but if you look at the aspect of appearance. It still tastes good and you can feed quite a few people if you simply consider this mountain of vegetables that would have been otherwise just thrown away. This picture provides another connection to the people" (Slow Food Youth member, Essen, female, 20-30 years old, student).

The study included members of Slow Food Youth, which were intensively involved in activism with regard to food waste and food commensality. These interviewees were young adults with occupations that allowed for time to participate in the movement, e.g., students. Other members had a professional background that provided them the opportunity to integrate their activities regarding food waste in their professional activities. For example, teachers organized class trips and meetings with experts, where students had an opportunity to gain direct insights into the food waste problem. Participants in the study by Germov and Williams (2008) were mature agricultural producers that were running their own businesses. Compared to agricultural producers, teachers and students are more likely to have leisure time for Slow Food activities. The occupational background of interviewees can be seen as an explanation for the differences between the two studies. Also, when comparing within the movement, Slow Food Youth members have higher interest and involvement in contributing to public awareness and related activism, e.g., demonstrations and events that attract public attention, than members in leading roles. Interviewees with leading positions were more interested in activities related to high quality food. This result is surprising, since members in leading roles have committed to representative, organizational, and administrative duties, which would be expected to coincide with a strong interest in publicity.

German Food Sharing members have similar motivations as Slow Food members. Their motivations are to reduce food waste, to act against overconsumption, and to promote the value of food and food commensality within Germany. In contrast to Ganglbauer et al. (2014), instrumental motivation was not found. The interviewed members state that instrumental motivations are also undesired by the organization. Saving money or material gain are exclusion

criteria from the organization. The difference can be explained by the fact that this study interviewed volunteers who collect items from markets, retailers, and growers. The volunteers are required to follow the organizational philosophy since they have a representing role. Ganglbauer et al. (2014) analyzed posts from all members registered on the Food Sharing website. Accordingly, their study included members that do not volunteer, but use the network for their benefit. These ordinary members do not need to follow the code of conduct. Volunteering at Food Sharing requires identification with the organization, ideological motivation, and commitment. It requires an integration of these activities in the individuals' weekly routines. In addition, members must show efforts to obtain the status of volunteers who collect the food items, the so-called food savers. Volunteers representing the organization in public are known as a food ambassadors.

"To me it is very clear that each Wednesday and Saturday I am at the market to collect the items. This is part of my appointment book. Well, this is standard" (Food Sharing member, Munich, female, 20-30 years old, student).

"All food savers are trained. You are required to sign a waiver, so the whole thing is legal. You need to pass a quiz to show that you understand what you are doing. Yes, and then you will be verified. You must have done three test collections with an ambassador or a more experienced food saver" (Food Sharing member, Ulm, male, 20-30 years old, actor).

Both statements emphasize the importance of commitment in food movements. As discussed by Allen and Meyer (1990), organizational commitment, in this case commitment to Food Sharing, relates to the affinity of Food Sharing members towards their organization. The wish to belong, and the efforts made by interviewees to attain volunteer status are not based on moral obligation or normative pressure. Members' affective commitment is a sign of a strong identification with the movement.

Dumpster divers want to save money, believe they contribute to the common good through saving food from going to waste, and want to take a stand against the market economy. Some enjoy the stimulation from performing illegal activities. Among the dumpster divers interviewed instrumental and ideological motivations are dominant.

"Due to being in need. If you have almost no money or no money, then you have to stop thinking. You just try it because you are hungry"(Dumpster diver, Munich, male, 20-30 years old, student).

Some dumpster divers reported as their motivation to sustain their living as a student. Others underlined their unwillingness to work, and regarded dumpster diving as an opportunity to access free food (see also Fernandez et al. 2011). Other interviewees stated not to be in need themselves, but being in contact with homeless people or retirees who improve their living through dumpster diving. These findings confirm the study by Eikenberry and Smith (2005) who identified dumpster diving as a common practice among low-income groups. Our study adds that also retirees are among low-income groups that rely on dumpster diving to improve their living.

Considering the ideological motivation, some dumpster divers outlined that they dislike the market system and the prevalence of consumption within the society. They blame "mindless consumers" and retailers for food waste. They consider dumpster diving as acting against the system and advocate the reduction of consumption (see also Nguyen et al. 2014). Another group is mostly concerned about food waste and wants to actively act against it, as well as raise awareness in the society.

"But now I'm no longer excited when I go to the dumpster. This became a routine for me. Moreover, I do this on public garbage cans, right on the roadside. That is nothing to me, even if ten people pass by. In addition, I want to do it in public, so people know, okay, there is somebody who is not in need but still does it. I used to work, for example, in the municipality, I am a relatively well-known face, and many people know me. I want to send a signal. People, there is so much inside, food, that is incredible" (Dumpster diver and Food Sharing member, Stuttgart, male, 20-30 years old, actor).

Divers with strong ideological motivations to act against food waste, turned out to also be active members of Food Sharing, and in addition, some were closely connected to Slow Food. These interviewees were dumpster divers first, but through reflecting on their motivation, they joined other organizations, which they perceive as more committed to political activism. Other divers are interested in community aspects, such as diving dinners or group diving. According to Nguyen et al. (2014), social motives, such as sharing and companionship, play an important role. The current study confirms these findings only in parts, since the motivation to join group activities also has an instrumental nature, as shown by the following statements of two dumpster divers.

"I have not done it in a larger group. I usually go alone or with my roommate. Since I miss the contact with a larger group, which has actually been one reason why I made this Facebook page, so I will get in touch with such a group. Of course, I cannot say in public, come here, we go dumpster diving" (Dumpster diver, Munich, male, 20-30 years old, student).

"I think that within the group, you know better which food people want. And you can even better search for it. In addition, of course, the success rate that you get what you need is probably higher, eight eyes see more than two eyes" (Dumpster diver, Munich, male, 20-30 years old, student).

In all food movements, the motivations presented by Klandermans (2004) could be found. Table 2 presents the motivations of food movement members categorized into instrumental, ideological, and identificational motivations. Among Slow Food and Food Sharing members, ideological motivations, for instance, the reduction of food waste for the good of the society, and identificational motivations were prominent. The motivations of dumpster divers were of instrumental and ideological nature. The dumpster divers interviewed, stated economic motivations, such as saving money, and ideological motivation, e.g., acting against consumption and waste. Identificational motivations were not found. In contrast to Slow Food and Food Sharing members, dumpster divers have no organizational background. The organizational background, and the contact with other members throughout the organization might have had an

influence on members' motivations. Instrumental motivations of Slow Food and Food Sharing members were rather of psychological nature, and did not include economic benefits.

Table 2. Motivations to participate in food movements

Food Movement	Instrumental motivations	Ideological motivations	Identificational motivations
Slow Food	▪ Health ▪ Pleasure	▪ Act against food waste ▪ Concerns about agricultural practice	▪ Promote food value and commensality ▪ Be a part of Slow Food activities
Food Sharing	Not found	▪ Act against food waste	▪ Promote food commensality ▪ Be part of Food Sharing activities
Dumpster diving	▪ Save money ▪ Fulfilling a need ▪ Enjoyment ▪ Stimulation	▪ Act against the market system ▪ Consumption and waste	Not found

Knowledge of Food Waste and Other Food Movements

Knowledge related to food waste differs widely among members of the three movements. Slow Food and Food Sharing members explain the various causes of food waste within the supply chain. They mention the problem of standards and norms within food production, and discuss the usefulness of the-best-before date in retail. Further, they perceive the expectations of German consumers with regard to the availability of every product at any time as too high. They wish that supermarkets offered only seasonal and regional products. The aspect of product availability reveals anti-consumption tendencies (Nguyen et al. 2014). The desire for seasonal and regional products, reflects the goals of their organizations. The interviewees correctly identified that a substantial amount of food waste occurs on the household level, and furthermore a considerable amount of produce gets sorted out due to EU-norms on the agricultural production level. A German study estimates that 59% of the food waste occur on the household level, 7% are attributed to retail, 17 % to processing, and 17% to hospitals and other large scale consumers (Kranert et al. 2012, 184). This estimate excluded the production level.

The amount of food waste occurring in German agriculture is yet to be determined. A Swedish study aiming to quantify the amount of waste occurring in agricultural production identified the difficulties involved. One reason for the lack of data on the production level is that produce intended for the food industry can be affected by diseases and then will not be defined as food. In addition, produce remains in the field if the cost of harvest and other processing cannot be recovered (Eriksson 2012). The interviewees might have addressed the level of production, since they are familiar with agricultural production through their activities within the movement. In addition, interviewees provided detailed suggestions for the reduction of food waste on the household level and for the gastronomy sector. They suggested decreased sizes of meals, and a system that requires consumers to pay additional money for what they waste. Furthermore, they highlighted the importance of food knowledge and cooking skills. Interviewees believe that food

is wasted on the household level, since people do not know how to cook fresh produce, or do not have time for cooking.

Slow Food and Food Sharing members are aware of each other as food movements, since they collaborate for certain events. Examples of other organizations that interviewees know are the German Farmers' Association and food banks. Both movements appreciate governmental campaigns with regard to food waste, but criticize that awareness is not enough; they ask for changes in policies. The knowledge of regular dumpster divers who are not also members of other food movements is mostly limited to the retail and the household level. They are neither aware of governmental campaigns nor of other food movements, such as Slow Food or Food Sharing. Only four of the five dumpster divers who are active members in Food Sharing and in contact with Slow Food have comprehensive knowledge on the topic. Since dumpster divers do not lack education, as many of them are students, the organizational background of Slow Food and Food Sharing may explain part of the knowledge gap.

Activities to Reduce Food Waste

Interviewees participate in and organize activities to reduce food waste within their movements. Slow Food members believe that their movement contributes to the reduction of food waste through public events. The events have both an educational and a social character. Particularly, Slow Food Youth members underline their activities to reduce food waste. Examples are "Eat ins", "Disco soup," and a yearly demonstration against food waste and current agricultural practices in Berlin, the German capital. The demonstration is organized during a well-known agricultural trade fair, the International Green Week, and therefore reaches many people and garners media attention. For "Disco soup", Slow Food Youth members collect vegetables from local growers that do not meet EU standards, in terms of their appearance. Slow Food Youth members and other people who join the event prepare and cook the vegetables together. The event is accompanied by disco music. With the event, Slow Food Youth members want to raise awareness that too much food is wasted in Germany, and that the produce that does not comply with standards is still a pleasant tasting meal. An "Eat-in" is a common dinner, where each member prepares food, and all dishes are shared among the participants. In addition, parts of the Eat-in can come from dumpsters or Food Sharing. This example shows that Slow Food Youth members are connected with other food movements.

Further Slow Food events are food markets, as well as, cooking with children, students, or adults. During these events, Slow Food members teach how to plan grocery shopping and meals, how to prepare fresh fruits and vegetables, and promote local food. Interviewees emphasize that they enjoy cooking and eating together, but that these events should prevent food waste. Slow Food members believe that if they pass on the knowledge how to plan shopping and teach cooking, less food will be wasted. In addition, Slow Food members consider their campaigns as an inspiration to society, and perceive them as a contribution to increased awareness of food waste.

Food Sharing members collect unmarketable food items, daily or weekly from markets or shops and offer them on online platforms. The platforms also serve as discussion forums. Interviewees emphasize further activities, for instance the installment of local spots. Spots are rooms or refrigerators, where shared food is open to the public. Their activities include cooking events,

where volunteers and guests prepare meals with the collected items. Interviewees note that part of the goals of the activities is to demonstrate the importance of food. Food Sharing members want to underline that the value of food cannot be reduced to its retail price. Part of the Food Sharing philosophy is to consider food as means of living.

"No, it is free. That is give or take. Therefore, there is no exchange, everything works without any money. In addition, of course, and there is not a direct swap. This is also an important factor in food sharing, that we want to exclude food from all exchange factors, especially money. We just want to bring back the ideological value of food. And that's it. For example, if you throw away an apple, you do throw away only the value of the good, 60 or 80 cents. However, you throw away this apple, with all its resources, with labor, with transportation costs, and so on. The apple was watered and fertilized and automatically all this goes to the bin. Moreover, this we want to put into the spotlight, food is a mean of living. And this is actually one of the most important tasks of Food Sharing. That is why, even if you take from somewhere, you need not give back. It is for the cause that food is saved" (Food Sharing member, Stuttgart, male, 20-30 years old, actor).

Some dumpster divers emphasize the benefits and disadvantages of the activity itself, and underline the communal aspects of the activity. Other divers see their activity as a contribution to reduce food waste, and as a measure, which increases awareness within the society. Group divers report on joint cooking afterwards. Furthermore, divers share surplus items through social networks and the Food Sharing website. Similar as reported by Nguyen et al. (2014), dumpster divers clean food in order to wash away the stigma of their activities, or simply for hygienic reasons. Some interviewees report to fear diseases or the reaction of their closest social environment. The divers stated that they would not offer food coming from a dumpster to anyone without telling them. While motivations to dumpster dive are generally of an instrumental nature, which implies self-centered motivations, divers act social among each other. Interviewees reported that they let people in need take the food items from the dumpster before they help themselves.

Considering the activities of the three movements, they raise public awareness and contribute to the reduction of food waste on a small scale. Still, the effectiveness needs to be questioned, considering the extent of the problem. Besides the activities to reduce food waste, an important activity in all movements is the sharing of food.

Food Movement Activities in the Context of Fostering Change

As outlined by James and Van Seeters (2014), the desire for change is a defining characteristic of a social movement, and activities aim to foster change. Therefore, the typology of Den Hond and De Bakker (2007) is applied to activities of Slow Food, Food Sharing, and dumpster diving (see Figure 2).
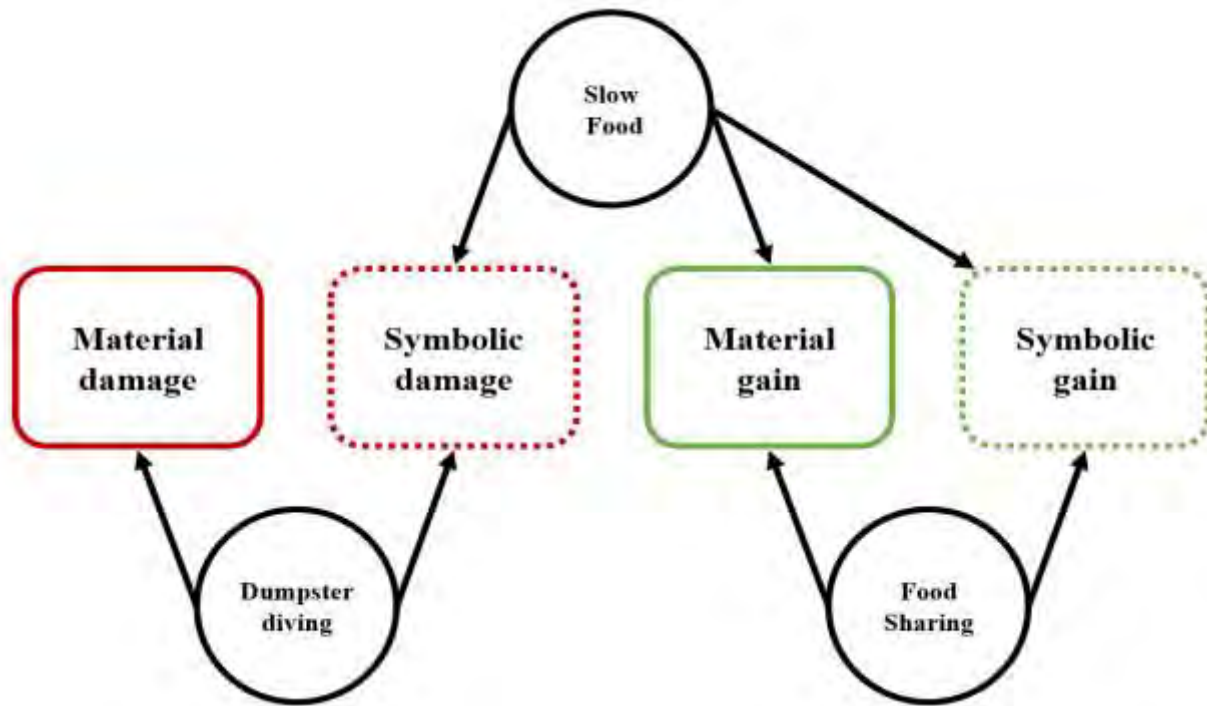
Figure 2. Tactics to Foster Change in German Food Movements

Slow Food members use material gain as tactics to foster change in the society. Interviewees prefer small-scale, local food providers over others, which is a form of "buycott." Slow Food relies on collaboration with other food movements, e.g., Food Sharing, as well as cooperation with governmental authorities. Furthermore, Slow Food members volunteer at events or other organizational activities, which is a form of symbolic gain. Symbolic damage may occur as a side effect of their public campaigns, and is one of the goals of the annual demonstrations in Berlin.

Similarly, Food Sharing members prefer local food and avoid global food retail chains. In that regard members even note that the activities within their organization strongly influence their actions in a private context. Members identify themselves with the organization and value it. Accordingly, they adjust their behavior and values towards the organization's philosophy.

"I try to buy in small shops. In small health food stores or where I know that they produce locally. If I need a loaf of bread, then I go to the bakery" (Food Sharing member, Munich, female, 20-30 years old, student).

"I told my friends not to give me anything material for my birthday or for Christmas. Just something to eat or drink" (Food Sharing member, Hamburg, female, 20-30 years old, nurse).

Moreover, Food Sharing as an organization collaborates with Slow Food, which also represents material gain. Both organizations have similar goals, and partly support each other's activities. For example, Food Sharing members help to collect food from farmers and retailers for events such as "Disco soup". As outlined by Den Hond and De Bakker (2007) volunteering belongs to

the tactics of symbolic gain. With respect to Food Sharing, this is a very dominant tactic of the movement. Since Food Sharing strives to be independent from financial means, members volunteer for the organization and are involved in events and activities without financial compensation. Food Sharing does not use symbolic or material damage as tactics to foster change.

In contrast, dumpster divers cause symbolic damage and, at the same time, material damage. This is due to the nature of the activity and can be explained by the individuals' motivations to dumpster dive. Since the motivations of regular dumpster divers who are not also members of Food Sharing are more self-centered, and of an instrumental nature, dumpster divers have little interest in collaboration with other food movements. This could explain the absence of any forms of gain as tactics. In addition, the lack of an organizational background might be another explanation why forms of gain were not found. By taking food items from dumpsters, the divers believe to move outside the market economy. Their actions can also be framed as a boycott of regular shops. In this interpretation, dumpster diving is not only a practical activity to reduce food waste. According to Nguyen et al. (2014), dumpster divers view the current society as too strongly focused on consumption. Therefore, their activities have to be conceived as form of protest against a consumer society.

Comparing the activities of the three movements, it is noticeable that different from the dumpster diving movement, Slow Food and Food Sharing do not use material damage as a tactic to foster change. Since Slow Food and Food Sharing are movements that are still growing, and desire to increase membership numbers and acceptance within the society, material damage does not appear as an appropriate tactic, since it would reduce the reputation of the organizations. With respect to symbolic damage, it must be considered that Food Sharing is a rather young movement. It is still establishing membership and structure, and fully relies on volunteers. The organization does not have the financial background and capacities to organize campaigns and demonstrations to use symbolic damage as a tactic.

Material gain in the context of Slow Food and Food Sharing refers to the activities of the organizations. Since interests and activities of both organizations are overlapping, a collaboration is of value for both organizations. "Buycott", as a further tactic of material gain, is rather related to individual members' choice than to the entire organization. However, since the organizations' philosophy might influence this choice, it is present for both Slow Food and Food Sharing members interviewed. With respect to the adaption of symbolic gain as a tactic, both, Slow Food and Food Sharing members volunteer for their organization. By considering the organizational model and the organizational philosophy of Food Sharing, it becomes obvious why members volunteer, because Food Sharing aims to become an organization independent of financial inputs. Therefore, they have adopted symbolic gain as a tactic. The Slow Food philosophy is rather the opposite. The valuation of Slow Food products and services is reflected in prices. Consequently, members are asked to pay membership dues. However, members also volunteer. This activity reflects the importance of the organizational goals and the members' desire to accomplish change.

Conclusions

Results underline a strong social component in the activities of German food movements. All movements strive to raise awareness of food waste and aim to reduce it. Their activities are a form of social happenings, which fulfill the needs of the members. At the same time, the activities are a form of activism that fosters change in accordance with the movements' goals. All movements show tendencies of anti-consumption. This also indicates that alternative consumption groups are gaining influence in Germany.

Marketing managers should not ignore food movement members as consumer target groups. Slow Food and Food Sharing members seem to be highly educated consumers who do not wish to share mainstream trends. In order to address these consumers' wishes, marketing strategies that positively emphasize the unique appearance of fruits and vegetables could be a solution. Austrian and Swiss marketing campaigns, such as "Weirdo" and "Unique" (ZEIT 2015; COOP 2015, REWE 2015) can provide an orientation. In both cases, retail chains included misshaped produce in their assortment, and the shelves with those products found acceptance among consumers. In 2015, the Swiss retail chain COOP extended this part of their assortment (COOP 2015). A similar strategy might be promising to retailers in other countries, since it could contribute to a more positive image. An indication of the acceptance of this kind of produce, as an additional food segment in German food retail, are successful startups, such as "Ugly Fruits – the shop for special fruits," which exclusively sells misshaped produce (Federal Ministry of Food and Agriculture 2015).

Alternatively, growers could sell their fresh produce not meeting EU standards as processed products via farm sales. For example, drinks and jams can depict the appearance of the misshaped produce on the packaging. In this way, the products might attract consumers favoring local produce and also children. Alternatively, growers could market the product with a marketing strategy, emphasizing that the ingredients are products that would have been wasted since they do not comply with norms.

Furthermore, politicians might consider adjusting laws and regulations with respect to food waste. Regulations that encourage the donation of unmarketable food items to social organizations would support people in need and spare them from having to rely on practices such as dumpster diving. In an effort to reduce food waste, the government could focus on providing unequivocal information to food retailers that donating unmarketable food items to charitable organization does not constitute an act of unfair hindrance (see the Act against Restrains of Competition §20(4), German Federal Law Gazette), since this is still misunderstood by some retailers.

In addition, the best-before-date requires critical reflection. In order to avoid food waste, consumers must understand that the best-before-date is not an expiration date. For retailers, the best-before-date is a critical point, since offering food items passed the best-before-date might not be in line with the quality expectations of consumers. A further aspect concerning the Act against Restrains of Competition §20(4) requires evaluation. §20(4) prohibits discrimination and unfair hindrance among German food retailers. The sale of food products below the price of purchase (see §2(2) of the German Food and Feed Code) is sanctioned. Similar to other

European countries, such as Switzerland and Norway, German retailer could be allowed to offer food products near to the best-before-date at a reduced price. This might be a reasonable strategy for retailers to reduce food waste, and to avoid drastic changes in regulation, as have currently been enacted in France. In May 2015, the French parliament implemented an amendment regarding food waste in the French food retail sector. Retailers are not permitted to discard food items. They have to provide the products for further utilization, for instance animal feed and other agricultural purposes. Stores with a size of 400 square meters and above, must support educational or charitable institutions with the food items that could not be sold (New York Times 2015).

With respect to the alternative use of food waste, Food Sharing could consider a more intensive exchange with food banks. As found in this study, as well as by Eikenberry and Smith (2005), low-income groups, such as homeless people, rely on dumpster diving in order to sustain their living. Cooperation between both organizations could help to prevent food waste and to support people in need.

Considering the movements' strategies to contribute to the reduction of food waste, a change in the focus of actions could be beneficial. The majority of activities are small scale, while the bigger picture of the problem remains untouched. Accordingly, Slow Food and Food Sharing, as food movements with an organizational background, could cooperate even more actively. Both organizations share common goals, and apparently, their members share motivations and interests. Joint events with a focus on prevention of food waste and education could take place. Since Food Sharing members already support events such as "Disco soup", they could also be part of events, where students and children learn how to cook and avoid food waste. Food Sharing members would enrich these activities with their practical knowledge and experience.

Through cooperation, both movements would reach larger audiences. Moreover, a collaboration between Slow Food, Food Sharing, and the Federal Ministry of Food and Agriculture could increase the awareness of food waste in Germany. The bundled skills of both movements to reach people and to raise awareness could be an asset to official campaigns and other measures to reach the public. The activities of the movements and using members' experiences could help develop authentic media and awareness campaigns.

Further research will investigate the process of change in food movements more deeply. A focus can be set on how individual members in food movements contribute to change within the movement and vice versa, how the organization contributes to change of the individual members. A comparison between Slow Food and Food Sharing seems promising, since both movements share an organizational background and there are some similarities with respect to their activities and concerns.

Acknowledgements

References

Allen, N.J. and J.P Meyer. 1990. The measurement and antecedents of affective, continuance and normative commitment to the organization. *Journal of Occupational Psychology* 63 (1): 1-18.

Belk, R. 2014. You are what you can access: Sharing and collaborative consumption online. *Journal of Business Research* 67 (8): 1595-1600.

Bitsch, V. 2005. Qualitative research: A grounded theory example and evaluation criteria. *Journal of Agribusiness* 23 (1): 75-91.

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.

Chrzan, J. 2004. Slow Food: What, why and to where? *Food, Culture and Society* 7 (2): 117-132.

COOP. 2015. Unique. Small individuals on the fruit and vegetable shelves [in German]. Online: http://www.coop.ch/pb/site/common2/node/80607266/Lde/index.html [accessed July 12, 2015].

Den Hond, F. and F. De Bakker. 2007. Ideologically motivated activism: How activist groups influence corporate social change activities. *Academy of Management* 32 (3): 901-924.

Edwards, F. and D. Mercer. 2007. Gleaning from gluttony: An Australian youth subculture confronts the ethics of waste. *Australian Geographer* 38 (3): 279-96.

Eikenberry, N. and C. Smith. 2005. Attitudes, beliefs, and prevalence of dumpster diving as a means to obtain food by Midwestern, low-income, urban dwellers. *Agriculture and Human Values* 22 (2): 187–202.

Eriksson, M. 2012. Retail food wastage. A case study approach to quantities and causes. Online: http://pub.epsilon.slu.se/9264/1/eriksson_m_121126.pdf [accessed July 20, 2015].

Federal Ministry of Food and Agriculture. 2015. Food that we buy is wasted. Too, good for the bin. Ugly fruits, even with some damages, attractive, healthy and tasty [in German]. Online: https:// www. Zu gut fuer die tonne.de/neuigkeiten/beispielhaft/artikel/ugly-fruits-trotz-kleiner-macken-schoen- gesund- und -lecker/[accessed July 16, 2015].

Fernandez, K.V., A.J. Brittain and S.D. Bennett. 2011. Doing the duck: Negotiating the resistant-consumer identity. *European Journal of Marketing* 45 (11/12): 1779-1788.

Food Sharing. 2015. Food Sharing. Share food instead of wasting it [in German].Online: https://foodsharing.de [accessed June 29, 2015].

Frost, W. and J. Laing. 2013. Communicating persuasive messages through slow food festivals. *Journal of Vacation Marketing* 19 (1): 67-74.

Ganglbauer, E., G. Fitzpatrick, O. Subasi and F. Güldnpfennig. 2014. Think globally, act locally: A case study of a free Food Sharing community and social networking. In: Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '14), ACM, February, 15- 19, New York, USA.

Gaytan, M.S. 2003. Globalizing the local: Slow Food and the collective imaginary. In: Proceedings of the annual meeting of the American Sociological Association, August, 16, Atlanta, USA.

Germov, J. and L. Williams. 2008. A qualitative study of Slow Food in Australia. In: Proceedings of the Annual Conference of the Australian Sociological Association (TASA): Re-imagining Sociology, December, 2-5, Melbourne, Australia.

Germov, J., L. Williams and M. Freij. 2011. Portrayal of the Slow Food movement in the Australian print media: Conviviality, localism and romanticism. *Journal of Sociology* 47 (1): 89-106.

Gustavsson, J., C. Cederberg, U. Sonesson, R. van Otterdijk and A. Meybeck. 2011. Global food losses and food waste. Extent, causes and prevention. Study conducted for the International Save Food Congress at Interpack 2011, Düsseldorf, Germany; Food and Agricultural Organization of the United Nations: Rome, Italy.

Hsieh, H.F. and S.E. Shannon. 2005. Three approaches to qualitative content analysis. *Qualitative Health Research* 15 (9): 1277-1288.

James, P. and P. Van Seeters. 2014. *Globalization and politics, volume II: Global social movements and global civil society*. London, Sage.

Jones, P., P. Shears, D. Hillier, D. Comfort and J. Lowell. 2003. Return to traditional values? A case study of Slow Food. *British Food Journal* 105 (4/5): 297-304.

Kera, D. and N.L. Sulaiman. 2014. FridgeMatch: Design probe into the future of urban food commensality. *Futures* 62 (Part B): 194-201.

Klandermans, B. 2004. The demand and supply of participation: Social-psychological correlates of participation in social movements. In: Snow, D.A., S.A. Soule and H. Kriesi (Eds.), *The Blackwell Companion to Social Movements* (pp. 360-379). Oxford: Blackwell Publishing.

Kranert, M., G. Hafner, J. Barabosz, H. Schuller, D. Leverenz, A. Kölbig, F. Schneider, S. Lebersorger, and S. Scherhaufer. 2012. Determination of food waste amounts and suggestions for reduction of the waste rate for food in Germany   [in German]. Institute for Sanitary Engineering, Water Quality and Solid Waste Management (ISWA), Stuttgart.

Laudan, R. 2004. Slow Food, the French terroir strategy, and culinary modernism. An essay review. *Food, Culture and Society* 7 (2): 133-149.

Lebersorger, S. and F. Schneider. 2014. Food loss rates at the food retail, influencing factors and reasons as a basis for waste prevention measures. *Waste Management* 34 (11): 1911-1919.

Leitch, A. 2003. Slow food and the politics of pork fat: Italian food and European identity. *Ethnos* 68 (4): 437-462.

Lubeck, J. 2014. Food Sharing – There are many ways, to avoid food waste. *DIE WELT* [in German]. Online: http://www.welt.de/regionales/hamburg/article132545750/Viele-Wege-Lebensmittel-nicht-zu-verschwenden.html [accessed January 12, 2015].

Neves, M.F., V.G Trombin and R.B. Kalaki. 2013. Competitiveness of the orange juice chain in Brazil. *International Food and Agribusiness Management Review* 16 (4): 141-158.

New York Times. 2015. France cracks down on food waste by supermarkets. Online: http://www.nytimes.com/aponline/2015/05/22/world/europe/ap-eu-france-supermarket-waste.html?_r=0 [accessed July 16, 2015].

Nguyen, H.P., S. Chen and S. Mukherjee. 2014. Reverse stigma in the freegan community. *Journal of Business Research* 67 (9): 1877–1884.

Noack, E.M, F. Hoffmeister and R. Marggraf. 2014. Food utilization desirable, but dumpster diving forbidden? In: Proceedings of 24th Annual Conference of the Austrian Society of Agricultural Economics, September, 25-26, Vienna, Austria.

Olson, M. 1965. The logic of collective action: Public goods and the theory of groups. Cambridge, MA: Harvard University Press.

REWE 2015. Green products: Weirdo. The variety of nature [in German]. Online: https://www.rewegroup.at/Nachhaltigkeit/Gr_ne_Produkte/Wunderlinge/rg_Content.aspx [accessed July 16, 2015].

Ryan, R.M. and E.L. Deci. 2000. Intrinsic and extrinsic motivations. Classic definitions and new directions. *Contemporary Educational Psychology* 25 (1): 54-67.

Sassatelli, R. and F. Davolio. 2010. Consumption, pleasure and politics. Slow Food and the politico-aesthetic problematization of food. *Journal of Consumer Culture* 10 (2): 202-232.

Slow Food. 2015. Food waste. Online: http://www.slowfood.com/international/164/food-waste# [accessed January 12, 2015].

ZEIT. 2015. Food: Vegetables, young, and wild [in German]. Online: http://www.zeit.de/wirtschaft / 2013-11/lebensmittel-normen-edeka [accessed July 16, 2015].

Appendix. Interview Guide for Food Sharing Members

Icebreaker
Please introduce yourself.
Are you member in a community or in a club? Please tell me something about this community or club. Please describe your role in that community or club.

Food waste
What do you know about food waste? Please tell me about food waste in Germany.
Please share your opinion, on the causes of food waste in Germany.
What do you think, what kind of measures must be applied to reduce food waste in Germany?
Please explain to me, who should carry out the suggested measures and why?
What do you do personally to reduce food waste? Please think about different situations in your daily routines.
How about food waste, if you eat outside home?
What do you think about governmental campaigns?

Food Sharing
How did you get to know Food Sharing?
What was on your mind, when you started becoming active in the organization?
What are your duties within the organization?
Please explain the situation, including your feelings when you saved food for the very first time.
Please explain the situation, including your feelings when you save food today.
Please share an experience regarding your activities that influenced you the most?
What happens to the food? Please explain us the entire process of food saving. If you reflect your activities in food saving today, compared to the beginning, what is the outcome?
Do you know other reasons why people save food?
What do you think, what are barriers, why other people do not join Food Sharing?

Other food movements
Do you know other organizations or actors concerned about food waste?
Can you tell me something about (actor/organization being mentioned)? What do you think about their activities?
How does Food Sharing interact with (actor/organization being mentioned)?

Change
Please reflect, how did your activity within Food Sharing affect your attitude towards food waste? Please reflect, did you also notice any change in your behavior with respect to food waste?
With respect to food waste, where do you see room for improvement?
Where do you see further potential for Food Sharing and their collaboration with other actors?

Wrap up
Is there anything that we have not discussed, that you would like to address?
Is there anything that you would like to ask me?

Sustainability Certification and Palm Oil Smallholders' Livelihood: A Comparison between Scheme Smallholders and Independent Smallholders in Indonesia

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Abstract

Most sustainability certifications in Indonesia are developed by Northern-based businesses and NGOs to regulate the production of agricultural commodities in the South. However, research still shows a lot of uncertainty about what sustainability certifications imply for the livelihood of smallholder farmers. Given these uncertainties, this paper explores the potential of certifications to improve the livelihood of smallholder farmers. To achieve this objective we developed an amended livelihood framework applied to an exploratory study of Indonesian smallholders who participate in the Roundtable of Sustainable Palm Oil (RSPO). Although access to markets and vulnerability are not improved through certification, indirect effects through organizational changes increase productivity. If certification schemes are weakly institutionalized, farmers will easily shift to a more profitable way of production. Further analysis is needed to discover the balance between the ethical aspects of certification while improving economic profitability for participating smallholders.

Keywords: sustainability certification, sustainable livelihood, smallholders, RSPO, Indonesia

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Introduction

Since the mid-1990s, voluntary sustainability standards and certifications have been introduced as a new governance model in global agrifood chains. Most of them aim to regulate the negative environmental and social effects of food production in Southern, often developing countries. However, their impacts on the livelihood of smallholder farmers at the production level are still widely debated (Auld 2010, Blackman and Rivera 2010, Bitzer 2012, Glasbergen 2013, Méndez et al. 2010).

Most studies analyze the impact on a combination of social, economic, and environmental indicators related to production processes of agricultural commodities. These findings are contradictory and fluctuate among attributing positive economic effects (Becchetti and Costantino 2008, Brandi et al. 2013, Bacon 2005, Beuchelt and Zeller 2011), social effects (Elder, Zerriffi, and Le Billon 2012, Giovannucci et al. 2008), environmental effects (Melo and Wolf 2007, Blackman and Naranjo 2012), towards insignificant effects (Ruben and Fort 2012, Valkila 2009, Bacon et al. 2008), mixed results (Pirotte, Pleyers, and Poncelet 2006), and even negative consequences of certification (Beall 2012).

We assume that these contradictions may be due to the different indicators that are used to measure impact, the different research methods, and, as we see as most important, the lack of a more generally accepted underlying theoretical consideration for the choice of variables. Based on this assumption, this paper aims to further explore the potential of certifications to improve the livelihood of smallholder farmers, asking the questions:

1) How can we conceptually understand the relationship between certification and the livelihood of smallholders?
2) What does an application of this conceptual understanding teach us about the factors playing a role in improving farmer's livelihood through certification and what challenges can be identified?

We are particularly interested in smallholder farmers' perspectives - what participation in the certification implies to them, what they value, what they regard as long-term positive and negative effects. To that end we developed an amended livelihood framework which comprehensively defines economic, social and environmental variables that may influence the relationship between certification and smallholder's livelihoods.

This analytical model is applied in an exploratory study of Indonesian smallholders who participated in the Round Table on Sustainable Palm Oil (RSPO). The RSPO, formally established in 2004, is a Northern-based international multi-stakeholder initiative in sustainable palm oil cultivation with members and participants from different backgrounds and with different interests, including palm oil processors and traders, consumer goods manufacturers, retailers, banks/investors, representatives of oil palm producers, and social and environmental NGOs. The RSPO is generally regarded as a promising certification scheme; it has a considerable impact on production processes and a market share of certified palm oil of about 15% (Schouten and Glasbergen 2012, Schouten, Leroy, and Glasbergen 2012).

Indonesia was chosen as our study field because this country is the largest producer and exporter of palm oil world-wide (WWF 2013). However, inclusion of smallholders in palm oil certification has proven to be difficult (Opijnen, Brinkmann, and Meekers 2013), despite efforts made by the RSPO to accommodate smallholders in the RSPO system. The General Assembly established a Smallholder Task Force (STF) in 2005, focusing on the relevance and applicability of the RSPO principles and criteria for smallholders. In 2012, the RSPO's Smallholders' Fund Initiative (SFI) was launched to support the smallholders' certification process and to increase smallholders' awareness on the advantages of certification (Pesqueira and Glasbergen 2013).

Smallholders are an important but economically vulnerable production group in palm oil. Their vulnerability is partly due to the characteristics of the commodity: Fresh Fruit Bunch (FFB) or palm oil fruit should be milled within 24 hours after harvest to maintain its quality. As palm oil smallholders often do not have the means to sell and transport their FFB quickly, the quality of their FFB is easily reduced (Colchester and Jiwan 2006, Hanu and Sadjli 2013). Other factors contributing to smallholders' economic vulnerability are uncertainty about market access, price fluctuations in the market, lack of knowledge about maintaining palm oil plantations which reduces their productivity, and their dependency on agents to sell their outputs to mills (Papenfus 2000, Marti 2008).

In the coming years, the claim for a more sustainable production, including that of smallholders, will become even more important. Smallholder oil palm plantations in Indonesia increased from 3,125 ha in 1979 to 3,387,257 ha in 2010 and cover 40% of the total area of oil palm plantations. These areas are predicted to increase continually and reach 4,166,778 ha by the end of 2014 (Directorate General of Estate 2011). Moreover, the Indonesian government is in the process of developing its own sustainability standards and certification scheme called Indonesian Sustainable Palm Oil (ISPO), which will be mandatory, and aims to include the smallholder farmers (Hospes 2014).

Presently, only 3.8% (of 4,415,800 hectares) of the smallholders' oil palm plantations have been certified (estimated value[1]). We expect the experiences from the first certified smallholders (either positive or negative), on which this study focuses, may have an influence on the willingness (the target group) of uncertified farmers to participate in a certification scheme.

This article is structured as follows. In the first section we develop the analytical framework that conceptualizes the relationship between certification and livelihood outcomes. Thereafter we introduce the research field and our research methods. Our research findings are presented in the next five sections. The last section reveals the pattern of relationships that has become visible and reflects on our research findings.

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[1]The percentage of certified plantation is calculated by comparing total certified (independent and scheme) smallholders' land area with total area of smallholders' oil palm plantation in Indonesia. Certified Independent smallholders in Indonesia: 1,199 ha; certified scheme smallholders in Indonesia: 165,181 ha (Primary data).

Conceptual Model

Following van Rijn, Burger, and den Belder (2012), who connected the livelihood concept to impact research, we take the livelihood concept as a starting point to analyze the relationships between certification and smallholders' living conditions. We consider the livelihood concept a powerful notion to select and arrange variables and to create order in the conceptual complexity underlying the relation between certification and impact.

The livelihood concept is rooted in development thinking that traditionally focused on production, employment and income to describe poverty levels. This approach was considered too narrow and could not explain the complexity of interacting aspects that influence the situation of the rural poor. The livelihood notion therefore introduced a more comprehensive approach to poverty alleviation (Chambers and Conway 1992, Scoones 1998, Carney 1998, DfID 1999, Ellis 2000) that goes beyond analyzing the economic realities and opportunities of the poor.

Based on the definition of the Department for International Development (DfID), the concept of livelihood comprises the capabilities, assets and activities required for sustaining or improving a means of living (DfID 1999). At the core of the livelihood concept lie the assets (resources) that can be utilized to undertake production, engage in markets, and improve ways of living (Scoones 1998, Utting 2009). Assets are conceptualized as different forms of capital: human, social, financial, natural, and physical capital (Scoones 1998, DfID 1999). Human capital refers to skills, knowledge, and health needed to enable people to pursue different livelihood strategies and achieve their livelihood goals (DfID 1999). According to Scoones (1998), social capital refers to empowerment—the opportunity to form networks, membership of groups, and relationships. Financial capital comprises all stocks and flows in income, credit, and savings (Scoones 1998, DfID 1999). Natural capital encompasses natural resources including biodiversity, land, and forests. Issues of transport, shelter, water, energy, and communication belong to the category of physical capital (DfID 1999, Scoones 1998, Utting 2009).

These forms of capital provide smallholders the capacity to act and sustain or improve their livelihood. However, all these forms of capital are assumed to be influenced by (a) external factors, referred to as the vulnerability context, which encompasses critical economic trends, shocks and seasonality; (b) transforming structures and processes, such as policies and legislation; and (c) strategies of rural entities, which refers to activities and choices that smallholders make with the intention to improve their livelihood. A livelihood is considered sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base (Scoones 1998, Carney et al. 1999). In the sustainable livelihood approach this is indicated with the variable of outcomes, which results from livelihood strategies, and covers the conservation and enhancement of social, environmental and economic aspects.

Although it provides an underpinned interpretation of the potential relationships between certification and impact on living conditions, the sustainable livelihood concept has also been criticized. First, the concept is said to give scant attention to commercial factors such as profitability (Utting 2009) and lacks understanding of economic and market issues (Carney

2003). Second, it does not capture cultural issues, and lacks attention to power relationships, politics (Adato and Meinzen-Dick 2002, Carney 2003, De Haan 2012), and the role of history and historical experiences (Adato and Meinzen-Dick 2002, Carney 2003). In addition, people's priorities and preferences are commonly missing from the framework while they are believed to play a fundamental role in determining livelihood strategies (Ashley and Hussein 2000). Another criticism relates to the inadequate representation of the relation between access to assets and a proper use of assets. Bebbington (1999) emphasized that social capital (indirectly) affects livelihoods because it provides access to resources. However, access to assets is a necessary but not sufficient condition to guarantee sustainable livelihoods, if the productive capacities of farmers are not linked to access to markets (Bitzer, Glasbergen, & Arts 2013).

Taking these criticisms into account, we developed an amended livelihood framework (see Figure 1) that connects certification to livelihood outcomes and addresses the criticisms by including additional variables. In this framework certification intervention is the independent variable and the livelihood outcome is the dependent variable. The framework consists of the following components: (1) the certification intervention; (2) livelihood components which consist of assets, livelihood strategies (activities), and livelihood outcomes; (3) smallholders' priorities and preferences; and (4) external factors.
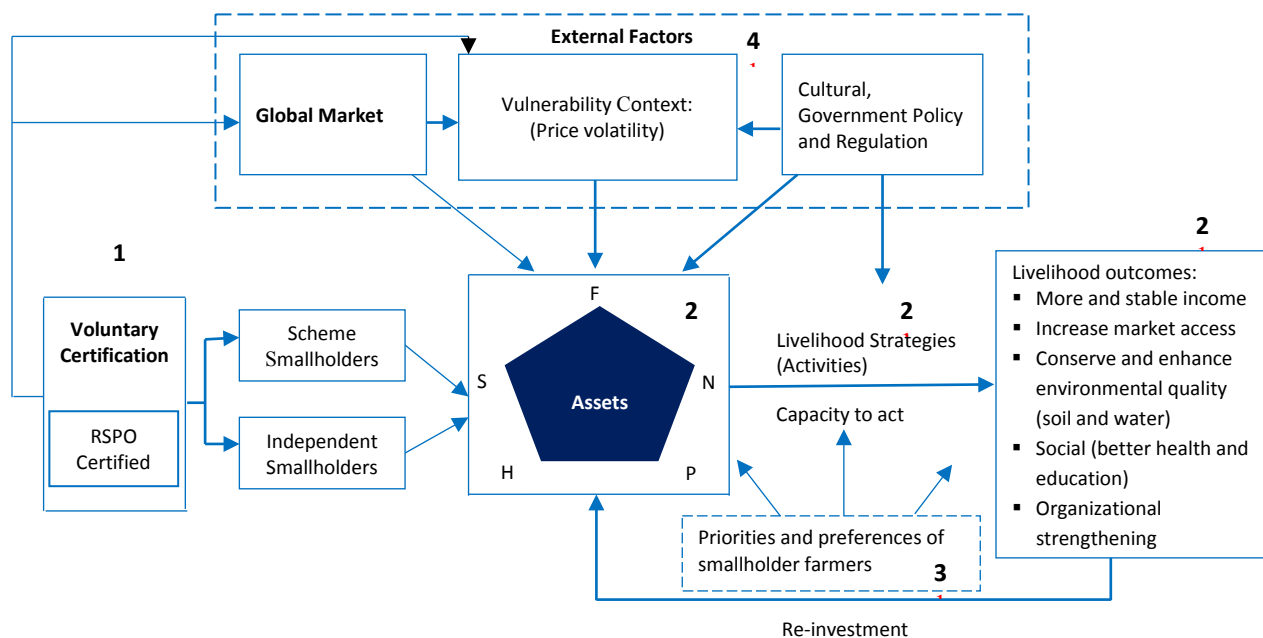
Figure 1. Conceptual framework amended from DFID (1999)

Based on this conceptual model (Figure 1) we hypothesize that sustainability certification can potentially support smallholders to improve their livelihood. This hypothesis has been further explicated in four assumptions.

- First, and most general, we assume that certification affects assets, which will then be used to perform activities that are expected to create better livelihood outcomes. We operationalized outcomes as increased and stable income, increased market access,

conserved and enhanced environmental quality, better health and education, and organizational strengthening.

−   Second, we assume that certification may improve livelihoods in three ways: (1) through directly changing the assets of smallholders, such as skills and management practices; (2) through increasing smallholders' access to the global market; 3) through reducing the economic vulnerability of smallholders, understood as the extent to which smallholders are influenced by uncontrolled or limitedly controlled factors such as price volatility.

−   Third, we assume that the preferences of smallholders play a role in the intervention process, as they influence choices to decide on what assets to invest, what activities to pursue, and what outcomes to be achieved.

−   Fourth, we assume that changes in livelihood should also be understood in the context of external socio-economic factors. Besides the context of the global market and external vulnerabilities, these are the cultural contexts (beliefs, history and traditions), politics, and other regulations.

Research Field and Methods

We took the conceptual model of Figure 1 as starting point and comparatively analyzed the role of certification in sustaining and enhancing the livelihoods of two groups of smallholders: scheme smallholders and independent smallholders.

Respondents in the certified scheme smallholders group live in the province of South Sumatera, which is the third most important province in Indonesia in terms of smallholder land-area and an important site of scheme smallholder production of palm oil. Scheme smallholders are structurally bound by a contract or credit agreement to a particular mill or estate. Scheme smallholders are often not free to choose what crop they develop, are supervised in their planting and crop management techniques, and are often organized, supervised or directly managed by the managers of the mill, estate or scheme to which they are structurally linked (RSPO 2009). Scheme smallholders in our research represent the PT Hindoli/ Cargill Group, which was the first RSPO certified scheme-smallholder group in the world.

The scheme smallholders group consists of 8,797 members and covers 17,594 ha oil palm plantations. The smallholders scheme in PT Hindoli, explains Ross (2010), originated from a government transmigration project (PIR-Trans scheme, which was established in the early 1980s for growing soybeans. However, the soybean project failed and in 1991 PT Hindoli received government approval for the development of oil palm plantations including a plasma (smallholders) plantation establishment. The project was financed by PIR-Trans scheme and KKPA (*Koperasi Kredit Primer Anggota* or Cooperative Credit Scheme). PT Hindoli established a Farmers Development Department and hired Farmer Development Assistants located in the village to train the smallholders. PT Hindoli was taken-over by Cargill in 1995. The smallholder oil palm plantations were planted in the early 1990s and the palms are now mature and in the first cycle.

The respondents from the independent smallholders group are from the province of Riau, which has the highest share of smallholder land-area and smallholder production of palm oil in Indonesia. Independent smallholders are characterized by freedom to choose how to use their lands, what crops to plant and how to manage them. They are self-organized, self-managed, self-financed, and not contractually bound to any particular mill or association (RSPO 2010). We studied the *Asosiasi Swadaya Amanah* group. This is the second largest independent smallholder group in the world and the first RSPO certified in Indonesia (Savi 2013).

There are 349 independent smallholders in *Asosiasi Swadaya Amanah* who have individual agreements with the association to comply with the RSPO certification requirement. *Asosiasi Swadaya Amanah* comprises 10 sub-groups of farmers and covers 763 ha of land. All the palms are in the first planting cycle and matured. Gustomo (2013) explains that the land of *Asosiasi Swadaya Amanah* members was originally obtained via government lease and the land status is officially issued by The National Land Agency in the form of *Sertifikat Hak Milik* or Land Ownership Certificate. This certificate indicates that the land of the association is neither illegal nor under conservation areas. The independent smallholders in *Asosiasi Swadaya Amanah* sell FFB to a partnering mill, specifically Ukui Palm Oil Mill that belongs to PT Inti Indosawit Subur (IIS).

The data collection methods covered semi-structured in-depth interviews, informal discussions, participant observations and literature studies. The interviews consisted of questions regarding smallholders' motivation to join the RSPO, the institutional changes the membership induces, and perceived effects of certification on livelihood outcomes. Semi-structured interviews were held with 66 certified smallholders (34 scheme smallholders and 32 independent smallholders). Farmers were selected with the help of representatives of farmers group. To guarantee that the results would not be colored by the influence of (changes in) property rights and livelihood strategies imposed by actors outside the certification schemes, we only selected farmers who own and manage their land themselves. Farmers had to be literate and able to communicate in the Indonesian language (Bahasa).

During the time at the villages the first author participated in meetings and also had many informal discussions with farmers about the topic of the research, for example with those farmers that were hesitant to participate in the formal interviews. Additional Interviews were conducted with other stakeholders, such as companies, government actors, farmer organizations, an NGO and experts (see Table 1). These interviews were partly used to verify the results of the interviews with the smallholder farmers.

As the farmer groups are very homogeneous in aspects such as ethnic background, level of education, land area, and start of the plantations, this sample is regarded to represent a normal distribution of the population in the villages; results will not be influenced by significant differences in demographic background. A tabulated pivot table was used to capture whether respondents experienced any relationship between the components of Figure 1, and the type of relationship they experienced. This table was subsequently used as the main basis for deriving our results and conclusions.

Table 1. Interview Subjects by Affiliation.

No	Respondent	Number of Formal Interviews
Smallholder Groups		
1	Independent smallholders from *Asosiasi Swadaya Amanah*, Riau	32
2	Scheme smallholders from PT Hindoli, Cargill Group, South Sumatera	34
Key Informants		
1	Farmer organizations (cooperative, association)	5
2	Government (district, regional and national such as Directorate General of Estate)	6
3	NGO (WWF)	1
4	Expert (Green Palm Company, RSPO Secretariat and researcher)	3
5	Palm oil company (PT Hindoli)	3
	Total	**84**

Motivations to Participate in the Certification Scheme

The two groups of smallholders in our study came to participate in the RSPO with a similar understanding of the potential of certification. For both groups, certification was something new; a program that came from abroad and that was introduced to them by an external actor. In fact, the smallholders were unaware of the philosophy behind sustainability certification and the concept of the RSPO. For them, certification was (and still is) a set of technicalities that need to be fulfilled to improve their production and get a better price for their FFB. One farmer said:

> "*RSPO is English, I am Indonesian and I did not go to school. I do not know what the RSPO is. But I do know and do apply the technical things. RSPO obliges farmers to have a land certificate; we are banned to do total spraying.... Obviously, I want to join the RSPO because the RSPO guarantees selling of the certified product …*" (Independent farmer).

Another farmer said:

> "*…I do not know what the RSPO stands for; after joining the RSPO our oil palm plantation became environmentally friendly because we reduced the use of chemicals …. For farmers the first and the most important thing is a higher price of the product*" (Scheme farmer).

Their motivation to join the certification is related to this unawareness about what the RSPO stands for. Our data show that all smallholders mention financial considerations as their main motive for joining RSPO. Motives related to social and environmental improvements did not play a significant role in their decisions. The smallholders see certification as a marketing tool and not as a tool to create a more sustainable production. In our cases, participation in the RSPO certification scheme was even more attractive as the certification-related costs were covered by external actors; the nucleus company for scheme smallholders and an NGO for the independent smallholders. These motivations give a first indication on how farmers may value the effects of the RSPO on their livelihood, namely, in economic terms.

Organizational Consequences of Participation in the Certification

As smallholders cannot directly access certification individually (Bitzer, Glasbergen & Arts 2013, Brandi et al. 2013), and need support from external actors to comply with the standards (Lemeilleur 2013), participation has implications for the organizational structures within which they work. Regarding the RSPO, the organizational changes also result from the obligation that the smallholders should join a group certification and establish a group manager who is responsible for an internal control system (ICS) to monitor smallholders' performance (RSPO 2013b).

These organizational requirements have different consequences for the groups of smallholders. Scheme smallholders can only enter the market of certified palm oil when the nucleus they are connected to is certified. Their organizational embeddedness does not change that much. For scheme smallholders, certification is led by a group manager coming from the nucleus company. This nucleus company is responsible for the establishment of internal control mechanisms including the standard operational procedures (SOP) and a 'farmer development' team in order to conduct an internal audit. Figure 2 shows three important actors supporting scheme smallholders to become certified, namely a group manager, the Cooperative/Village Unit Cooperative/*Koperasi Unit Desa* (KUD), and farmer groups.
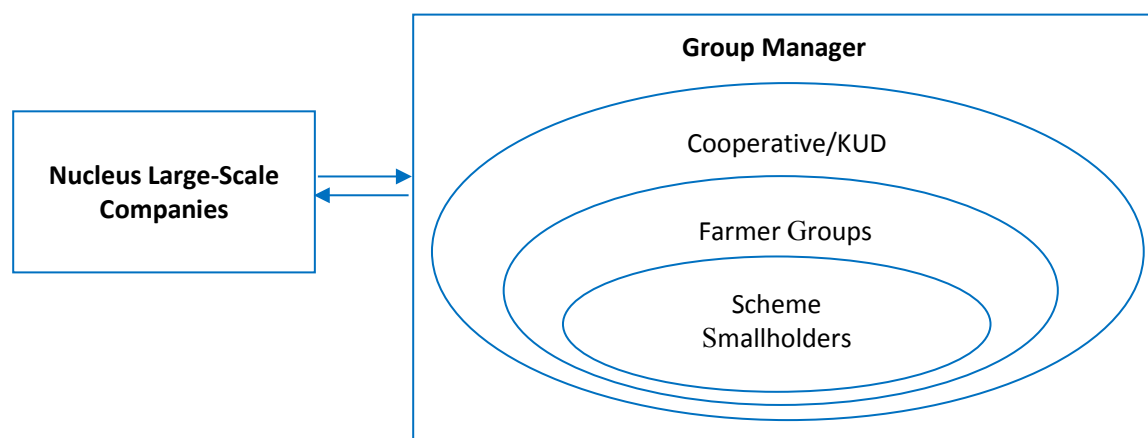
Figure 2. Key actors supporting scheme smallholders to participate in sustainability certification.

Although participation in the certification does not change the scheme smallholders' organizational embeddedness, the roles of the cooperative and farmer groups become more pivotal. After joining the certification, all plantation activities ranging from input supply and credit support to FFB selling, are centralized in a KUD. The KUD also provides a forum for sharing and communicating problems as well as the possible solutions related to palm oil plantation. The KUD, however, cannot manage all individual smallholders directly; farmer groups are important to link the KUD with individual scheme smallholders. The farmer groups are a forum for sharing knowledge and information on a smaller scale. They also supervise all oil palm plantation activities, including fertilizer application, harvesting, sorting, loading and transporting the FFB, and distributing income from FFB selling to farmer members. A post harvesting monitor needs to guarantee traceability of the RSPO FFB from certified smallholders to mills.

The independent smallholders entered the RSPO scheme after being made aware of the certified market by an NGO: WWF Indonesia. The NGO purposefully selected these independent smallholders because—as Java Trans migrants, they already had a long experience with farmer groups and a legal status of their land. The same ethnical background translates into comparable interests and easiness to communicate with each other. The smallholders were also selected because they are located near a conservation area. This is related to the objective of the NGO: conserving biodiversity through the certification of sustainable palm oil plantation management. Participation in the RSPO certification changes the independent smallholders' organizational structure more fundamentally than for scheme smallholders. Joining certification implies that the smallholders need to select a group manager from the farmers; one who is experienced in managing cooperatives or farmer groups. They also have to organize themselves to establish a quality control mechanism. They need to construct an internal control system (ICS) team for the internal audit and arrange the standard operational procedures (SOP). In the audit process they have to convince the third party auditor about the reliability of the SOP and the capability of managers and the ICS team. Figure 3 illustrates actors that support independent smallholders to participate in the sustainable certification.
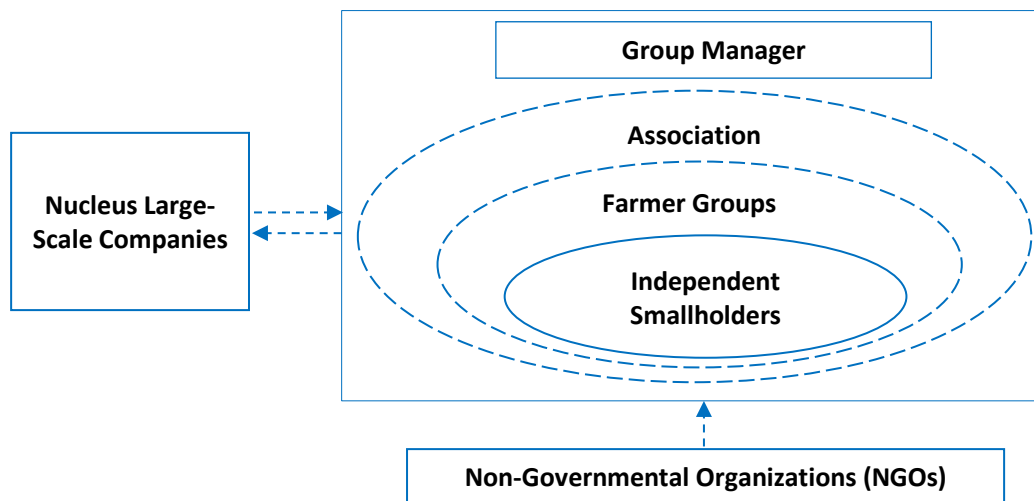
Figure 3. Key actors supporting independent smallholders to participate in sustainable certification

The independent smallholders' cooperative or association has more responsibilities than the scheme smallholders' cooperative. The association is not only responsible for the internal control mechanisms, which is also part of the nucleus company's responsibility for scheme smallholders, but also for selling the FFB, buying production input, and providing credit. In the same way, independent smallholders' farmer groups have more responsibilities than scheme smallholders' farmer groups. The functions of the independent farmer group are not only limited to supervision and knowledge sharing, but also include activities such as coordinating plantation activities to gain benefits from economics of scale.

Embeddedness of the Smallholders in New Dependencies

In both cases, participation in the certification put the smallholders in a system of new dependency relationships which determined their action space. The smallholders are dependent on the other stakeholders to get the RSPO certification and to gain benefit from participation in the certification. In the scheme smallholder case, the dependency on the nucleus company is stronger than before participating in the certification due to the rules of the RSPO. These rules require that certified palm oil growers with a Nucleus Estate Smallholder (NES) scheme are obliged to certify their smallholders within three years after the certification of the nucleus. The nucleus company is directly involved in the certification process; it pays for the RSPO membership and the costs of audits and takes responsibility for capacity building of the connected smallholders (e.g. training and strengthening farmer organizations). The company is also contractually bound to buy certified FFB from scheme smallholders and responsible for the distribution of a premium for Crude Sustainable Palm Oil (CSPO) sales (if buyers can be found who are willing to pay a premium). The new dependency of the scheme smallholders on the company obviously relates to the fact that the company is the one who holds the RSPO certificate.

Different from scheme smallholders, independent smallholders hold their own sustainability certificate. However, although independent smallholders are characterized as independent and not bound by a contract to a nucleus, participation in the certification makes them reliant on external actors. This dependency is triggered by smallholders' demand for, but incapacity to gain, credit, risk management, information, technology, and market access. The independent smallholders in our research became particularly dependent on an NGO: WWF Indonesia. The independent smallholders entered the RSPO scheme after they were made aware of the certified market by the NGO. Furthermore, the NGO socialized the required standards, conducted training, and helped to prepare for the RSPO certification audit. In turn, WWF was funded by the philanthropic Carrefour Foundation, which is concerned about the negative impacts of uncontrolled production of palm oil, to organize trainings.

WWF also facilitated the smallholders to join a company to receive technological help and they have sold their RSPO certificate via the Green Palm trading system, which is the channel to the market of sustainable palm oil, and the way to get a premium fee. The certified independent smallholders can sell their products in two ways. The traditional way is selling the FFB (physical) to a nucleus company/mill. If the FFB has a higher quality than uncertified FFB, the smallholders can get a higher price. However, in this case smallholders are fully dependent on the company. The second way is new and opened by the RSPO certification scheme. RSPO certified palm oil producers can register a quantity of their output with the Green Palm program. It is only through this trading program that the smallholders can sell their certified products to buyers (e.g. consumer goods manufacturers). They are awarded one Green Palm certificate for each ton of palm oil which has been sustainably produced. They can then put those certificates up for sale on the Green Palm web based trading platform to get a premium fee (see also http://greenpalm.org/).

Benefits of Participation in the Certification

Although the dependency relations of scheme and independent smallholders change in a different way through certification, the influence on their assets is more or less the same. Direct effects are observable in the assets of social and human capital, as well as some provisions that are related to physical capital. These direct effects are closely related to the new organizational structure, which provides the farmers with the necessary training to become certified. Therefore, these direct effects have already been visible or materialized from the first year of certification and can be identified as short term benefits.

Farmers' organizations are trained by the certification facilitators (companies or NGOs) to better manage their business (including filing data), to better communicate with members, and to build business relationships with the company and input supplier. This contributes positively to farmer's social capital (e.g. increase opportunities for networks and relationships) and human capital (skills and knowledge). The majority of smallholders hold the view that the farmer organization's staff is better trained and their services improved. They also feel that they have more opportunities to participate in the organizations.

Social and human capital is further strengthened through training of farmers in Good Agricultural Practices (GAP), focusing on integrated pest management, limited use of pesticide and spraying, proper fertilizer application, and best harvesting techniques. Furthermore, human capital is improved via trainings on High Conservation Values (HCV) and trainings on the concept of protected animals and Environmental Impact Assessment. At this training, farmers receive ample information on the safe use of chemical pesticides and safe ways to deal with chemical waste. In addition, they are also introduced to healthy and safe working conditions, first aid, and ways to deal with fire (see Ekayani, Nurrochmat, and Darusman 2015), that, in turn, contribute to better health conditions. Next to that, smallholders get access to elements of physical capital such as safety tools (masks, boots, helmets, gloves and affronts), chemical storage systems, sanitary rooms, waste ponds, and owl nests.

Other assets (natural and financial) are not directly improved through participation in the certification scheme, but indirectly through the process of capacity building. Moreover, these improvements are seen as long term effects that are not visible yet. Although smallholders cannot specify the value, they believe that sustainability certification may preserve natural capital. Our interviews indicate that scheme and independent smallholders, after becoming a member in the RSPO, have undertaken several conservation activities which result in positive livelihood outcomes in the area of conserving and enhancing environmental quality, such as planting bamboo or trees to prevent erosion and floods. They also conserve soil and water quality, for example through arranging palm oil midribs in a 'U' shape to reduce erosion, maintain soil fertility, and keep the irrigation channels clear from any obstructions to prevent flooding. Due to better understanding of the harmfulness of pesticides and herbicides to health and biodiversity, the farmers apply a waste management system. They never wash chemical containers in the river, but collect used chemical containers and send them to the cooperative and company to be destroyed safely. Furthermore, farmers use natural predators for eradicating pest by building owl nests and plant *Turnera ulmifolia* and do not hunt protected animals - such as

cobra snakes, owls, and *Varanus salvator* (water monitor lizard)- to safeguard biodiversity. The following comment of an independent smallholder is an illustration:

> *"... Maybe the effects [of certification] on environmental quality cannot be seen yet, because we are recently certified. But at least to reduce land and water degradation we have already applied many activities. We do not apply fertilizer in the dry season and do not wash fertilizer containers in the river to protect animate creatures in the river. In essence, RSPO teaches us to protect our nature...."* (Independent smallholder).

A scheme smallholder opinioned:

> *"... Effects on the environmental quality can be seen if we look at our plantation, which is greener now because we keep weed in our plantation to cover soil and reduce erosion due to surface runoff (rainfall), although it looks messy. Before joining RSPO, we believed that a good plantation is the one that is free from weed, so we applied total spraying with excessive herbicides"* (Scheme smallholder).

Certification is also considered to potentially contribute to an increase of smallholders' financial capital and hence to contribute positively to the livelihood outcomes (more income). Within this context certification is particularly valued by the smallholders because participation increases the volume and quality of their production, which opens opportunities for a higher income. Furthermore, understanding of Good Agricultural Practices encourages them to apply the right fertilizers at the right time and with the right dosage, which also increases the productivity of the plantation. Next, increasing knowledge on harmful chemicals leads the smallholders to reduce pesticide and herbicide use which reduces the cost of spraying from approximately IDR 900,000 – 1000,000 /ha/year to IDR 400,000 /ha/year (interview with head of independent smallholder association). Also, compared to uncertified smallholders, most certified scheme and independent smallholders believe that they get a higher price for their FFB. This higher price does not so much result from the fact that the FFB is certified, but from the fact that the quality of certified FFB is generally higher than uncertified FFB. In addition, centralization of plantation activities (including fertilizer application, spraying and selling FFB) increases smallholders' economies of scale that allows to share costs of production, management and transport. Table 2 shows the perception of farmers concerning the effects of certification on price, production volume, costs and income. Based on Table 2, the majority of smallholders perceived participation in the RSPO to positively contribute to price, production of FFB, and income, while decreasing cost of production.

Table 2. Smallholders' Perception Regarding Certification Effect on Price, Production, Costs and Income.

	Price (%)	Production (%)	Costs (%)	Income (%)
Higher	86	80	11	74
The same	14	17	12	11
Lower	0	2	77	2
Do not know	0	2	0	14

Table 3 summarizes the analysis of our data related to the different types of capital and several dimensions. The first dimension (direct versus indirect) refers to the presence of intervening variables that specify how a given effect occurs between an independent variable and a dependent variable, such as capacity building. The second dimension (short term versus long term) refers to the expected time lag between participation in the certification and effects. The third dimension (visible versus expected) takes the actual presence of results into account.

Table 3. Benefits of Certification on Smallholders' Livelihoods.

Assets	1st Dimension		2nd Dimension		3rd Dimension	
	Direct	**Indirect**	**Short Term**	**Long Term**	**Visible (materialized)**	**Expected**
Social Capital						
Strengthening organization	√		√		√	
Increasing smallholders' trust in organization		√		√		√
Increasing participation in organizations		√		√		√
Increasing connections and networking		√		√		√
Human Capital						
Increasing opportunity for training (improving knowledge and skill)	√		√		√	
Better health		√		√		√
Physical Capital						
Providing safety equipment and building chemical storage system, sanitary room, waste pond, owl nests and planting *Turnera*	√		√		√	
Natural Capital						
Conserving soil and water quality		√		√		√
Protecting biodiversity		√		√		√
Financial Capital						
Increasing income		√	√		√	
Increasing credit access		√		√		√
Premium fee		√	√		√	

Uncertainties of Participation in the Certification

Participation in the certification scheme does not only create benefits, but also new uncertainties that may hamper or counteract the earlier described positive effects of certification on livelihood outcomes. These uncertainties regard the premium fee, price volatility, market access and access to credit.

Premium Fee

Certified palm oil smallholders receive an annual premium fee which is different from premium prices for certified FFB at the farm gate[2]. Smallholders consider the premium fee as a bonus from a company or the Green Palm certificate sales. The amount of premium fee gathered by smallholders dependents on their production capacity and (for scheme smallholders) on the affiliated company. Therefore the policy and ability of the company to access international buyers who are willing to pay a premium fee plays an important role in the amount of premium fee. For independent smallholders, although they are facilitated by an NGO, their capability to negotiate with buyers of GreenPalm certificates determines the amount of premium fee they are able to receive.

The low uptake and slow growth of the Crude Sustainable Palm Oil (CSPO) uptake also influence the extent to which premium prices will be paid to the smallholders. In 2012, the actual volume of the CSPO produced was 6,724,236 tons, while the CSPO sales were 3,479,415 tons, which is only 51.7% of CSPO produced (RSPO 2013a). In 2013, the CSPO uptake did not significantly increase as the market absorbed only 52% of the global CSPO production in that year (WWF 2014). Furthermore, the global market share of CSPO is approximately 6% of the 58 million tons of global palm oil production (RSPO 2013a). WWF (2013) reported that in 2012 CSPO usage by the most important European markets equals 2,534,767 tons, which is approximately 43% of the 6,384,000 tons palm oil usage (Gerasimchuk and Koh 2013). These data show the lack of commitment of international buyers to support the sustainable certification and little possibilities to shift part of the certification costs to the buyer (World Growth 2013). It needs to be seen each year again if buyers are willing to pay a premium fee. This uncertainty becomes higher if more certified palm oil enters the market, while the demand for CSPO is not significantly changing.

The premium fee is managed by the cooperative (scheme smallholders) or association (independent smallholders) and is used to fund surveillance preparation such as training, safety tools, and ICS wages (for independent smallholders). It can also be used to fund social activities such as building a mosque. Premium fees are thus no direct source of income. The relationship between certification and livelihood outcomes in the financial domain should not be seen merely in terms of the availability of premium fees. Increased productivity and improved product quality more importantly contribute to the higher income of certified smallholders.

Price Volatility

Our interviews indicate that price volatility can be considered the most important factor to explain income insecurity. For example, smallholders experienced a sharp decrease of FFB price from IDR 2100/kg to IDR 760/kg (for scheme smallholders) or IDR 250/kg (for independent smallholders) at the end of 2007. This situation significantly decreased the smallholder's income. Smallholders try to cope with this permanent instability in different ways. The majority of the independent smallholders (56%) depends on a cooperative or association and uses the savings

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[2]For Independent smallholders, the average premium price is approximately $50/ton FFB, and the premium fee is around $1.82/ton FFB. For scheme smallholders, the premium price is managed by the farmer organization, there is no premium fee, and scheme smallholders directly receive premium prices as additional income.

and loans from the cooperative to contemporarily set-off a decrease in income. Around 16% of the smallholders employ non-agricultural activities and 13% has livestock as alternative source of income. The remaining 15% has even more than one income alternative. Different from the independent smallholders, the majority of scheme smallholders uses crop diversification as an income alternative (50%), although many of them still depend on the cooperative (26%) for a loan to fulfill their daily needs when their income decreases. Furthermore, approximately 9% of scheme-smallholders work in non-agricultural activities, 3% has livestock as alternative income, and 12% even has more than one income alternative.

Certification does not change the price volatility with which smallholders need to cope. Because of this, we can say that certification–although generally leading to higher income–does not result in more *stable* income. After becoming certified, smallholders stay (scheme) or become (independent) dependent on the company. Whether the company is willing to pay a higher price for certified palm oil depends on its policy, which may be different for each company. Although the FFB price is formally and by regulation, the same for scheme smallholders within a region and the incentive for certification is not regulated, it gives more freedom to companies to differ in their prices and limit surplus prices for certified palm oil. Scheme smallholders can, however, not go to another company (that may pay higher prices) because they are bounded to a company by contract. Independent smallholders have more leeway. They are free to decide to whom their FFB will be sold. Their choice is mainly determined by prices (which depends on the number of certified companies), and the distance to mills. However, the characteristic of FFB as a perishable commodity and the limited number of certified mills mostly constrain their choice. Also, independent smallholders tend to avoid risk and prefer to stay with one mill/company by arranging contracts and building commitment with the company. Maintaining commitment and social relations (social capital) are often as equally important for small holders as gaining higher prices.

Market Access

Smallholders do not have much insight into the market and global value chains. They consider the market as a place where they can sell their FFB directly, such as to middlemen (for independent smallholders), or to mill companies (for scheme smallholders). The smallholders perceive palm oil companies as the most important market for them as they pay higher prices than middlemen. Nevertheless, the number of certified mills is still limited; 107 mills (out of 324) are under 34 RSPO certified companies in Indonesia (RSPO 2014). In Pelalawan, Riau where independent smallholders reside, there are only three certified mills and in Musi Banyu Asin, South Sumatera there is only two. Certification limits smallholders' opportunities to access markets due to the limited availability of mills.

Scheme smallholders do not consider market access a benefit of certification. They have a market as the FFB of scheme smallholders must be bought by the corporation. In contrast to the scheme smallholders, independent smallholders perceive an improvement of their market access through increased opportunities for collaboration with companies. The FFB of certified independent smallholders is prioritized over uncertified FFB. Although in a peak season the certified smallholders are still able to easily sell their FFB. Therefore, independent certified smallholders do not need to spend extra transport costs and time to find alternative buyers.

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Furthermore, they can avoid deterioration of FFB quality and depreciation costs due to the time lag between harvesting and milling.

Access to Credit

Regarding access to credit, our research shows different results for scheme and independent smallholders. Our interviews indicate that the majority of independent smallholders (66%) do not observe an improvement in access to credit after joining RSPO. However, most of the scheme smallholders (59%) do experience better access to credit. Independent smallholders believe that access to credit is not influenced by participation in the certification, but by membership of a farmer organization. More than half— 56% of the independent smallholders rely on farmer groups, cooperatives or associations for their credits compared to 26% of the scheme smallholders. In contrast to independent smallholders, scheme smallholders believe that access to credit is affected by participation in the certification scheme because it increases income and their ability to repay loans. Moreover, better record-keeping and management of cooperative and farmer groups indicate the improvement of organizations' transparency. As a consequence, banks or other financial institutions have more trust in them and are more willing to provide loans.

The Role of Governments

Our data shows that external factors, such as the difficult access to the global market and vulnerability in terms of price fluctuations, do not change significantly with certification. Findings also indicate that government programs that are intended to improve smallholders' livelihood (for example through increasing oil palm productivity by providing palm oil seeds and subsidized fertilizers) do not succeed in doing so. This can be explained by limited information and/or access of the smallholders to these programs and by the fact that some of these programs are not even known by the smallholders. Training arranged by the government is only available to farmers who have just established new plantations or those who request training, which hampers the continuous development of human capital. Furthermore, and in line with Gauthier (2000) our study indicates that in the view of smallholders, policies often do not reach the poorest farmers due to limited budget allocation and bureaucracy. Improvements in infrastructure for example, are limited to village roads (*jalan desa*), while agricultural roads (*jalan usahatani*) (that are crucial to transport FFB) have to be established by the smallholders themselves. The smallholders in our research view the role of the government as non-responsive and even an obstacle to participating in the certification scheme. Because of complicated checks and approvals, all smallholders face a lot of difficulties to receive the Cultivation Registration Certificate (which is one of the RSPO requirements) showing that they comply with the national and local regulations. The following comment by the association management illustrates this:

> *"Cultivation Registration Certificate (Surat Tanda Daftar Budidaya/ STD-B) is very important after the Land Ownership Certificate (Surat Hak Milik/ SHM). The process is difficult because we need verification from the District Plantation Office and it should be signed by Head of the District Government… There has not been any support yet from the government… I think they only see oil palms as a matter of business…."*

Conclusions

To better understand the potential of sustainability certifications for improving the livelihood of Indonesian smallholder farmers we developed an amended sustainable livelihood framework as a conceptual model for our empirical study.

In accordance with the research of van Rijn, Burger, and den Belder (2012), who studied the impacts of coffee certification from a livelihood perspective, our research reveals that capacity building plays a vital role. Certification encourages the transformation of an unorganized, fragmented and uncontrolled production plantation into an organized one. First, certification requires organizational changes which are conditional in the certification process. Second, the changed organizational structure gives smallholders access to training, valuable relationships, and technology, which secures their ability to comply with the prerequisites, and improves production methods.

Organizational and technological changes induce a higher production quality that may benefit smallholders indirectly and financially. We found that certification, as a tool to create more sustainable agriculture, is not fully understood by the smallholders. Rather, certification is seen as an economic tool in the pursuit of a better livelihood. Smallholders participate because they have to (scheme smallholders), or because certification is introduced by trustful people who open opportunities for higher incomes (independent smallholders). Non-economic benefits from certification such as social and environmental improvements are less valued by the smallholders unless they lead to economic benefits.

Consistent with the findings of van Rijn, Burger, and den Belder (2012), our study reveals that participation in the certification process does not change farmers' dependency relations, nor their economic vulnerability and access to the market (scheme smallholders). Smallholders do not have much insight into the price setting of their products and they are still subject to unpredictable price fluctuations. There is also uncertainty about the uptake of certified palm oil in the market and premium prices. Furthermore, the governmental programs designed to improve smallholder livelihoods rarely reach them. Neither have the difficulties that result from smallholder alignments with certification programs become visible enough to influence the governmental programs designed to improve them.

Different from prior research which has focused on the impact of certifications on the environmental, social, and economical effects of sustainability certification (see Blackman and Rivera 2011, Alvarez and Hagen 2011), our research provides some first insights into the relationships between these impacts. These findings have led us to hypothesize that the ethical aspects of sustainability must be better aligned with the economic interests of the (Southern) farmers or the certifications will likely lead to weakly institutionalized practices.

The need to better accommodate the economic interests of farmers will probably increase as more smallholders are certified whereas the demand for certified palm oil is not growing. Currently the overproduction of certified palm oil lies around 50%; and many markets are not interested in buying certified palm oil if the price is higher than for conventional palm oil—a

similar trend is seen among other agricultural commodities certifications (KPMG Sustainability 2013).

This study examined two smallholder groups that are culturally homogeneously. Naturally, certification is more difficult if farmers do not share similar backgrounds as group belongingness and organizational identity are essential components to cohesiveness and willingness to work together in a group towards a shared goal. Cultural diversity and its impact on certification schemes is an underexplored topic in the current research. Such knowledge might further improve our understanding and potential for schemes to induce more sustainable livelihoods.

Also, the scope of this research did not examine the outcomes and relationships of uncertified smallholder groups, the difficulties in compelling them to participate in a certification scheme; and analyzing strategies to incorporate them while improving the livelihood effects of participation in sustainability certification.

Lastly, our research focuses on actors at the bottom of the value chain. However, these value chains are not power-neutral. As Bitzer and Glasbergen (2015) observed, with certification, smallholder farmers need to change production processes within their existing resources and power asymmetries. Their relative vulnerable position may influence the farmers' ability to cope with uncertainties inherent to participation in a certification scheme. Therefore, we suggest exploring the connection between the 'horizontal' livelihood framework and the logics of a 'vertically' organized agricultural value chain (see Vellema and van Wijk (2014)).

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References

Adato, Michelle, and Ruth Meinzen-Dick. 2002. Assessing the impact of agricultural research on poverty using the sustainable livelihoods framework. International Food Policy Research Institute. FCND Discussion Paper 128. http://ageconsearch.umn.edu/bitstream/ 16074/1/ep020089.pdf.

Alvarez, Gabriela, and Oliver Von Hagen. 2011. The Impacts of Private Standards on Producers in Developing Countries: Literature Review Series on the Impacts of Private Standards, Part II. Geneva: International Trade Centre (ITC). Doc. No. MAR-11-201.E. http://www.intracen.org/.

Ashley, Caroline, and Karim Hussein. 2000. Developing methodologies for livelihood impact assessment: experience of the African Wildlife Foundation in East Africa. Overseas Development Institute: London. http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2750.pdf.

Auld, Graeme. 2010. Assessing certification as governance: effects and broader consequences for coffee. *The Journal of Environment & Development* 19 (2):215-241.

Bacon, Christopher. 2005. Confronting the Coffee Crisis: Can Fair Trade, Organic, and Specialty Coffees Reduce Small-Scale Farmer Vulnerability in Northern Nicaragua? *World Development* 33 (3):497-511. doi: 10.1016/j.worlddev.2004.10.002.

Bacon, Christopher M., V. Ernesto Méndez, María Eugenia Flores Gómez, Douglas Stuart, and Sandro Raúl Díaz Flores. 2008. Are Sustainable Coffee Certifications Enough to Secure Farmer Livelihoods? The Millenium Development Goals and Nicaragua's Fair Trade Cooperatives. *Globalizations* 5 (2):259-274. doi: 10.1080/14747730802057688.

Beall, Elizabeth. 2012. Smallholders in Global Bioenergy Value Chains and Certification. *Environment and Natural Resources Management Working Paper* 50. http://www.fao.org/docrep/015/i2597e/i2597e00.pdf.

Bebbington, Anthony. 1999. Capitals and capabilities: a framework for analyzing peasant viability, rural livelihoods and poverty. *World Development* 27 (12):2021-2044.

Becchetti, Leonardo, and Marco Costantino. 2008. The effects of fair trade on affiliated producers: An impact analysis on Kenyan farmers. *World Development* 36 (5):823-842.

Beuchelt, Tina D., and Manfred Zeller. 2011. Profits and poverty: Certification's troubled link for Nicaragua's organic and fairtrade coffee producers. *Ecological Economics* 70 (7):1316-1324. doi: 10.1016/j.ecolecon.2011.01.005.

Bitzer, Verena. 2012. Partnering for change in chains: The capacity of partnerships to promote sustainable change in global agrifood chains. *International Food and Agribusiness Management Review* 15 (Special Issue B):13-37.

Bitzer, Verena, and Pieter Glasbergen. 2015. Business–NGO partnerships in global value chains: part of the solution or part of the problem of sustainable change? *Current Opinion in Environmental Sustainability* 12:35-40. doi: 10.1016/j.cosust.2014.08.012.

Bitzer, Verena, Pieter Glasbergen, and Bas Arts. 2013. Exploring the potential of intersectoral partnerships to improve the position of farmers in global agrifood chains: findings from the coffee sector in Peru. *Agriculture and Human Values* 30 (1):5-20. doi: DOI 10.1007/s10460-012-9372-z.

Blackman, A., and J. Rivera. 2011. Producer-level benefits of sustainability certification. *Conserv Biol* 25 (6):1176-85. doi: 10.1111/j.1523-1739.2011.01774.x.

Blackman, Allen, and Maria A. Naranjo. 2012. Does eco-certification have environmental benefits? Organic coffee in Costa Rica. *Ecological Economics* 83:58-66. doi: 10.1016/j.ecolecon.2012.08.001.

Blackman, Allen, and Jorge Rivera. 2010. The evidence base for environmental and socioeconomic impacts of "sustainable" certification. *Resources for the Future: RF-DP-10-17*.

Brandi, Clara, Tobias Cabani, Christoph Hosang, Sonja Schirmbeck, Lotte Westermann, and Hannah Wiese. 2013. Sustainability certification in the Indonesian palm oil sector, Benefits and challenges for smallholders. German Development Institute (DIE):Bonn http://www.die-gdi.de/

Carney, Diana. 1998. Sustainable rural livelihoods: what contribution can we make? The Department for International Development's Natural Resources Advisers' Conference. London, England, July 1998.

Carney, Diana. 2003. Sustainable livelihoods approaches: progress and possibilities for change. In, ed Omar Sattaur. London: Department for International Development London.

Carney, Diana, Michael Drinkwater, Tamara Rusinow, Koos Neefjes, Samir Wanmali, and Naresh Singh. 1999. Livelihoods approaches compared. London: Department for International Development (DFID): London.

Chambers, Robert, and Gordon Conway. 1992. Sustainable rural livelihoods: practical concepts for the 21st century. Institute of Development Studies (UK): Brighton. Discussion Paper 296. http://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/775/Dp296.pdf? sequence.

Colchester, Marcus, and Norman Jiwan. 2006. Ghost on Our Own Land Indonesian Oil Palm Smallholders and the Roundtable on Sustainable Palm Oil.Forest Peoples Programme: England http://www.forestpeoples.org/sites/fpp/files/publication/2011/02/ ghostsonourownlandtxt06eng.pdf

De Haan, Leo J. 2012. The livelihood approach: a critical exploration. *Erdkunde* 66 (4):345-357.

Department for International Development (DfID). 1999. A livelihood comprises the capabilities, assets and activities required for a means of living. In *Sustainable livelihoods guidance sheets*. London: DFID Department for International Development. http://mhpss.net/?get=216/1382088062-DFID_Sustainable_livelihoods_guidance_ sheet.pdf .

Directorate General of Estate. 2011. *Tree crop estate statistics of Indonesia, 2010-2012 oil palm*. Jakarta: Directorate General of Estate.

Ekayani, Meti, Dodik Ridho Nurrochmat, and Dudung Darusman. 2015. The role of scientists in forest fire media discourse and its potential influence for policy-agenda setting in Indonesia. *Forest Policy and Economics*. doi: 10.1016/j.forpol.2015.01.001.

Elder, Sara D., Hisham Zerriffi, and Philippe Le Billon. 2012. Effects of Fair Trade Certification on Social Capital: The Case of Rwandan Coffee Producers. *World Development* 40 (11):2355-2367. doi: 10.1016/j.worlddev.2012.06.010.

Ellis, Frank. 2000. *Rural Livelihoods and Diversity in Developing Countries*. Oxford: Oxford University Press.

Gauthier, R. 2000. Agro-ecological strategies in North Lampung, Indonesia: social contraints to biological management in soil fertility. *Netherlands Journal of Agricultural Science* 48:91-104.

Gerasimchuk, Ivetta, and Peng Yam Koh. 2013. The EU Biofuel Policy and Palm Oil: Cutting subsidies or cutting rainforest? Manitoba: The International Institute for Sustainable Development.

Giovannucci, Daniele, Jason Potts, B Killian, C Wunderlich, G Soto, S Schuller, F Pinard, K Schroeder, and Isabelle Vagneron. 2008. "Seeking sustainability: COSA preliminary analysis of sustainability initiatives in the coffee sector." *Committee on Sustainability Assessment*.

Glasbergen, Pieter. 2013. Legitimation of Certifying Partnerships in the Global Market Place. *Environmental Policy and Governance* 23 (6):354-367. doi: 10.1002/eet.1625.

Gustomo, Aryo. 2013. RSPO public summary report of Independent smallholder initial certification assessment Assosiasi Swadaya Amanah Ukui-Pelalawan District, Riau Province, Indonesia. BSi Group.

Hanu, Mansuetus Alsy, and Marlina Sadjli. 2013. Market Transformation by Oil Palm Smallholders. Oil Palm Smallholders Union: Bogor. http://www.files.com/set/52e9e35c5fa0c.

Hospes, Otto. 2014. Marking the success or end of global multi-stakeholder governance? The rise of national sustainability standards in Indonesia and Brazil for palm oil and soy. *Agriculture and Human Values* 31 (3):425-437. doi: 10.1007/s10460-014-9511-9.

KPMG Sustainability. 2013. Improving smallholder livelihoods: Effectiveness of certification in coffee, cocoa and cotton. http://www.sustaineo.org/.

Lemeilleur, Sylvaine. 2013. Smallholder Compliance with Private Standard Certification: The Case of GlobalGAP Adoption by Mango Producers in Peru. *International Food and Agribusiness Management Review* 16 (4):159-180.

Marti, Serge. 2008. Losing ground: the human rights impacts of oil palm plantation expansion in Indonesia. Friend of Earth, LifeMosaic and SawitWatch. http://www.foei.org/.

Melo, Cristian J., and Steven A. Wolf. 2007. Ecocertification of Ecuadorian Bananas: Prospects for Progressive North–South Linkages. *Studies in Comparative International Development* 42 (3-4):256-278. doi: 10.1007/s12116-007-9009-1.

Méndez, V. Ernesto, Angel Mendoza, Christopher M. Bacon, Meryl Olson, Seth Petchers, Doribel Herrador, Cecilia Carranza, Laura Trujillo, Carlos Guadarrama-Zugasti, and Antonio Cordón. 2010. Effects of Fair Trade and organic certifications on small-scale coffee farmer households in Central America and Mexico. *Renewable Agriculture and Food Systems* 25 (3):236-251. doi: 10.1017/S1742170510000268.

Opijnen, Marjon van, Arjen Brinkmann, and Petra Meekers. 2013. Lessons Learned on RSPO Smallholder Certification in Indonesia. CREM. http://www.crem.nl/.

Papenfus, Michael M. 2000. Investing in Oil Palm an Analysis of Independent Smallholder Oil Palm Adoption in Sumatera, Indonesia. Southeast Asia Policy Research Working Paper, No. 15. http://www.worldagroforestry.org/.

Pesqueira, Luli, and Pieter Glasbergen. 2013. Playing the politics of scale: Oxfam's intervention in the Roundtable on Sustainable Palm Oil. *Geoforum* 45:296-304. doi: 10.1016/j.geoforum.2012.11.017.

Pirotte, Gautier, Geoffrey Pleyers, and Marc Poncelet. 2006. Fair-trade coffee in Nicaragua and Tanzania: a comparison. *Development in practice* 16 (5):441-451.

Ross, Charlie. 2010. Public Summary Report RSPO Certification Assessment PT Hindoli Scheme Smallholders South Sumatera Indonesia. BSi Group. http://www.rspo.org/ .

RSPO. 2009. Rountable Sustainable Palm Oil (RSPO) Principles and Criteria for Sustainable Palm Oil Production Guidance on Scheme Smallholders. http://www.rspo.org/.

RSPO. 2010. Rountable Sustainable Palm Oil (RSPO) Principles and Criteria for Sustainable Palm Oil Production. Guidance on Independent Smallholders. http://www.rspo.org/.

RSPO. 2013a. Key statistics for certification. http://www.rspo.org/ http://issuu.com/rspo2013/docs/cspo_uptake___production_-_charts-feb_final_#.

RSPO. 2013b. RSPO Standard for Group Certification Final – approved July 2010 (Amendment April 2013). http://www.rspo.org/

RSPO. 2014. Certified grower May 2014. edited by RSPO. http://www.rspo.org/

Ruben, Ruerd, and Ricardo Fort. 2012. The Impact of Fair Trade Certification for Coffee Farmers in Peru. *World Development* 40 (3):570-582. doi: 10.1016/j.worlddev.2011.07.030.

Savi, Stefano. 2013. World second group of independent smallholders to be RSPO certified [accessed 31-July 2015] http://www.rspo.org/news-and-events/news/worlds-second-group-of-independent-smallholders-to-be-rspo-certified.

Schouten, Greetje, and Pieter Glasbergen. 2012. Private multi-stakeholder governance in the agricultural market place: An analysis of legitimization processes of the roundtables on sustainable palm oil and responsible soy. *International Food and Agribusiness Management Review* 15 (Special B):63-88.

Schouten, Greetje, Pieter Leroy, and Pieter Glasbergen. 2012. On the deliberative capacity of private multi-stakeholder governance: the roundtables on responsible soy and sustainable palm oil. *Ecological Economics* 83:42-50.

Scoones, Ian. 1998. Sustainable rural livelihoods: a framework for analysis. *IDS Working Paper* 72. Institute of Development Studies. http://www.ids.ac.uk/.

Utting, Karla. 2009. Assessing the Impact of Fair Trade Coffee: Towards an Integrative Framework. *Journal of Business Ethics* 86 (S1):127-149. doi: 10.1007/s10551-008-9761-9.

Valkila, J. 2009. Fair Trade organic coffee production in Nicaragua - Sustainable development or a poverty trap? *Ecological Economics* 68 (12):3018-3025. doi: DOI 10.1016/j.ecolecon.2009.07.002.

van Rijn, Fédes, Kees Burger, and Eefje den Belder. 2012. Impact assessment in the Sustainable Livelihood Framework. *Development in Practice* 22 (7):1019-1035. doi: 10.1080/09614524.2012.696586.

Vellema, Sietze, and Jeroen van Wijk. 2014. Partnerships intervening in global food chains: the emergence of co-creation in standard-setting and certification. *Journal of Cleaner Production*. doi: 10.1016/j.jclepro.2014.03.090.

World Growth. 2013. Smallholders: Costs and Challenges of Small-Farmer Certification. Melbourne: World Growth. http://worldgrowth.org/.

WWF. 2013. Palm Oil Buyers Scorecard Measuring the Progress of Palm Oil Buyers. http://wwf.panda.org/what_we_do/footprint/agriculture/palm_oil/solutions/responsible_purchasing/palm_oil_buyers_scorecard_2013/.

WWF. 2014. UNSEEN, Palm Oil Consumption Digital Campaign. 15-January. http://www.wwf.or.id/berita_fakta/index.cfm?uNewsID=30862&uLangID=1.

An Empirical Analysis of Wholesale Cheese Pricing Practices on the Chicago Mercantile Exchange (CME) Spot Cheese Market

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Abstract

The CME spot cheese market performs a number of key functions in the United States dairy industry. The CME spot cheese prices are used as reference prices in contract cheese market, and they also influence milk prices at the farm-first-handler level set within a public pricing system, the Federal and State Milk Marketing Orders. The CME spot cheese market performs a critical price-discovery function in the United States dairy industry. This research evaluates the nature of pricing practices used by CME cheese wholesalers during the period of 2000-2014. The analysis focuses on the farm-to-wholesale price transmission process, which reflects the nature of cost pass-through. The empirical evidence presented in the article indicates that pricing strategies of cheese sellers in the analyzed market are consistent with the ones predicted by the profit-maximization models of oligopolistic behavior. The overall empirical evidence may suggest that cheese sellers on the CME spot cheese market used an output (cheese) price stabilization method during the analyzed period of time.

Keywords: asymmetric price transmission, cheese industry, Chicago Mercantile Exchange, cost pass-through, dairy industry, Federal Milk Marketing Orders, oligopoly, price regulation, price stabilization practice, spot market, supply chain management, thin market

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Introduction

The Chicago Mercantile Exchange (CME) spot cheese market performs a number of key functions in the United States dairy industry. First, the CME spot cheese prices are used as reference prices in cheese contracts used to transact more than 90% of cheese manufactured in the country. Second, the CME spot cheese prices influence milk prices set within the Federal and State Milk Marketing Orders (a public pricing system)[1]. The analyzed spot cheese market (which currently functions on the Chicago Mercantile Exchange) is a private industry institution. It was organized at the beginning of the last century with the original purpose of trading surpluses of cheese. Over time, this market became an institution performing a primary price discovery function in the United States dairy industry[2].

The CME spot cheese market is a low volume market in which a relatively small number of traders regularly participate. Typically less than 1% of the total volume of cheese produced in the country is traded on it (Table 1; GAO report 2007). Its major participants are large cheese/food processing companies and large agricultural cooperatives manufacturing cheese, who also operate in the contract cheese market. In light of the role that the Exchange spot cheese market plays for milk as well as cheese price discovery in the modern dairy industry, these market characteristics have raised concerns about occasional market manipulations allegedly taking place on this market (Mueller et al. 1996, Mueller et al. 1997, Mueller and Marion 2000, GAO report 2007, U.S. Departments of Agriculture and Justice 2010a,b, Carstensen 2010, Gould 2010).

Despite a significant role that the CME spot cheese market performs in the modern dairy industry, research examining pricing issues relevant to this market is practically absent. To the best of our knowledge, only one systematic research project was undertaken, and it was during the time when the spot cheese trade took place on the National Cheese Exchange (NCE) prior to being moved to the CME. Mueller et al. (1996, 1997) and Mueller and Marion (2000) conducted an extensive empirical analysis of the conduct on the NCE and its performance during the period of 1988-1993, when the issue of susceptibility of this market to price manipulations was raised[3].

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[1] Almost all raw milk produced in the U.S. is marketed within the system of Federal and State Milk Marketing Orders, which use a classified milk pricing principle to set the minimum prices paid for milk at the farm-first-handler level.

[2] In this article, "CME" and "Exchange" are used interchangeably. The predecessors of the CME spot cheese market are Wisconsin Cheese Exchange (Plymouth, WI) and National Cheese Exchange (Green Bay, WI). For a historical overview of cheese exchanges see Hamm and March (1995), Mueller et al. (1996) and Manchester and Blayney (1997). Despite the change of the physical location of the spot cheese market, the main participants and trading rules remained practically the same.

[3] There is research analyzing pricing issues in the overall cheese industry. For example, Chavas and Kim (2004, 2005) evaluated the effects of the price support program on price dynamics and price volatility in the U.S. cheese industry. Franklin and Cotterill (1994), Cotterill and Samson (2002) and Kim and Cotterill (2008) examined pricing issues in the national branded cheese industry. Kinnucan and Forker (1987), Awokuse and Wang (2009) and Stewart and Blayney (2011) analyzed asymmetries in price transmission process at the farm-to-retail and wholesale-to-retail levels of the cheese industry.

The objective of this research is to analyze the nature of wholesale cheese pricing practices used by cheese wholesalers on the CME spot cheese market. To accomplish this objective, the research proceeds as follows. First, we analyze the vertical milk price transmission process, which reflects the nature of cost pass-through for cheese wholesalers. Milk is the main input used to produce cheese, and the share of milk cost in the wholesale cheese price is approximately 90-95%. The estimated magnitude of cost pass-through can be used to distinguish between a perfectly competitive pricing and an imperfectly competitive pricing and to identify a pricing method used by cheese wholesalers.

Second, we use an econometric framework, which allows to analyze asymmetries in the milk price transmission process. Using this framework, we can identify whether these asymmetries exist and analyze their nature. In particular, we evaluate the CME wholesale cheese price response to increases and decreases in farm-level milk price. Third, using the cost pass-through estimates we calculate milk price transmission elasticities. The econometric analysis is based on publicly available data reported by the U.S. Department of Agriculture. The period of analysis is January 2000 – December 2014.

The article is organized as follows. First, a discussion of the CME spot cheese market structural characteristics and of its role in the dairy industry pricing is presented. Next, a traditional theoretical framework used to analyze the mechanism of vertical price transmission is discussed and is used to develop an econometric model to be estimated. The following sections discuss data and estimation results. The major findings of the analysis are summarized in the conclusion.

Chicago Mercantile Exchange (CME) Spot Cheese Market

The CME ("Exchange") spot cheese market is a low volume market and is concentrated. Only one variety of cheese, cheddar cheese, is traded on the Exchange. It is sold in 40 pound blocks and 500 pound barrels. The first, block cheddar, is of a type and packaging that is consistent with food manufacturing, food service, and retail uses of cheddar cheese. The second, barrel cheddar, is of a quality and cost that is oriented towards the production of processed cheese, which is especially important in food services. During the period of 2000-2013, less than 2% of the total cheddar cheese volume produced in the country was sold on the Exchange, which represented less than 1% of the total cheese production (Table 1).

Although there are 30-40 members in this market, only a small number of buyers and sellers actively trade on the Exchange (GAO report 2007). These are large cheese/food manufacturers and large agricultural cooperatives. The buyers and sellers trading on the CME are also active participants in the contract cheese market. As reported by GAO (2007), during the period of 1999-2007, two market participants bought 74% of all block cheese, and three market participants sold 67% of all block cheese. Four market participants bought 56% of all barrel cheese and two market participants sold 68% of all barrel cheese. In addition to the low relative volume of trade, transactions are infrequent.

The CME spot cheese market structural characteristics are similar to the ones typically associated with imperfectly competitive market structures: a high degree of product homogeneity, inelastic short-run demand/supply, a relatively small number of traders (i.e. high

market concentration) and a relatively high barriers to entry. Cheddar cheese traded on the CME is a highly standardized product with inelastic short-run demand and supply, there are relatively few large market participants and a group of smaller firms, the entry is relatively limited because it requires a potential entrant to be able to buy or sell very large quantities of cheese on the spot (Mueller et al. 1996, Mueller et al. 1997).

In addition, some market participants may have incentives to influence the CME spot cheese prices in order to control the contract cheese market, where more than 90% of cheese is sold, and/or to influence prices of milk used in cheese manufacturing. Cheese pricing strategies in the contract market typically depend on the type of buyers. At the first handler level, contract prices are based on the Exchange spot cheese price on the day of cheese production plus or minus a premium (Hayenga 1979, Manchester and Blayney 1997). According to milk price formulas used to price milk within the Federal Milk Marketing Orders since 2000, manufacturing milk price (Class III milk price) is a function of a survey-based wholesale cheese prices collected by the U.S. Department of Agriculture[4]. The latter are at approximately the same level as the CME spot cheese prices (Table 1) and are highly correlated with these prices (GAO report 2007).

Cheese processors who buy cheese to manufacture processed cheese products would benefit from lower CME spot cheese prices. However, the net benefits would depend on the design of pricing systems used in cheese contracts. Agricultural cooperatives involved in cheese manufacturing would benefit from higher CME spot cheese prices because this would lead to higher prices paid for milk. Given the CME spot cheese market structural characteristics and potential incentives of its participants, we hypothesize that pricing practices used by cheese wholesalers are consistent with an imperfectly competitive pricing rather than with a perfectly competitive pricing.

Theoretical Framework

Vertical Price Transmission

An economic model of vertical price transmission is used as a theoretical framework for empirical analysis of wholesale cheese pricing practices. The vertical price transmission mechanism characterizes the process of reaction of output prices to changes in input prices. A considerable number of studies focusing on vertical price transmission in agricultural and food industries explored asymmetries in the transmission of changes in input prices to output prices, which is common in these industries. The nature of vertical price transmission characterizes market efficiency and performance. Also, the vertical price transmission mechanism reflects cost pass-through, which can be used to characterize pricing practices used by the food supply chain participants (i.e. wholesalers and retailers).

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[4] Within the system of Federal Milk Marketing Orders, there are four classes of milk that are based on four different final uses of raw milk. Class I milk is used to produce fluid beverage milk products, Class II milk is used to manufacture "soft" dairy products (yogurt, cottage cheese, ice cream, etc.), Class III milk is used to manufacture "hard" dairy products (cheese and cream cheese), and Class IV milk is used to produce butter and dry milk. Class III milk price is the "mover" of the overall FMMOs pricing structure.

The mechanism of vertical price transmission has been a focus of many theoretical and empirical studies. Some studies developed theoretical models without applying them to a particular industry setting (Azzam 1999, McCorriston et al. 2001, Weldegebriel 2004). The hypotheses developed in these studies provide a valuable guidance for future empirical work. Some studies focused on time-series econometric analysis to test hypotheses in the setting of a specific industry, which provides insights on how this industry performs (Kinnucan and Forker 1987, Lass et al. 2001, Lass 2005, Carman and Sexton 2005, Capps and Sherwell 2007, Awokuse and Wang 2009, Stewart and Blayney 2011)[5].

There is no unique research methodology used to analyze vertical price transmission. The core of any model, whether simple or complex, theoretical or empirical, is that output (downstream) price is modeled as a function of input (upstream) price. In the setting of agricultural and food industries, the output price is typically represented by either retail or wholesale price, in which case the input price is represented by wholesale and/or farm price.

We use a theoretical framework adopted in earlier empirical studies focusing on farm-to-retail price transmission and retail pricing practices in the U.S. fluid milk industry (Carman and Sexton 2005, Bolotova and Novakovic 2012). This theoretical framework includes re-arranged versions of standard profit-maximizing first-order conditions for a perfectly competitive industry, monopoly and oligopoly. These conditions represent pricing rules and are derived using classis static models of profit-maximizing behavior, in which firms set output quantity to maximize their profit (i.e. the Cournot model in the case of oligopoly); other assumptions include an assumption on demand (linear or non-linear) and a constant marginal cost (Besanko and Braeutigam 2002, Carlton and Perloff 2005).

CME Spot Cheese Market: Vertical Price Transmission Mechanism and Hypotheses

Equation (1) represents a linear farm-to-wholesale price transmission process. The price of output (downstream price) is specified as a linear function of the input price (upstream price).

(1) $WP = a + b*FP$.

In the setting of our research, *WP* is the CME wholesale cheddar cheese price ("cheese price" to be referred further in the article)[6], *FP* is a farm-level price of milk used in cheese manufacturing ("milk price" to be refereed further in the article), *a* is a non-negative constant, and *b* is a farm price transmission coefficient (i.e. a cost pass-through).

Milk represents about 90% of the cost of bulk cheese manufacturing. The farm price in equation (1) is represented by the Class III milk price. This is a government-set minimum price that milk processors have to pay for milk used in cheese manufacturing within the system of Federal Milk Marketing Orders. Dairy farmers do not receive this price directly. Rather they receive a price

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[5] For comprehensive surveys of these studies, see Meyer and von Cramon-Taubadel (2004) and Frey and Manera (2007).
[6] "Wholesale cheese price" and "spot cheese price" are used interchangeably throughout the article. Similarly, "wholesale cheese market" and "spot cheese market" are used interchangeably.

related to the weighted average of all milk class prices, called the Uniform or blend price. As such, the Class III milk price is not a "farm price" in the conventional sense of what is paid to the farmer, but it is the transaction price relevant to the farmer-first-handler level of the supply chain.

The Class III milk price is announced by the 5th of the month following the month in which this price applies. Therefore, during the current month only the previous month Class III milk price is known. The flow of the causation effect from the previous month Class III milk price (*FP*) to the current month CME spot cheese price (*WP*) is ensured in the cheese industry institutional environment.

Given that wholesale margin is the difference between wholesale price and farm price:

(2)   *WM=WP-FP*,

       substituting (1) into (2) yields the identity for wholesale margin:

(3)   *WM = a + (b-1)*FP*.

The magnitude of the coefficients in equations (1) and (3) provides evidence on the pricing method used by wholesalers. The magnitude of *b=1* and *a>0* would reflect a fixed absolute markup pricing consistent with perfect competition characterized by a "sticky" margin (*WM=a*). In the case of imperfectly competitive pricing, two special cases can be considered (*b<1* and *b>1*).

If a profit-maximizing monopolist operates in a market environment with linear demand and constant marginal cost, the magnitude of *b* is equal to 0.5 (i.e. incomplete cost pass-through). The first-order profit-maximization condition for this monopolist can be rearranged to express its output price as a function of marginal cost: *P = 0.5 + 0.5*MC*. The constant *a* is non-negative in this case. A profit-maximizing oligopoly in a similar market environment would yield the magnitude of *b* in the range from 0.5 (monopoly) to 1 (perfect competition). The output price stabilization practice would be consistent with pricing predicted by these models.

In the case of a profit-maximizing monopoly and a profit-maximizing oligopoly operating in a market environment with non-linear demand and constant marginal cost, the magnitude of *b* is greater than 1 (i.e. more than a complete cost pass-through). The oligopoly cost pass-through is greater than one and is smaller than the monopoly cost pass-through. The first-order profit-maximization conditions (FOC) for monopoly and oligopoly are:

$$P = \left(\frac{1}{1+\frac{1}{\eta}} \right) \times MC \text{ and } P = \left(\frac{1}{1+\frac{1}{N \times \eta}} \right) \times MC, \text{ respectively } (\eta_{Q,P} = \frac{dQ}{dP} \times \frac{P}{Q} < 0 \text{ is the market}$$

demand elasticity, and *N* is the number of firms in the case of oligopoly). The constant *a* is zero in these models. The terms in the parentheses (i.e. cost pass-through) must

be greater than one for the output price to exceed marginal cost[7]. Introducing *N* in the FOC for oligopoly decreases the magnitude of cost pass-through, as compared to the monopoly case. The fixed percentage markup pricing (George and King 1971, Carman and Sexton 2005, Bolotova and Novakovic 2012) is consistent with pricing predicted by these models; this pricing method reflects the margin stabilization strategy.

The behavior of wholesale margin is conditional on the magnitude of cost pass-through. If b=1 (a perfect competition case), wholesale margin is constant: *WM=a* in equation (3); the margin does not respond to the changes in the farm price in this case. If b>1 or b<1 (an imperfect competition case), wholesale margin responds to the changes in the farm price. In the case of incomplete cost pass-through (b<1), wholesale margin decreases (increases), given a farm price increase (decrease). In the case of more than a complete cost pass-through (b>1), wholesale margin increases (decreases), given a farm price increase (decrease). Therefore, the margin response to the same change in the farm price is different under the two presented scenarios of imperfectly competitive pricing.

Econometric Framework

Econometric Models of Asymmetric Price Transmission: The Overview

There is a wide variety of econometric models that can be used to analyze asymmetry in the price transmission process. In their comprehensive survey of econometric models of asymmetric price transmission, Frey and Manera (2007) distinguish nine types of econometric models, and the total of fifteen modifications of these models (Frey and Manera 2007: Table 5). The most common econometric models include autoregressive distributed lag models (ARDL), error correction models (ECM), regime switching model (RSM), vector error correction model (VECM) and vector autoregressive models (VAR). Meyer and von Cramon-Taubadel (2004) is another survey of econometric models used to analyze asymmetric price transmission. They classify the analyzed models into the pre-integration approaches to testing for asymmetric price transmission (ARDL is an example) and cointegration analysis (ECM is an example). The ECM and cointegration assume that the long-run equilibrium exists between the output price and input price, which precludes these prices to drift apart (Meyer and von Cramon-Taubadel 2004). If this is true for the analyzed data, then ECM may be superior to other econometric models.

The choice of the econometric model for a particular study typically depends on the time-series properties of the analyzed data. A standard approach is to conduct an appropriate statistical test to check on the stationarity of the output and input prices, which relationship is analyzed. If the price series was found to be nonstationary (may indicate the need for ECM), the second step is to check for cointegration[8]. Capps and Sherwell (2007) analyzed the performance of a traditional Houck model (a variation of ARDL) and ECM in the case of U.S. fluid milk industry. Based on the empirical evidence reported for a number of U.S. cities and fluid milk products (whole milk

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[7] The cost pass-through is greater than one, if the absolute value of market demand elasticity is greater than one (i.e. monopolist and oligopolists price on the elastic region of market demand curve, in which case marginal revenue is positive).
[8] A comprehensive explanation of the available statistical tests and procedures is presented in Kennedy (2003).

and reduced fat milk), it was concluded that the Houck approach and ECM were statistically indistinguishable.

The Houck approach has been widely used to analyze asymmetries in the vertical price transmission process in the U.S. dairy industry (Kinnucan and Forker 1987, Lass et al. 2001, Lass 2005, Carman and Sexton 2005, Capps and Sherwell 2007, Bolotova and Novakovic 2012). The two studies that applied ECMs are Awokuse and Wang (2009) and Stewart and Blayney (2011). Some of the estimated econometric models reported for the cheese industry in the latter studies have a low level of explanatory power and some of the coefficients lack statistical significance. The institutional environment of the U.S. dairy industry includes regulated pricing at the farm level, which may affect the nature of farm-to-retail price transmission process in the U.S. dairy industry and the performance of econometric models. The milk prices at the farm-first-handler level are calculated by the government and publicly announced on a monthly basis. This affects the pricing strategies of wholesalers and retailers, who are likely to adjust their pricing decisions on a monthly basis as well, following the government price announcement at the farm level.

CME Spot Cheese Market: Econometric Model of Vertical Price Transmission

Following the majority of previous empirical studies focusing on the U.S. dairy industry, we use the Houck approach to specify an econometric model. As indicated by the results of statistical tests reported later in the article, the cheese and milk prices used in the empirical analysis are stationary. Therefore, we do not explore the possibility of using an error correction model.

Equation (1) is used as a base to specify an econometric model to be estimated. In this equation, the cost pass-through is restricted to be invariant to increases and decreases in the farm price. To allow for asymmetric adjustment of the CME wholesale cheese price to increases and decreases in a farm milk price (i.e. Class III milk price), we incorporate the Houck (1977) procedure to specifying and estimating nonreversible functions into wholesale price equation (1). The Houck approach is based on segmenting an independent variable of interest into its increasing and decreasing phases in order to explore asymmetries in the adjustment of the dependent variable to increases and decreases in the independent variable. Equation (4) represents a general version of the Houck model.

$$(4)\quad Y_t^* = a_0 \times t + a_1 \times INC_t^* + a_2 \times DEC_t^*,$$

where Y_t^* is the sum of all period-to-period changes in the dependent variable from its initial value, INC_t^* is the sum of all period-to-period increases and DEC_t^* is the sum of all period-to-period decreases in the independent variable from its initial value. INC_t^* is always positive, and DEC_t^* is always negative. If a_0 is non-zero, then it appears as a trend coefficient.

The Houck procedure was originally developed as a static model. In many applications, corresponding econometric models were specified with distributed lag structures to account for dynamic effects. This approach allows the researcher to analyze asymmetries in terms of both the magnitude and speed of price transmission.

By combining equations (1) and (4), we specify an econometric model to be estimated, which is represented by equation (5). This is a linear distributed lag model.

$$(5) \quad WP_t^* = \alpha_0 \times t + \sum_{i=0}^{N} \beta_i^+ \times FP\_INC_{t-i}^* + \sum_{i=0}^{M} \beta_i^- \times FP\_DEC_{t-i}^* + u_t.$$

The majority of the notations used in equation (5) are as explained above. N and M are the number of lagged terms for increasing and decreasing phases of milk price, respectively. Due to the specifics of the Class III milk price announcement procedure mentioned earlier, the previous month Class III milk price is used as the current month FP in the econometric model. β_i^+ and β_i^- are the milk price transmission coefficients (i.e. cost pass-through) for increasing and decreasing phases of milk price, respectively. u_t is the error term.

The null hypothesis of the symmetry in terms of the speed[9] of the cheese price adjustment to increases and decreases in milk price would be supported if $N=M$. The null hypothesis of the symmetry in terms of the magnitude of the cheese price adjustment would be supported if $\beta_0^+ = \beta_0^-$ (for the current month effect) and $\sum_{i=o}^{N} \beta_i^+ = \sum_{i=0}^{M} \beta_i^-$ (for the cumulative effect). Furthermore, the magnitude of the estimated cost pass-through is to be interpreted in light of the discussion presented in the previous section. The empirical evidence supporting a perfectly competitive pricing would include the magnitude of cost pass-through equal to one and a symmetric adjustment of the cheese price to increases and decreases in milk price. The empirical evidence on the magnitude of cost pass-through statistically smaller or greater than one and a presence of asymmetries in the cheese price response would indicate a presence of imperfectly competitive pricing.

The estimated coefficients from equation (5) can be used to calculate the price transmission elasticities (Kinnucan and Forker 1987, Lass et al. 2001, Capps and Sherwell 2007, Bolotova and Novakovic 2012). The elasticities calculated based on the current month effect of milk price change are: $e_{INC} = \beta_0^+ \times \dfrac{\overline{FP_t}}{\overline{WP_t}}$ (the milk price-increase transmission elasticity) and $e_{DEC} = \beta_0^- \times \dfrac{\overline{FP_t}}{\overline{WP_t}}$ (the milk price-decrease transmission elasticity), where $\overline{FP_t}$ and $\overline{WP_t}$ are sample means for the milk price series and the CME wholesale cheese price series, respectively. Similarly, the elasticities of cumulative effects of the milk price changes[10] are $e_{INC} = \sum_{i=0}^{N} \beta_i^+ \times \dfrac{\overline{FP_t}}{\overline{WP_t}}$ and

$e_{DEC} = \sum_{i=0}^{M} \beta_i^- \times \dfrac{\overline{FP_t}}{\overline{WP_t}}.$

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[9] See Meyer and von Cramon-Taubadel (2004) for a discussion of different types of asymmetry in the price adjustment process (i.e. in terms of speed, magnitude, etc.).
[10] The price transmission elasticity calculated based on the current month effect of the farm price change is often referred to as the short-run price-transmission elasticity, and the one calculated based on the cumulative effect of the farm price changes is referred to as the long-run price-transmission elasticity (Kinnucan and Forker 1987, Capps and

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The magnitude of price transmission elasticities can be interpreted conditional on the magnitude of cost pass-through. The price transmission elasticity in a perfectly competitive market is equal to the ratio of the farm price to the wholesale price, because the cost pass-through is equal to one in this case. The elasticity corresponding to an oligopolistic/monopolistic market with linear demand is smaller than the ratio of the farm price to the wholesale price, and the elasticity characterizing an oligopolistic/monopolistic market with non-linear demand is greater than this ratio. This is because the cost pass-through is smaller than one in the former case and is greater than one in the latter case.

Data

The variables used in econometric analysis are collected from the data bases maintained by the U.S. Department of Agriculture Agricultural Marketing Service (USDA AMS). CME cheddar cheese prices are reported by the USDA AMS Dairy Market News Portal and are represented by two price series: cheddar prices for 500 pound barrels and cheddar prices for 40 pound blocks. CME cheddar cheese prices are originally reported on a daily basis, but they are also available on a weekly and a monthly basis. Class III milk prices are reported in the USDA AMS Milk Marketing Order Statistics Public Database. Class III milk price is determined and announced (reported) on a monthly basis. The econometric model is estimated using monthly data, the frequency at which both cheese and milk prices are available. The period of analysis is January 2000 – December 2014.

CME cheddar cheese prices are reported in \$/pound, and Class III milk price is reported in \$/cwt[11]. As a general rule, about 10 pounds of milk yields 1 pound of cheese. Therefore, instead of using milk price expressed in \$/cwt in the econometric models, we use a yield adjusted measure of the cost of milk incurred to produce one pound of cheese. This variable is obtained by dividing milk price expressed in \$/cwt by 10. This simple transformation allows for easier interpretation of the parameter estimates.

Estimation Results

Two econometric models were estimated. One model used the CME cheddar barrel price as the dependent variable, and the other model used the CME cheddar block price as the dependent variable[12]. The Ordinary Least Squares (OLS) estimation procedure was used to estimate econometric models. The estimation results of the two models were very similar. Given that cheddar block has a wider variety of uses than cheddar barrel and is also directly used in final consumption, we present and discuss the estimation results for the model which has the CME

Sherwell 2007). Lass et al. (2001) use a different terminology: a former is referred to as the current elasticity, and the latter is referred to as the short-run elasticity.

[11] One cwt (hundredweight) contains 100 pounds.

[12] The cheddar cheese (block and barrel) and milk price series were tested for a presence of the unit root using the standard and modified Dickey-Fuller tests. The null hypothesis of a presence of the unit root is rejected. For example, the DF test statistics for cheddar barrel price, cheddar block price and milk price are -3.90, -3.71 and -3.26, respectively. These values are below the DF test statistic critical value at the 10% significance level, -3.13 (i.e. the null hypothesis of the unit root is rejected). These tests' outcomes suggest that the analyzed price series are stationary.

cheddar block price as the dependent variable. The estimation results along with the outcomes of statistical tests are summarized in Table 2[13].

The estimation results indicate that the estimated coefficients for the current month price and its first lag are statistically significant for the increasing phase of milk price, and only the estimated coefficient for the current month price is statistically significant for the decreasing phase of milk price. This empirical evidence reflects a presence of asymmetry in the speed of the cheese price adjustment. All estimated coefficients for the segmented phases of milk price are statistically significant from zero at the 1% significance level. The explanatory power of the model is high, suggesting that the cumulative changes in milk price explain approximately 76% of the cumulative changes in cheese price.

The estimated model allows distinguishing between the immediate (i.e. the current month) and cumulative (i.e. the current and lagged months) effects of changes in milk price on the cheese price. The cumulative effect of the milk price increase is exactly the same as of the milk price decrease (i.e. symmetric in terms of the magnitude of cheese price response). The magnitude of cost pass-through is 0.64. The null hypothesis $\beta_0^+ + \beta_1^+ = \beta_0^-$ fails to be rejected[14]. The null hypotheses of a perfectly competitive pricing $\beta_0^+ + \beta_1^+ = 1$ and $\beta_0^- = 1$ are rejected in favor of the alternative hypotheses $\beta_0^+ + \beta_1^+ < 1$ and $\beta_0^- < 1$. Furthermore, the null hypotheses of a profit-maximizing monopoly pricing (linear demand) $\beta_0^+ + \beta_1^+ = 0.5$ and $\beta_0^- = 0.5$ are rejected in favor of the alternative hypotheses $\beta_0^+ + \beta_1^+ > 0.5$ and $\beta_0^- > 0.5$. The magnitude of cost pass-through equal to 0.64 along with the T-test outcomes suggest that the wholesale cheese pricing practice used on CME spot cheese market is consistent with a profit-maximizing behavior of oligopoly in the market with linear demand and constant marginal cost.

The immediate impact (i.e. the current month effect) of the increasing and decreasing phases of milk price on the cheese price is somewhat different from the pattern discussed above. The estimated coefficient for the current month milk price-increase is 1.23, and the estimated coefficient for the current month milk price-decrease is 0.64. The current month cheese price adjustment is asymmetric, as indicated by the magnitude of cost pass-through and the T-test outcome. The null hypothesis of a symmetric adjustment of the cheese price to increases and decreases in milk price $\beta_0^+ = \beta_0^-$ is rejected in favor of the alternative hypothesis of a positive asymmetric adjustment $\beta_0^+ > \beta_0^-$. The null hypotheses of a perfectly competitive pricing $\beta_0^+ = 1$ and $\beta_0^- = 1$ are rejected in favor of the alternative hypotheses $\beta_0^+ > 1$ and $\beta_0^- < 1$ for the milk price increase and decrease, respectively.

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[13] As indicated by the Durbin-Watson statistics, there is a presence of autocorrelation in the estimated models (the magnitude of DW-Statistic in the cheddar block model is 1.28; Table 2). Given that the OLS estimator is unbiased in the presence of autocorrelation, the magnitude of the estimated coefficients is not affected by this process, but the standard errors of the estimated coefficients are affected. The autocorrelation-robust standard errors are computed based on the Newey-West approach; these standard errors are used to conduct all statistical tests.

[14] The outcomes of statistical tests on the wholesale cheese pricing methods are presented in Table 2. These tests were conducted using a one-tailed T-test and the 10% significance level.

The magnitude of the estimated coefficients for the current month changes in milk price and T-test outcomes provide evidence on a presence of imperfectly competitive pricing. The current month milk price increase is transmitted at a much higher rate than the current month milk price decrease; the ratio of the former to the latter is equal to 1.92. Furthermore, the milk price-decrease transmission is incomplete (0.64), and the milk price-increase transmission is more than a complete (1.23). The first effect is consistent with the profit-maximizing behavior of oligopoly in the market with linear demand and constant marginal cost. The second effect is consistent with the profit-maximizing behavior of monopoly/oligopoly in the market with non-linear demand and constant marginal cost.

The wholesale margin analysis can help understand the observed pricing behavior in the case of the cumulative and immediate effects of milk price changes. The wholesale margin behavior depends on the magnitude of cost pass-through[15]. First, consider the cumulative effect case, where the cheese price response is symmetric to the increase and decrease in milk price and the cost pass-through is incomplete. If milk price increases (decreases) by $1/10 pounds, cheese price increases (decreases) by $0.64/pound and wholesale margin decreases (increases) by $0.36/pound. If the cost pass-through is incomplete, an increase (a decrease) in milk price causes the wholesale margin to decrease (increase). This empirical evidence may suggest that cheese wholesalers use an output (cheese) price stabilization practice.

Second, in the case of the immediate effect of milk price change, the cheese price response is asymmetric. Furthermore, the rate of milk price-increase transmission is greater than one, and the rate of milk price-decrease transmission is smaller than one. If milk price increases by $1/10 pounds, cheese price increases by $1.23/pound and wholesale margin increases by $0.23/pound. If milk price decreases by $1/10 pounds, cheese price decreases by $0.64/pound and wholesale margin increases by $0.38/pound.

Finally, we calculate milk price transmission elasticities. During the analyzed period of time, the average CME cheddar cheese block price is $1.55/pound and the average milk price (in terms of the cost of milk used in cheese manufacturing) is $1.48/pound. The ratio of milk price to cheese price is 0.95 (i.e. the share of farm value of milk in the wholesale cheese price). The current month price transmission elasticities are 1.17 for milk price-increase and 0.61 for milk price-decrease. The current month increase (decrease) in milk price by 1% leads to a 1.17% (0.61%) increase (decrease) in the CME cheddar block price. When the cumulative effect of milk price changes is considered, both the increase and decrease in milk price cause the same magnitude response in the CME cheddar block price. An increase (a decrease) in milk price by 1% causes a 0.61% increase (decrease) in the CME cheddar block price.

Conclusion

The empirical evidence on the mechanism of vertical price transmission and the nature of cost pass-through at the wholesale market for cheddar cheese on the Chicago Mercantile Exchange indicates that pricing practices used by cheese wholesalers are not consistent with perfect

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[15] Equations (1) and (3) and the estimates of cost pass-through are used to determine the response of wholesale cheese price and wholesale margin to the changes in milk price.

competition, but tend to be consistent with pricing methods used by profit-maximizing oligopolists. This empirical evidence is consistent with pricing strategies that may be expected to be found in markets with structural characteristics similar to the CME spot cheese market: a relatively small number of sellers (i.e. high market concentration) trade a highly standardized (homogeneous) product in a market environment with inelastic demand and limited entry.

The empirical findings presented in the article indicate that the transmission of milk price-decrease is always incomplete. In contrast, the transmission of milk price-increase may be either incomplete or more than complete depending on the time period considered. It takes two months to pass on milk price increase, and it takes only one month to pass on milk price decrease. The pattern of the immediate impact of changes in milk price reflects a presence of a significant asymmetry. However, when the cumulative changes in milk price are taken into account, the milk price transmission (cost pass through) is incomplete. A milk price increase leads to a decrease in wholesale cheese margin, and a milk price decrease leads to an increase in wholesale cheese margin.

In summary, the overall empirical evidence may suggest that the wholesale cheese pricing practice used by cheese sellers on the Chicago Mercantile Exchange spot cheese market is an output (cheese) price stabilization. In a typical wholesale market, wholesalers use a fixed-percentage markup pricing method (a margin stabilization strategy). The CME spot cheese market is not a typical wholesale market. The CME spot cheese market is a thin (low volume) market, which prices are used as reference prices in cheese contracts used to transact practically all cheese produced in the country. Furthermore, the analyzed market is a low margin market. The wholesale cheese margin was on average 5% of the wholesale cheese price during the analyzed period of time. The cheese price stabilization pricing method used by cheese wholesalers is consistent with the nature of the CME spot cheese market and its role in the United States dairy industry pricing.

References

Awokuse, T.O., and X. Wang. 2009. Threshold Effects and Asymmetric Price Adjustments in U.S. Dairy Markets. *Canadian Journal of Agricultural Economics* 57: 269-286.

Azzam, A.M. 1999. Asymmetry and Rigidity in Farm-Retail Price Transmission. *American Journal of Agricultural Economics* 81: 525-533.

Besanko, D., and R.R. Braeutigam. 2002. Microeconomics: an integrated approach. John Wiley & Sons, Inc.

Bolotova, Y., and A.M. Novakovic. 2012. The Impact of the New York State Milk Price Gouging Law on the Price Transmission Process and Supermarket Pricing Strategies in the Fluid Whole Milk Market. *Agribusiness: An International Journal* 28: 377-399.

Capps, O. Jr., and P. Sherwell. 2007. Alternative Approaches in Detecting Asymmetry in Farm-Retail Price Transmission of Fluid Milk. *Agribusiness: An International Journal* 23: 313-331.

Carlton, D.W., and J.M. Perloff. 2005. Modern industrial organization. 4th Edition. Pearson.

Carman, H.F., and R.J. Sexton. 2005. Supermarket Fluid Milk Pricing Practices in the Western United States. *Agribusiness: An International Journal* 21: 509-530.

Carstensen, P.C. 2010. Comments for the United States Departments of Agriculture and Justice Workshops on Competition Issues in Agriculture. Legal Studies Research Paper Series Paper No. 1103, University of Wisconsin Law School, Madison, WI. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1537191

Chavas, J-P., and K. Kim. 2005. An Econometric Analysis of Price Dynamics in the Presence of a Price Floor: The Case of American Cheese. *Journal of Agricultural and Applied Economics* 37: 21-35.

Chavas, J-P., and K. Kim. A Heteroscedastic Multivariate Tobit Analysis of Price Dynamics in the Presence of Price Floors. 2004. *American Journal of Agricultural Economics* 86: 576-593.

Cotterill, R.W. and P.O. Samson. 2002. Estimating a Brand-level Demand System for American Cheese Products to Evaluate Unilateral and Coordinated Market Power Strategies. *American Journal of Agricultural Economics* 84: 817-823.

Franklin, A.W. and R.W. Cotterill. 1994. Pricing and Market Strategies in the National Branded Cheese Industry. Research Report No. 26, Food Marketing Policy Center, Department of Agricultural and Resource Economics, University of Connecticut, Storrs, CT. http://ageconsearch.umn.edu/bitstream/25170/1/rr940026.pdf

Frey, G., and M. Manera. 2007. Econometric Models of Asymmetric Price Transmission. *Journal of Economics Surveys* 21: 349-415.

George, P.S. and G.A. King. 1971. Consumer Demand for Food Commodities in the United States, with Projections for 1980. Giannini Foundation Monograph No. 26, Department of Agricultural and Resource Economics, University of California, Davis. http://ageconsearch. umn.edu/bitstream_/11936/1/ms710026.pdf

Gould, B.W. 2010. Consolidation and Concentration in the U.S. Dairy Industry. *Choices* 25. http://www.choicesmagazine.org/magazine/article.php?article=123

Hamm, L.G., and R. March. 1995. The National Cheese Exchange: Impacts on Dairy Pricing. Dairy Markets and Policy - Issues and Options, # M-7, Program on Dairy Markets and Policy, Cornell University, Ithaca, NY.

Hayenga, M.L. 1979. Cheese Pricing System. WP-38, Department of Agricultural Economics, University of Wisconsin-Madison, Madison, WI. http://www.aae.wisc.edu/fsrg/publications/Archived/wp-38.pdf

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Houck, J.P. 1977. An Approach to Specifying and Estimating Nonreversible Functions. *American Journal of Agricultural Economics* 59: 570-572.

Kennedy, P. 2003. A guide to econometrics. 5th edition. The MIT Press, Cambridge, Massachusetts.

Kim, D., and R.W. Cotterill. 2008. Cost Pass-through in Differentiated Product Markets: The Case of U.S. Processed Cheese. *Journal of Industrial Economics* LV: 32-47.

Kinnucan, H.W., and O.D. Forker. 1987. Asymmetry in Farm-Retail Price Transmission for Major Dairy Products. *American Journal of Agricultural Economics* 69: 285-292.

Lass, D.A. 2005. Asymmetric Response of Retail Milk Prices in the Northeast Revisited. *Agribusiness: An International Journal* 21: 493-508.

Lass, D.A., M. Adanu, and P.G. Allen. 2001. Impacts of the Northeast Dairy Compact on New England Retail Prices. *Agricultural and Resource Economics Review* 30: 83-92.

Manchester, A.C. and D.P. Blayney. 1997. The Structure of Dairy Markets: Past, Present, Future. Agricultural Economics Report No. 757, Commercial Agriculture Division, Economic Research Service, U.S. Department of Agriculture. http://ageconsearch.umn.edu/bitstream/33929/1/ae970757.pdf

McCorriston, S., C.W. Morgan, and A.J. Rayner. 2001. Price Transmission: The Interaction Between Market Power and Returns to Scale. *European Review of Agricultural Economics* 28: 143-159.

Meyer, J. and S. von Cramon-Taubadel. 2004. Asymmetric Price-transmission: A Survey. *Journal of Agricultural Economics* 55: 581-611.

Mueller, W.F. and B.W. Marion. 2000. Market Power in the Cheese Industry: Further Evidence. *Review of Industrial Organization* 17: 177-191.

Mueller, W.F., B.W. Marion, and M.H. Sial. 1997. Price Leadership on the National Cheese Exchange. *Review of Industrial Organization* 12: 145-170.

Mueller, W.F., B.W. Marion, M.H. Sial, and F.E. Geithman. 1996. Cheese Pricing: A Study of the National Cheese Exchange. A Report of the Food System Research Group, Department of Agricultural Economics, University of Wisconsin-Madison prepared for the Wisconsin Department of Agriculture, Trade and Consumer Protection Investigation into Cheese Pricing. http://www.aae.wisc.edu/fsrg/CheeseStudy.htm

Stewart, H., and D.P. Blayney. 2011. Retail Dairy Prices Fluctuate with the Farm Value of Milk. *Agricultural and Resource Economics Review* 40: 201-217.

United States Departments of Agriculture and Justice. 2010a. A Series of Workshops "Agriculture and Antitrust Enforcement Issues in our 21st Century Economy". http://www.justice.gov/atr/public/workshops/ag2010/index.html

United States Departments of Agriculture and Justice. 2010b. Dairy Industry Workshop (Madison, WI), one of the "Agriculture and Antitrust Enforcement Issues in Our 21st Century Economy" Workshops. http://www.justice.gov/atr/public/workshops/ag2010/wisconsin-agworkshop-transcript.txt

United States Government Accountability Office (GAO) Report to Congressional Requesters. 2007. Spot Cheese Market: Market Oversight Has Increased, but Concerns Remain About Potential Manipulation. http://www.gao.gov/new.items/d07707.pdf

Weldegebriel, H.T. 2004. Imperfect Price Transmission: Is Market Power Really to Blame? *Journal of Agricultural Economics* 55: 101-114.

Wooldridge, J.M. 2003. Introductory econometrics: a modern approach. Thomson South-Western.

Appendix

Table 1. Chicago Mercantile Exchange (CME) spot cheese market: Cheddar cheese sales and wholesale cheese prices (2000-2013).

Year	CME cheddar sales (carloads[1])		Cheese production (mill pounds)		CME cheddar sales as a percentage of cheese production		Wholesale price CME		Wholesale price USDA NASS[2]	
	barrel	block	cheddar	all varieties	cheddar	all varieties	barrel $/pound	block $/pound	barrel $/pound	block $/pound
2000	584	623	2,819	8,258	1.80	0.61	1.1109	1.1465	1.0985	1.1332
2001	209	501	2,747	8,261	1.09	0.36	1.4052	1.4386	1.4039	1.4165
2002	194	644	2,822	8,547	1.25	0.41	1.1438	1.1822	1.1575	1.1808
2003	109	590	2,701	8,557	1.09	0.34	1.2703	1.3172	1.2771	1.297
2004	239	806	3,004	8,873	1.46	0.49	1.6036	1.6492	1.6216	1.6325
2005	190	805	3,046	9,149	1.37	0.46	1.4484	1.4928	1.4621	1.4821
2006	180	353	3,124	9,525	0.72	0.24	1.219	1.2385	1.2305	1.2318
2007	485	451	3,057	9,777	1.29	0.40	1.7411	1.7578	1.7267	1.7172
2008	492	704	3,186	9,913	1.58	0.51	1.8357	1.8558	1.8836	1.8801
2009	545	1,179	3,207	10,109	2.26	0.72	1.2518	1.2961	1.2734	1.2900
2010	550	592	3,235	10,443	1.48	0.46	1.4751	1.4964	1.5033	1.5138
2011	496	591	3,096	10,595	1.47	0.43	1.7870	1.8064	1.8146	1.8084
2012	446	457	3,147	10,890	1.21	0.35	1.6599	1.6980	N/A	N/A
2013	389	466	3,189	11,101	1.13	0.32	1.7165	1.7642	N/A	N/A
Average	**365**	**626**	**3,027**	**9,571**	**1.37**	**0.44**	**1.4763**	**1.5100**	**1.4544**	**1.4653**

[1] A carload includes 40,000-44,000 pounds of cheese. The conversion is made assuming that the carload is 42,000 pounds of cheese.
Source. Authors' tabulations of the USDA NASS cheese production and price data and USDA AMS cheese price data.
[2] USDA NASS cheese prices are survey-based prices. Dairy processors report cheese prices, which are tied to the CME spot cheese prices due to the nature of pricing systems used in cheese contracts.

Table 2. Chicago Mercantile Exchange (CME) spot cheese market: The OLS estimation results of cost pass-through (CPT) and the hypotheses test outcomes on wholesale cheese pricing (2000 – 2014).

Independent variable	Dependent variable: CME cheddar block price		CME wholesale cheese pricing practices: hypotheses tests (T-ratio; p-value)
	Est. coef. (CPT)	T-ratio	
			The cumulative effect of changes in FP
$FP\_INC^*_t$ (β_0^+)	1.23*	7.62	$Ho: \beta_0^+ + \beta_1^+ = \beta_0^-$ fails to be rejected $\{Ha: \beta_0^+ + \beta_1^+ > \beta_0^-\}$ (0.86; 0.3931)
$FP\_INC^*_{t-1}$ (β_1')	-0.58*	-3.24	$Ho: \beta_0^+ + \beta_1^+ = 1$ is rejected in favor of $Ha: \beta_0^+ + \beta_1^+ < 1$ (-7.30; 0.0000)
$FP\_DEC^*_t$ (β_0^-)	0.64*	12.04	$Ho: \beta_0^+ + \beta_1^+ = 0.5$ is rejected in favor of $Ha: \beta_0^+ + \beta_1^+ > 0.5$ (3.03; 0.0029)
Constant	0.03	1.47	$Ho: \beta_0^- = 1$ is rejected in favor of $Ha: \beta_0^- < 1$ (-6.77; 0.0000)
$\beta_0' + \beta_1^+$	0.64	12.90	$Ho: \beta_0^- = 0.5$ is rejected in favor of $Ha: \beta_0^- > 0.5$ (2.64; 0.0091)
			The immediate (current month) effect of changes in FP
DW-statistic	1.28		$Ho: \beta_0^+ = \beta_0^-$ is rejected in favor of $Ha: \beta_0^+ > \beta_0^-$ (3.26; 0.0014)
R2	0.76		$Ho: \beta_0^+ = 1$ is rejected in favor of $Ha: \beta_0^+ > 1$ (1.41; 0.1611)
Sample size	178		$Ho: \beta_0^- = 1$ is rejected in favor of $Ha: \beta_0^- < 1$ (-6.77; 0.0000)
			$Ho: \beta_0^- = 0.5$ is rejected in favor of $Ha: \beta_0^- > 0.5$ (2.64; 0.0091)

*The estimated coefficient is statistically significant at the 1% significance level.
Ho: β=0 and Ha: β≠0; the T-statistic (df=174) rejection regions are (-∞;-2.58] and [2.58; +∞).
A set of hypotheses on wholesale cheese pricing practices (one-tailed T-test, 10% significance level):
$Ho: CPT = c$ is rejected in favor of $Ha: CPT > c$: the T-statistic rejection region is [1.28; +∞);
$Ho: CPT = c$ is rejected in favor of $Ha: CPT < c$: the T-statistic rejection region is (-∞; -1.28].
c denotes the CPT magnitude: c=1 under perfect competition, c=0.5 under monopoly with linear demand, 0.5<c<1 under oligopoly with linear demand, and c>1 under monopoly/oligopoly with non-linear demand.
$Ho: CPT^+ = CPT^-$ (symmetry) is rejected in favor of $Ha: CPT^+ > CPT^-$ (positive asymmetry): the T-statistic rejection region is [1.28;+∞).
All T-ratios are computed using the autocorrelation-adjusted standard errors (Newey-West approach).

Rethinking Entry Mode Choice of Agro-Exporters: The Effect of the Internet

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Abstract

Understanding a firm's internationalization process, including entry mode decisions, has attracted increasing attention from the literature in international business. However, most of the existing literature on exportation by agri-food firms examines single-stage decision making processes based on the decision of whether or not to export, which export mode to use (direct *versus* indirect export), or both of them simultaneously, with three independent alternatives. This article researches the impact of internet use on entry mode decisions of exporting agri-food firms. In this new context, we propose that the Internet influences the entry mode decision and that the decision regarding exporting and the choice of export channels are nested decisions. The results show a positive effect of internet use on the propensity to export. The empirical evidence of the paper also supports the existence of a nested structure.

Keywords: export mode, Internet, nested decisions, sequential logit model, two-stage choice process, internationalization.

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Introduction

The literature on international trade points out that there are two main alternatives for conventional sales channels: a direct sales channel, or an indirect sales channel which employs independent members located in the foreign market (Frazier 1999, Gabrielson and Gabrielson 2011). The Uppsala model proposes a slow and sequential internationalization process that depends on the gradual accumulation of knowledge of foreign markets (Johanson and Vahlne 1977). Traditionally, in the first stages, export intermediaries perform an important "middleman" function by linking firms and customers in geographically distinct markets that could not have been connected otherwise. Later, as firms gain experience, they adopt the direct sales channel option (Gabrielson and Gabrielson 2011). However, since the Internet can reduce the liabilities of foreignness and newness and resource scarcity (Samiee 1998, Gabrielson and Gabrielson 2011) it could be modifying the entry mode choices. The Internet can be used as a direct sales channel and thus contribute to accelerating the firm´s internationalization process (Arenius et al. 2006, Gabrielson and Gabrielson 2011).

The intense process of the globalization of economic activity has made addressing the internationalization process a condition for the survival of enterprises in the agro-industrial sector. However, the entry into international markets is still a challenge for a number of companies, especially in industries such as wine, which is very fragmented and composed of small wineries. For small companies, crossing the border means facing the initial costs of the internationalization process and then competing and managing an international business in a heterogeneous and more demanding context than the local market. The agro-exporters´ lack of size and the absence of the necessary resources and skills make internationalization a high risk proposition. However, the Internet is reducing the initial costs associated with finding information and is shortening the internationalization process (Sinkovics and Penz 2005, Mariussen and Ndlovu 2012, Sinkovics et al. 2013). According to a recent report by the OEMV (Spanish Observatory of the Wine Market), e-commerce in wine is growing exponentially worldwide. The online wine trade in the US has reached 600 million dollars and is also playing a leading role in Europe, where for example, online wine sales account for a total of 200 million euros a year in Britain.

Despite the expansion and relevance of the Internet in the business world, the impact of the Internet on the configuration of international corporate modes of operations and sales channels has been overlooked in the literature (Arenius et al. 2006). However, some authors have argued that this impact can be significant (Gabrielsson et al. 2002), so it is necessary to analyze in detail the effect that the Internet can have on selecting the mode of entry. The Internet improves the access to information of foreign markets, reduces transaction costs, and has also mitigated the effect of distance between countries (Bojnec and Ferto 2010). All this is particularly important for the first entry mode decision, when the firm decides whether or not to export. Some authors have argued that the Internet is one of the ways for small size firms to sell abroad rapidly (Gabrielsson and Kirpalani 2004). As a matter of fact, some evidence shows that when properly used, the Internet can reduce the liabilities of foreignness and newness (Kotha et al. 2001) and resource scarcity, and thus contribute to a faster internationalization (Arenius et al. 2006).

In this sense, the Internet has the capacity to significantly increase not only the efficiency of market transactions, but also to enhance the learning process of international operations through faster and more extensive access to relevant information (Glavas and Mathews 2014). Therefore, the Internet can serve as a direct channel saving costs and eliminating intermediaries between wine producers and end consumers. Furthermore, as Rodríguez and Cervantes (2011) point out, the Internet is an important communication and distribution channel, particularly for SMEs due to the efficiency-cost relationship. By using the Internet through website applications, SMEs have been able to considerably reduce international business operating costs, thus increasing their ability to respond to new international market opportunities (Glavas and Mathews 2014).

The basic choice made by firms, i.e. whether or not to export to foreign markets, is usually treated in the literature of probabilistic choice as a single, independent decision and Binomial Logit Models are used (for example, García et al. 2002). As an alternative to previous research, Pan and Tse (2000) and Kumar and Subramaniam (1997) assume that the decision on entry mode is a more complex process, in which a natural hierarchy exists among the various modes of entry. Following this multi-stage approach, we propose that the Internet modifies the decision on entry mode so that the decision to sell abroad and the choice of export channel (indirect versus direct export) are nested decisions. In this context, this article researches the impact of internet use on the entry mode decisions of exporting agri-food firms. In light of the above the study carries out empirical analysis using a DOC (Designation of Origin) Rioja sample of 177 firms, with focus on internet use.

The rest of the paper is organized as follows. In the next section we analyze the influence of the Internet on the decision of mode entry and then the superiority of a sequential multi-stage process for choosing entry mode type over a single-stage choice process. We specify the hypotheses in this section. Then we describe the data and methodology used to test the hypotheses and report the findings of our research. Finally, we discuss the main conclusions of the study.

Theoretical Framework and Hypotheses

The Internet and the Export Mode Entry Decision

The entry mode literature has attempted to explain channel selection on the basis of cost and efficiency considerations (Gabrielson and Gabrielson 2011). As it is well known, such entry can be done by external means (low control modes) or be internalized within the company (high control modes). In this sense, the Transaction Costs (TCs) approach has been one of the approaches used most frequently. The Transaction Costs approach posits that firms select the mode of entry that provides them with the lowest cost solution (Masten 1993, Shelanski and Klein 1995, Goldsmith and Sporleder 1998). Chiles and McMackin (1996: 74) put it succinctly: TCs approach focus the attention on the attributes of the transaction. Similarly, economizing on TCs is viewed as the main purpose of economic institutions (Brouthers et al. 2003).

Accordingly, the conventional view of the incremental process of internationalization (Uppsala model) proposes a slow and sequential internationalization process that depends on the gradual accumulation of knowledge of foreign markets (Johanson and Vahlne 1977). Since indirect

exporting involves a smaller commitment of financial resources than direct exporting (Johanson and Wiedersheim-Paul 1975), the literature predicts that smaller firms will prefer the indirect export mode (Osborne 1996, Campa and Guillén 1995, Rialp et al. 2002). However, recent developments in modern technologies, such as the Internet, can modify the transaction costs. In this regard, the Internet can decrease the minimum transaction size at which direct sales are efficient (Javalgi and Ramsey 2001, Gabrielson and Gabrielson 2011) and it can make early internationalization a more viable and cost-effective option (Sinkovics and Penz 2005, Sinkovics et al. 2013) In this sense, as Gabrielson and Gabrielson (2011) propose, when the Internet is used as a sales channel it has the potential to enable a remote connection that in many cases, would not be possible otherwise. Therefore, the Internet can influence the export mode entry decision because Internet suitability of products influences the channel selection (Gabrielson and Gabrielson 2011).

Applying the logic of TCs to the online context, the Internet as an alternative to a physical presence refers to the extent to which firms can use electronic integration to replace functions previously conducted by foreign distributors or agents with information acquired online and without establishing a physical subsidiary or joint venture (Sinkovics et al. 2013).

Some studies have already shown how ICTs allow companies to internationalize faster, leading to a "new wave" of global companies. For these companies the Internet is a central factor in business development and in the decision to enter into foreign markets (Bell and Loane 2010). These authors demonstrate how companies using ICTs can quickly become international companies. Likewise, Glavas and Mathews (2014) found a positive relationship between international entrepreneurship characteristics and the use of Internet capabilities for the international business processes. In this sense, authors such as Petersen et al. (2002) propose a rethinking of internationalization theory in light of significant changes to information dissemination due to the Internet. Johanson and Vahlne (2003) have revised their initial model to explain the increase in born-global firms, and others such as Arenius et al. (2006) have shown how the Internet can provide a means to decrease the effects of the liabilities of foreignness and resource scarcity, and thereby contribute to increasing the speed of internationalization.

Therefore, we propose that the use of the Internet has the potential to increase both the propensity for internationalization and the global diversity of the firm. By using the Internet, the firm can compensate the lack of firm size in international experience and business development. Arenius et al. (2006) believe that the Internet can simplify the internationalization path and the marketing organization structure necessary for conducting international business. We therefore predict that:

Hypothesis 1: The emergence of the Internet will imply higher propensity to export

Singles Stage versus Two-Stage Process of Decision Making

In this context, traditional research on the choice of entry modes into international markets has assumed that the mode of entry is a single stage rational analytical decision by a manager or a team of managers. The previous literature assumes that managers consider all entry modes at the same level and that all factors are of equal importance. However, according to Kumar and

Subramaniam (1997), given the presence of multiple types of entry mode, some of them are more similar to one another than others, and therefore, a natural hierarchy exists among the various modes of entry.

In this sense, we consider that the Internet can influence the export mode entry decision so that the choice of entry mode then follows a hierarchical process in which managers would first structure various entry modes into a multi-level hierarchy and define a set of evaluation criteria for each level (Pan and Tse 2000). Drawing upon the previous literature, this research proposes that entry mode choice can be examined from a hierarchical perspective, where "exporting *versus* non-exporting" and "direct exporting *versus* indirect exporting" are nested decisions. Regarding the influence of internet use, we propose the superiority of this two-stage decision process over the single-stage decision process. In the sequential model, the response categories can be perceived as a sequence with stages. The response in a later stage is nested in the response in an earlier stage (Liao 1994, Goldsmith and Sporleder 1998). See Figure 1.
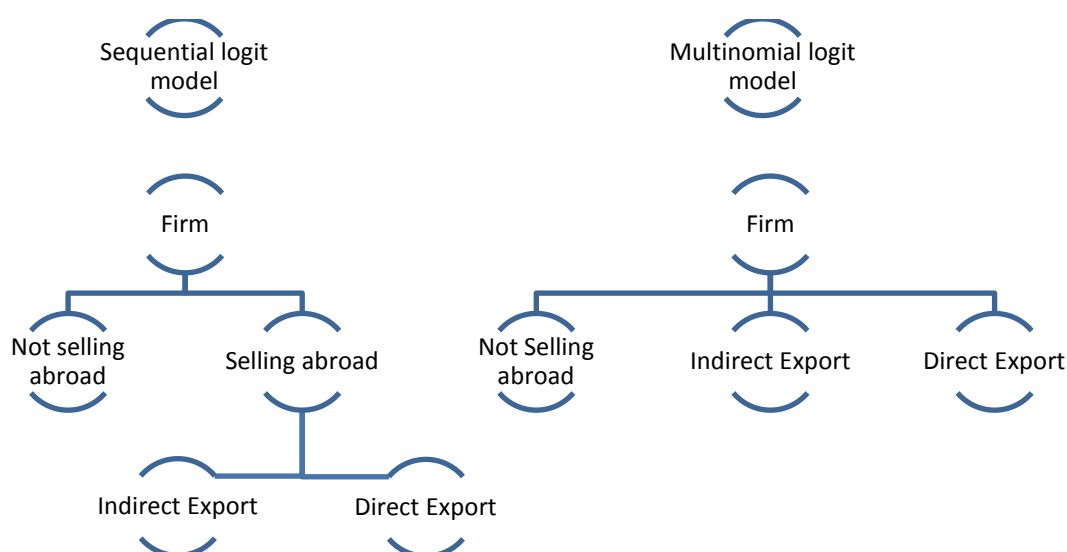
Figure 1. Alternative Logit Models

Therefore, the Internet could modify the entry mode choice since the Internet can be used as a direct sales channel. In this sense, if the firm uses the Internet, the decisions regarding exporting and the choice of the export channel are nested decisions.The following hypothesis was defined by taking into account the above arguments.

> *Hypothesis 2. The emergence of the Internet also influences the choice between direct and indirect exports.*

Research Design

Methodology

This study evaluates two models in order to test the influence of the Internet. First, a single stage decision process with multinomial logit model in the choice of export mode (with three independents alternatives: no export, indirect export and direct export). Second, a two-stage decision process with a sequential logit model with the export decision preceding the export channel decision. The choice in the first stage is whether or not to export. In the second, firms decide between direct and indirect export modes. In the sequential logit model, the response categories can be perceived as a sequence with stages. The response in a later stage is nested in the response in an earlier stage (Liao 1994).

In order to match the econometric model to the decision process, a multinomial logit model is presented first.

The multinomial logit is estimated by the maximum likelihood method (Greene 2003) and for the purpose of this paper it takes the form $\Pr(Y_i = k) = e^{\beta_j X_i} / \Sigma_{j=0}^{2} e^{\beta_j X_i}$, where k (k = 0,1,2) refers to the different choices under analysis namely, no export activities, indirect export and direct export.

There are three equations for calculating the parameter estimates:

(1) $Y_1 = f(\theta_1, X_1)$

where Y = (0: Not exporting, 1: Indirect export)

(2) $Y_2 = f(\theta_2, X_2)$

where Y = (0: Not exporting, 1: Direct export)

(3) $Y_3 = f(\theta_3, X_3)$

where Y = (0: Indirect export, 1: Direct export) and θ are the parameter estimates and X the set of attributes (regressors). We use the same regressors in the equations so $X_1 = X_2 = X_3$.

In order to test whether the two-stage model is superior to the single-stage decision process, a sequential logit model is presented. In our study, the decision to export can be perceived as a sequence with two stages: first, the firm plans to export or not and, if it does, the firm selects the export channel:

   y=1 if the firm has decided not to export
   y=2 if the firm has decided to export indirectly with the help of an intermediary
   y=3 if the firm has decided to export directly to customers abroad

The related probabilities can be written as (Amemiya 1975, Maddala 1983):

(4) $P_1 = F(\sum_{k_1}^{K_1} \beta_{k_1} x_{k_1})$

(5) $P_2 = [1 - F(\sum_{k_1}^{K_1} \beta_{k_1} x_{k_1})]F(\sum_{k_2}^{K_2} \beta_{k_2} x_{k_2})$

(6) $P_3 = [1 - F(\sum_{k_1}^{K_1} \beta_{k_1} x_{k_1})][1 - F(\sum_{k_2}^{K_2} \beta_{k_2} x_{k_2})]$

where the k_1 and k_2 subscripts indicate the sets of x variables included in Stages 1 and 2, respectively. The parameters β_{k1} can be estimated by dividing the entire sample into two groups: firms who don´t export and who do export. The Stage 2 parameter β_{k2} can be estimated from the subsample of export firms by dividing it into two groups: those who have chosen direct exporting and those who have chosen indirect exporting.

Finally, there are two equations for calculating the parameter estimates:

(7) $Y_4 = f(\theta_4, X_4)$

where Y = (0: Not exporting, 1: Direct and Indirect exporting)

(8) $Y_5 = f(\theta_5, X_5)$

where Y = (0: Indirect exporting, 1: Direct export) and θ are the parameter estimates and X the set of attributes (regressors). We use the same regressors in the equations so $X_4 = X_5$.

Sample, Data and Variables

This paper analyses the wine industry from a region of Spain (Rioja). Other authors, such as Wickramasekera and Bamberry (2001), also explore the phenomenon of internet use by born-global firms within the Australian wine industry. The main sources used to obtain the list of wineries in the objective population were the directories drawn up by the Regulatory Council of the Rioja Designation of Origin (DOC).

The interest of analyzing this sample lies in the fact that recent changes in the technological environment have had a significant impact on the available alternatives of sales channel for agri-food firms. At the forefront of this development are the wine industry firms, which have been relatively quick to adopt internet-based channels. Some studies have confirmed that wineries in Rioja are pioneers in the use of the Internet and social networks in Spain (Regulatory Council of the Rioja Designation of Origin 2012). Moreover, 42.5% of Spanish wineries have website with between 1 and 5 years old and 38.2% of them have their own online store (OEMV 2012). It should be noted that the production area of Rioja leads the ranking of the use of these new technologies (OEMV 2012).

The Spanish wine sector in general, and the Qualified Designation of Origin Rioja wine industry in particular, have a markedly international character (Martínez-Carrión and Medina-Albaladejo 2010). Nowadays, Rioja's region is the clear leader in international markets among Spanish wine regions, with a market share of over 40% of total sales of premium wines (Fernandez-Olmos

2011). Although Rioja wine is sold in over a hundred of countries, the sales are concentrated in United Kingdom, nearly 32 per cent of total exports, followed by Germany (18 %) and United States (10.25%).

The data for this study were collected through the use of a structured survey. The survey data collection period ended in September 2010. The population from which the sample is drawn consists of wineries that fulfill the following requisites[1]: (1) they belong to the Rioja Designation of Origin of Spain, (2) they are wine-making processors, (3) they are obliged to present accounting information to the authorities and (4) they are not cooperatives. We received usable responses from 177 (83%).

Dependent Variables

To test the single-stage simultaneous model, this research uses a polychotomous variable with three options: (i) non-exporting, where a value of 1 shows that it has been chosen and 0 if not; (ii) indirect export, which takes a value of 1 when this combination is chosen and 0 if not; and (iii) direct export, which takes a value of 1 when direct export is chosen and 0 if not. To test the separate two-stage model, we use two dummy variables: (i) the export decision, where 1 is exporting and 0 non-exporting; and (ii) the export channel, where 1 is direct and 0 is indirect.

Independent Variable

Internet: We operationalized this variable by means of a direct question which enabled us to construct a dummy variable, which was given the value of "1" when the firm has its own website and "0" if not. This measure has been used by Nieto and Fernández (2005) and Dejo and Ramírez (2009). Moreover, as Kos-Labedowicz (2013) states, the most popular and commonly used Internet tool is the website, a tool of great information capacity and a platform allowing use of other communication tools.

Control Variables

In line with previous literature, the following control variables were included in the specification of the models:

Product differentiation: Previous studies (for example, Coughlan and Flaherty 1983, Coughlan 1985, Anderson and Coughlan 1987) have measured product differentiation with dummy variables coded 1 for highly differentiated goods and 0 for less differentiated goods.

The Control Board of DOC Rioja provides a classification of Rioja wines ordered by value added. From a qualitative point of view, "reserva" and "high profile" wines are the categories that underpin the DOC's great reputation and quality. Following this classification of the Board, product differentiation was defined as the percentage that this category represents of the winery´s wines.

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[1] The population was drawn from the 2007 list provided by the Regulatory Council of the Rioja Designation of Origin.

Human Capital: The literature on human capital theory often uses the education level of the employees as a source of labor productivity. In this paper, we include the proportion of the firm's employees with university degrees as a proxy for human capital. Plechero and Chaminade (2010) have used this value in a similar way.

Firm′s Size: Following previous studies, such as Brouthers et al. (2003) and Goerzen and Beamish (2003), we operationalize the variable size using the number of employees. We apply this measurement in logarithmic form in order to remedy the significant positive skew (Tabachnick and Fidell 2001). Hessels and Terjesen (2010) also compute the natural log of firm size.

Firm′s Age: Similarly to other empirical studies (Delios and Henisz 2003, Bouquet et al. 2004, and Majocchi et al. 2005) we measured firms' experience through a logarithmic transformation of their age.

Foreign Investors: We built a dichotomous variable indicating whether the firm has foreign ownership in its capital structure as in López and García (2005).

Table 1 shows the summary statistics of the data. We observed that 77% of the firms have their own website. Considering the size of firms and in relation to the number of employees, we can consider that the firms are SMEs. The average number of employees is 13.27 and only 9 companies have more than 50 employees.

Table 1. Summary Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
1. Differentiation	22.27	28.35	0	100
2. Human capital	0.21	0.23	0	1
3. Size (number of employees)	13.27	26.81	1	250
4. Age (number of ages)	37.67	46.07	3	408
5. Foreign investors	0.10	0.29	0	1
6. Internet	**0.77**	**0.42**	**0**	**1**

Results

A preliminary analysis was conducted to determine the relationships between pairs of independent and control variables. Table 2 displays Spearman's correlations[2] for each pair. Correlations ranged from -0.08 to 0.39, which indicates weak to moderate associations. This study also calculates the variance inflation factor (VIF) for each of the regression coefficients. The maximum VIF obtained in the three models is 2.10, which is substantially less than the conservative cut-off of 10 for multiple regression models (Neter et al. 1985, Hair et al. 1998).

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[2] The Kolmogorov-Smirnov test determined that the variables are not normally distributed. Consequently, we cannot use Pearson's correlations.

Table 2. Spearman´s Correlations and Variance Inflation Factors

Variables							
	1	**2**	**3**	**4**	**5**	**6**	**VIF**
1. Differentiation	1						1.15
2. Human capital	0.08	1					1.01
3. Size	0.32**	0.06	1				1.34
4. Age	0.18*	0.06	0.11	1			1.08
5. Foreign investors	0.02	-0.05	-0.08	-0.04	1		1.01
6. Internet	**0.27****	**0.13**	**0.39****	**0.11**	**-0.05**	**1**	**1.20**

Note. ** prob <0.01; * prob<0.05

Two models were estimated to carry out the study and analyze the Internet's influence on the decision to export and the selection of the entry mode; a single-stage process estimated with a multinomial logit model and a two-stage nested model estimated with a sequential logit model.

Model 1 (Table 3) represents the decision of whether or not to export and the channel selection as independent decisions so that the company chooses three possibilities simultaneously: *Decision (1)* Indirect export versus not exporting; *Decision (2)* Direct export versus not exporting; *Decision (3)* Direct export versus indirect export. If we pay attention to the Internet's effect on these decisions, it appears that the Internet has a positive influence in decisions 2 and 3, i.e., when deciding to use a direct channel. This result could indicate that having a company website favorably affects the decision to export using a direct channel. As Vázquez et al. (2015) indicate the Spanish wineries can opt for the direct sale of their products through online trade as a business strategy. However, these authors note that this sales channel (e-commerce) is still not widespread in the sector.

Table 3. Results of the Multinomial Logit Model (Model 1)

Independent and Control Variables	Simultaneous Single-Stage (3 Options) Structure					
	Decision (1): Indirect Export *versus* Not Exporting		Decision (2): Direct Export *versus* Not Exporting		Decision (3): Direct Export *versus* Indirect Export	
Internet	0.267	(0.552)	1.360**	(0.571)	1.093**	(0.542)
Differentiation	0.036*	(0.020)	0.044**	(0.020)	0.007	(0.008)
Human capital	-0.982	(1.102)	0.881	(0.966)	1.863*	(1.033)
Size	0.895**	(0.354)	1.502***	(0.347)	0.607**	(0.241)
Age	0.089	(0.269)	-0.062	(0.257)	-0.152	(0.229)
Foreign Investors	1.094	(0.929)	1.029	(0.926)	-0.065	(0.644)
Constant	-1.864*	(0.938)	- 2.898***	(0.956)	-1.033	(0.868)

Note. Standard errors in parentheses. *** Significant at the 1 percent, ** at the 5 percent, * at the 10 percent level. Number of observations=177

On the other hand, a two-stage model is evaluated with the export decision preceding the export channel decision (Model 2 in Table 4). This model takes into account a two-stage structure in which the decisions are nested, that is, the company first evaluates whether or not to export (Level 1), and once the firm has decided to export it selects a channel (Level 2). As shown in Level 1 in Table 4, the export decision is not independent of the firm's internet use. Our results indicate that wineries that use new ICTs tend to export more than their counterparts (β=0.837,

p<0.10). Also, the existence of a positive relationship between internet use and direct export is supported (Level 2 in Table 4 β=1.376, p<0.05).

As shown in Tables 3 and 4 we find support for Hypothesis 1. In this sense the results show that the Internet has a positive influence on the decision to export. Our findings also indicate that wineries are more likely to export using the direct mode if they have their own websites[3].

Table 4. Results of the sequential logit model (Model 2)

Independent and Control Variables	Two-Stage Structure			
	Level 1: Direct & Indirect Export *versus* Not Exporting		Level 2: Direct Export *versus* Indirect Export	
Internet	0.837*	(0.491)	1.376**	(0.569)
Differentiation	0.041**	(0.020)	0.009	(0.008)
Human capital	0.082	(0.868)	2.616**	(1.107)
Size	1.248***	(0.323)	0.642***	(0.245)
Age	0.007	(0.236)	-0.246	(0.243)
Foreign Investors	1.029	(0.869)	0.079	(0.682)
Constant	-1.661**	(0.839)	-1.222	(0.910)

Note. Standard errors in parentheses. *** Significant at the 1 percent, ** at the 5 percent, * at the 10 percent level. Number of observations=177

In order to corroborate that the entry mode choice corresponds to a two-stage structure in which decisions are nested, we use the Akaike and Schwarz Information Criteria (AIC and SIC) which are the most widely used in practice among the various model selection methods using information criteria. The results indicate that the two-stage structure (See Table 5, Model 2) provides a better fit (the preferred model is that with the lowest AIC and SIC values). Thus the optimum structure to represent the export decision sequence is a nested structure, with a first stage in which managers decide whether or not to export and a second stage in which those who decide to export choose between indirect and direct export channels**.** Therefore, these results validate the second hypothesis of this paper. The use of the Internet influences the decision process of the choice of the entry mode for exporting. In this context, a hierarchical decision process is superior to a single-stage process in the choice of direct or indirect export.

Table 5. Comparison among structures: single stage decision process *versus* two-stage decision process

	Model 1	Model 2
	Multinomial Logit	Sequential Logit
Akaike Information Criterion	287.233	284.283
Schwarz Information Criterion	331.699	328.749

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[3] As an example, we can cite the case study of one of the wineries of the sample. This winery has a website where it can be selected the language (Spanish, English, Russian and German). This winery currently exports to Russia, Europe, USA and China. It is interesting to highlight the interest of this winery by the Russian market. In this sense, the website is available in Russian, there is a Russian contact, etc.

With regards to the other control variables, we analyze the results obtained in Table 4, since it is the best fitting model. Our results indicate that wineries marketing differentiated (high-priced) wines tend to export more than their counterparts marketing lower quality products (β=0.041, p<0.05). However, the existence of a positive relationship between a higher level of product differentiation and direct export is not supported (Level 2 in Table 4).

The results also show no evidence that firms that employ more highly educated workers are more likely to export. One possible explanation could be found in the existence of many export assistance programs provided by public sector institutions, which assist domestic firms in the export process. With regard to the choice of channel, the data in Level 2 in Table 4 reveals a significant positive relationship between human capital and direct export for the wineries in our DOC Rioja sample. This is in line with findings from past studies that indicate that the abilities developed by highly educated employees, such as speaking foreign languages (Knowles et al. 2006) or understanding new technologies (Bojnec and Ferto 2010), make it easier for the firm to establish its own export channel.

The coefficients of size are positive and significant at all equations. These results coincide with those previously obtained (for example, Rialp et al. 2002), confirming that larger firms are more likely to export using the direct mode. It thus seems that exporting, and in particular direct exporting, requires a high level of investment.

The data also show that there is not a significant effect for age. This echoes the inconclusive results that have generally been obtained by other authors (for example, Majocchi et al. 2005, Fryges 2006, Moen and Servais 2002).

Finally, it is postulated that firms receiving foreign investment capital make significantly greater use of direct export than other firms; however, our data do not support this. Possibly the limited level of foreign participation in DOC Rioja wineries could explain this result.

Conclusions

Recent developments in modern technologies, such as the Internet, have decreased the minimum transaction size at which direct sales are efficient because the cost of a single transaction has been reduced (Javalgi and Ramsey 2001). Applying the logic of TCs approach to the online context, the Internet as an alternative to a physical presence refers to the extent to which firms use electronic integration to replace functions previously conducted by foreign distributors or agents with information acquired online and without establishing a physical subsidiary or joint venture (Sinkovics et al. 2013). Additionally, the Internet could be modifying the entry mode choices because it can be used as a direct sales channel and thus contribute to accelerating the firm´s internationalization process (Arenius et al. 2006, Gabrielson and Gabrielson 2011).

The literature reviewed in this paper shows that the Internet has the potential to moderate the liabilities of newness and foreignness so that the globalization process can be accelerated (Arenius et al. 2006). Existing models of the internationalization process, for instance, have not captured the important phenomenon of accelerated international growth of born-global firms,

which led Johanson and Vahlne (2003) to revise their model and some authors propose a rethinking of internationalization theory in light of significant changes due to the Internet.

In line with this, this article researches the impact of internet use on export decisions and the entry mode choices for agri-food firms. Our results show that the Internet has a positive influence on the decision to export. Our findings also indicate that wineries are more likely to export using the direct mode if they have their own website. Results corroborate earlier research findings that suggest a link between export intensity and the successful use of the Internet (Morgan-Thomas and Bridgewater 2004, Samiee 1998).

Additionally, our results have shown the sequential character of export decisions and, therefore, the decomposition of the choice of export channels into a two-stage process: the decision to export and the choice of the direct-indirect mode. The results of the estimated models confirm that a two-stage structure is the model that best explains the selection of the entry mode and shows that the use of the Internet determines these decisions. The decision on the channel type should be modeled jointly with the decision to export due to their interdependency (nested decisions), while taking into consideration the use of the Internet, since the Internet determines the entry mode, as shown by the results of this study.

The results have some implications for managers and politicians with special attention for food and beverages industry. First, Internet-based channels open new opportunities to firms' internationalization because as our results show the use of the Internet promotes export through direct channels. Second, the use of the Internet as a direct channel could involve an improvement in the management of logistics processes, for example, better control of circulation of goods and faster communication of requests, that could reduce transactions costs. Third, the Internet could improve the service to customers because the Internet could become a good and ideal support for sales, post-sales and customer services. Moreover, eliminating external agents improves access to information of customer for decision-making. To sum up, our results suggest that managers interested in expanding their wines into international markets should consider the Internet as a key factor influencing export activity. As such, it may be advisable to set up institutional programs that provide e-commerce learning or programs that improve the understanding of new technologies for managers and employees. Moreover, the results show that the outlook on internationalization is changing as a result of the rapid development of ICTs, including the use of the Internet. Thus, the barriers to exporting that small businesses were facing, are now minimized by the use of ICTs, so it is necessary to consider factors other than the size of the organization, or human capital, used traditionally, and consider new elements such as internet use. All of this should be taken into account, especially in programs to aid exports.

The paper also highlights some limitations which point to interesting avenues for future research. Our study has focused on the simple dichotomy in the decision of direct *versus* indirect exporting. We are sensitive to the fact that there is a wide array of indirect export channels, such as export promotion organizations or trade representatives (Albaum and Edwin 2002). Although they share some features, they exhibit many distinct strengths and weaknesses that may affect the choice process. However, we do not consider specific export channels because this could affect our ability to determine the impact of the characteristic factors of a particular export mode.

Acknowledgments

References

Albaum, G., and D. Edwin 2002. *International Marketing and Export Management*. Prentice Hall.

Amemiya, T. 1975. Qualitative response models. *Annals of Economic and Social Measurement* 4: 363-372.

Anderson, E., and A. Coughlan 1987. International market entry and expansion via independent or integrated channels of distribution. *Journal of Marketing* 51 (1): 71-82.

Arenius, P., V. Sasi, and M. Gabrielsson 2006. Rapid internationalisation enabled by the Internet: The case of a knowledge intensive company. *Journal of International Entrepreneurship* 3(4): 279–290.

Bell, J., and S. Loane 2010. New-wave'global firms: web 2.0 and SME internationalisation. *Journal of Marketing Management* 26 (3-4): 213-229.

Bojnec, S., and I. Ferto 2010. Internet and international food industry trade. *Industrial Management and Data Systems* 110 (5): 744–761.

Bouquet, C., L. Hébert, and A. Delios 2004. Foreign expansion in service industries: Separability and human capital intensity. *Journal of Business Research* 57 (1): 35-46.

Brouthers, K.D., L.E. Brouthers, and S. Werner 2003. Transaction cost-enhanced entry mode choices and firm performance. *Strategic Management Journal* 24 (12): 1239-1248.

Campa, J.M., and M. Guillén 1995. Firm determinants of export internationalization and the choice between commercial alliances and proprietary distribution channels. unpublished manuscript. Massachusetts Institute of Technology, Cambridge, MA.

Chiles, T.H. and J.F. McMackin 1996. Integrating variable risk preferences, trust, and transaction cost economics. *Academy of Management Review* 21(1): 73-99.

Coughlan, A. 1985. Competition and Cooperation in Marketing Channel Choice: Theory and Application. *Marketing Science* 4 (2): 110-129.

Coughlan, A., and T. Flaherty 1983. Measuring the International Marketing productivity of U.S: seminconductor companies. In *Productivity and Efficiency in Distributions Systems*, edited by David, A.,Gautschi, 123-153. North-Holland, New York.

Dejo, N., and M. Ramírez 2009. Export Behavior: a Study of Spanish SMEs. *GCG: Revista de Globalización, Competitividad y Gobernabilidad* 3 (2): 52-67.

Delios, A., and W. Henisz 2003. Political hazards, experience, and sequential entry strategies: The international expansion of Japanese firms, 1980-1998. *Strategic Management Journal* 24 (11): 1153-1164.

Fernandez-Olmos, M.F. 2011. The determinants of internationalization: Evidence from the wine industry. *Applied Economic Perspectives and Policy* 33 (3).

Frazier, G.L. 1999. Organizing and managing channels of distribution. *Academy of Marketing Science* 27 (2): 226–240.

Fryges, H. 2006. Hidden Champions – How Young and Small Technology-Oriented Firms Can Attain High Export-Sales Ratios. Center for European Economic Research. Discussion Paper, No. 06-045.

Gabrielson, M. and P. Gabrielson 2011. Internet-based sales channel strategies of born global firms. *International Business Review* 20: 88-99.

Gabrielsson, M., and M.V.H. Kirpalani 2004. Born globals: How to reach new business space rapidly. *International Business Review* 13 (5): 555–571.

Gabrielsson, M., M.V.H. Kirpalani, and R. Luostarinen 2002. Multiple channels strategies in the European personal computer industry. *Journal of International Marketing* 10: 73-95.

García, J.M., F.R. Álamo, and S.M. Suárez 2002. Determinantes organizativos y directivos de la actividad exportadora: evidencia empírica en el sector vitivinícola español. *Cuadernos de Economía y Dirección de la Empresa* 13: 519-544.

Glavas, Ch. and Sh. Mathews 2014. How international entrepreneurship characteristics influence Internet capabilities for the international business processes of the firm. *International Business Review* 23: 228-245.

Goerzen, A., and P. Beamish 2003. Geographic scope and multinational enterprise performance. *Strategic Management Journal* 24 (13): 1289-1306.

Goldsmith, P.D. and T.L. Sporleder 1998. Analyzing foreign direct investment decisions by food and beverage Firms: an empirical model of transaction theory. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie* 46(3): 329-346.

Greene, W. 2003. *Econometric Analysis*, 5th ed. Prentice Hall. Upper Saddle River, NJ.

Hair, J., A. Rolph, R. Tatham, and W. Black 1998. *Multivariate Data Analysis* 5th ed. Prentice-Hall, Englewood Cliffs, NJ.

Hessels, J., and S. Terjesen 2010. Resource dependency and institutional theory perspectives on direct and indirect export choices. *Small Business Economics* 34: 203-220.

Javalgi, R., and R. Ramsey 2001. Strategic issues of e-commerce as an alternative global distribution system. *International Marketing Review* 18 (4): 376–391.

Johanson, J. and J-E. Vahlne 1977. The internationalization process of the firm: A model of knowledge development on increasing foreign commitments. *Journal of International Business Studies* 8 (1): 23-32.

Johanson, J. and J-E. Vahlne 2003. Business relationship learning and commitment in the internationalization process. *Journal of International Entrepreneurship* 1 (1): 83-101.

Johanson, J., and F. Wiedersheim-Paul 1975. The internationalization of the firm fours Swedish cases *Journal of Management Studies* 12 (3): 305-322.

Knowles, D., T. Mughan, and L.L. Reason 2006. Decision-maker Characteristics and Performance of Internationalised SMEs. *Journal of Small Business and Enterprise Development* 13 (4): 620-641.

Kos-Labedowicz, J. 2013. Influence of modern technologies on internationalization of small and medium enterprises. *Information Systems in Management* 2 (1): 12-22.

Kotha, S., V.P. Rindova and F.T. Rothaermel 2001. Assets and actions: Firm-specific factors in the internationalization of U.S. Internet firms. *Journal of International Business Studies* 32 (4): 769–791.

Kumar, V., and V. Subramaniam 1997. A contingency framework for the mode of entry decision. *Journal of World Business* 32: 53-72.

Liao, T. 1994. *Interpreting Probability Models Logit, Probit and Other Generalized Linear Models,* Sage Publications, London.

López, J. and R. García 2005. Technology and export behaviour: A resource-based view approach. *International Business Review* 14: 539-557.

Maddala, G.S. 1983. *Limited-dependent and Qualitative Variables in Econometrics*. Cambridge University Press.

Majocchi, A., E. Bacchiocchi, and U. Mayhrofer 2005. Firm size, business experience and export intensity in SMEs: A longitudinal approach to complex relationships. *International Business Review* 14: 719-738.

Mariussen, A. and T. Ndlovu 2012. Internet–enabled value co–creation in SME internationalisation: current practices from the UK food and drink industry. *European Journal of International Management* 6 (5): 503-524.

Martínez-Carrión, J.M. and F.J. Medina-Albaladejo 2010. Change and Development in the Spanish Wine Sector, 1950–2009. *Journal of Wine Research* 21 (1): 77-95.

Masten, S.E. 1993. Transaction costs, mistakes, and performance: Assessing the importance of governance. *Managerial and decision economics* 14 (2): 119-129.

Moen, O., and P. Servais 2002. Born Global or Gradual Global? Examining the Export Behavior of Small and Medium-Sized Entreprises. *Journal of International Marketing* 10 (3): 49-72.

Morgan-Thomas, A. and S. Bridgewater 2004. Internet and exporting: Determinants of success in virtual export channels. *International Marketing Review* 21(4/5): 393-408.

Neter, J., W. Wasserman, and M.H. Kutner 1985. *Applied linear statistical models: Regression, analysis of variance, and experimental design*, Homewood, IL, Richard Irwin.

Nieto, M.J., and Z. Fernández 2005. The Role of Information Technology in Corporate Strategy of Small and Medium Enterprises. *Journal of International Entrepreneurship* 3(4): 251-262.

OEMV (Observatorio Español del Mercado del Vino – Spanish Observatory of the Wine Market) 2012. Consumo de vino en España y el vino en las redes sociales.

Osborne, K. 1996. The channel integration decision for SMEs manufacturing exporters. *International Small Business Journal* 14 (3): 40-56.

Pan, Y., and D. Tse 2000. The hierarchical model of market entry modes. *Journal of International Business Studies* 31 (4): 535-554.

Petersen, B., L.S. Welch and P.W. Liesch 2002. The internet and foreign market expansion by firms. *MIR: Management International Review* 42 (2): 207-221.

Plechero M., and C. Chaminade 2010. Different competences, different modes in the globalization of innovation? A comparative study of the Pune and Beijing regions. In circle working paper 3/2010.

Regulatory Council of the Rioja Designation of Origin 2012. Boletín Informativo (Newsletter) 84.

Rialp, A., C. Axinn and S. Thach 2002. Exploring channel internationalization among Spanish exporters. *International Marketing Review* 19 (2): 133-155

Rodríguez, C. and M. Cervantes 2011. The Internet as an alternative distribution and communication cannel for SMEs producing quality agro-food product. *aDResearch ESIC* enero-junio: 50-63.

Samiee, S. 1998. Exporting and the Internet: A conceptual perspective. *International Marketing Review* 15 (5): 413–426.

Shelanski, H.A. and P.G. Klein 1995. Empirical research in transaction cost economics: a review and assessment. *Journal of Law, Economics, & Organization* 11 (2): 335-361.

Sinkovics, R. and E. Penz 2005. Empowerment of SME websites: development of a web-empowerment scale and preliminary evidence. *Journal of International Entrepreneurship* 3 (4): 303-315.

Sinkovics, N., R. Sinkovics and R.J. Jean 2013. The internet as an alternative path to internationalization? *International marketing Review* 30 (2): 130-155.

Tabachnick, B.G. and L.S. Fidell 2001. Using multivariate statistics, 4th ed. Needham Heights, MA: Allyn & Bacon.

Vázquez de la Torre, G.M., J.M. Arjona Fuentes and F. Vázquez Palmero 2015. El Comercio Electrónico En La Comercialización Del Vino Español: Una Aproximación a Su Repercusión En El Sector Y a Sus Posible Sinergias Con El Turismo Enológico. *International Journal of Scientific Management and Tourism*, Forthcoming.

Wickramasekera, R., and G. Bamberry 2001. Born globals within the Australian wine industry: an exploratory study. Faculty of Commerce, Charles Sturt University.

An Economic Exploration of Smallholder Value Chains: Coffee Transactions in Chiapas, Mexico

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Abstract

Fair trade and vertical integration represent two popular approaches for enhancing the incomes of organized farmers in a volatile coffee market as compared to the uncertain plight of independent, non-affiliated growers. A mixed method approach, utilizing informal interviews and a household survey in Chiapas, Mexico, analyzed three coffee trading regimes: independent, non-affiliated farmers, and growers in cooperatives pursuing a fair trade or vertical integration strategy. Survey and econometric results indicate that concentration on specialty coffee production with a portfolio of foreign contracts is economically preferable to a vertically integrated cooperative, which in turn produces more favorable coffee prices for smallholders than the non-affiliated conventional, *coyote*-dominated trading system.

Keywords: coffee, smallholder agriculture, fair trade, vertical integration, Chiapas

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Introduction

Concerns surrounding the future of smallholder agriculture have emerged, again, in discussions among development, business, and governmental leaders (Wiggins et al. 2010, Fan et al. 2013). With smallholders representing two billion rural residents and producing eighty percent of the world's food supply, the commercial viability of small-scale farms represents a critical challenge for the global economic system.

Smallholder farmers struggle because of their limited access to inputs (e.g. credit, technology, information) while working on low-productivity land located far distances from output markets via an inadequate, high-cost road system. Efforts to link smallholders to the agrifood value chain must first recognize the importance of strict quality standards, high volume requirements, and dependability (e.g. preference for irrigated farms with access to paved roads) by buyers. Secondly, these linkage-building activities must stress vertical and horizontal coordination, group lending, enhanced organizations (i.e. marketing cooperatives, producer associations), and value-adding enterprises. Given the buyer-driven nature of global food and commodity chains, local value-added investments of time and money face a daunting, but not insurmountable, challenge (Kaganzi et al. 2009, Fischer and Qaim 2012). Successfully developed and maintained linkages build greater resilience in smallholder agriculture in volatile world markets.

Coffee, one of the most valuable traded commodities in the world, represents a critical source of income for smallholder farmers and their farm workers (Lewin et al. 2004). Fridell (2007) estimates that seventy percent of the coffee produced worldwide is grown on farms of less than ten hectares. Price volatility, a normal feature of the coffee market since 1989, places smallholder farmers on an economic rollercoaster. Supply-side shocks to the coffee trading system occur with weather events (e.g. droughts, hurricanes) and market entry. On the demand-side, more gradual but still shock-like change is due to increasing buyer concentration, evolving Arabica and Robusta substitutability and complementarity, and the continuing emergence of the specialty coffee sector (Calo and Wise 2005, Petchers and Harris 2008).

Most of the value-added in the coffee value chain (roasting, distribution, retailing) occurs in the consuming countries. Efforts to capture additional value closer to the smallholder level have centered on production and marketing strategies that feature fair trade, sustainability, organic certification, shade-grown coffee (Giovannucci and Koekoek 2003, Daviron and Ponte 2005). Less frequently documented attempts to capture value involve vertical integration--smallholders integrating downstream in an attempt to capture a larger income share for their coffee production (Talbot 2002).

Our initial research question was "Are smallholder coffee producers better off economically when they participate in value-added activities, specifically vertical integration?" We explore this question by comparing and contrasting three coffee trading regimes in Chiapas, Mexico: non-affiliated conventional, fair trade, and vertical integration. The smallholder and the smallholder farming system serve as the units of analysis in this unique three-way comparison. The next section of the paper provides an overview of the potential benefits of value chain interventions, focusing on fair trade and vertical integration. An explanation of our research design, including data sources and methods, follows with a detailed description of the three

alternative trading regimes. We discuss the results of our mixed method analysis and draw relevant conclusions for managers in, and scholars of, the global agribusiness system.

Value Chain Interventions

Background

Arabica and *Robusta* coffee varieties account for nearly all the 2.5 billion cups of coffee consumed on a daily basis. *Arabica* production requires higher elevations (1000-2000 meters), fertile soils, more intensive maintenance, is more susceptible to disease and insects (e.g. rust, borer), less resistant to adverse weather, and predominately is hand harvested while *Robusta* is a hardier plant that can be harvested mechanically. As a result, *Arabica* coffee production costs are 50-80 % higher than *Robusta* (Dicum and Luttinger 1999, Tuvhag 2008). *Arabica* beans are better quality, have superior aroma and taste, and contain less caffeine (0.8-1.4% for *Arabica* and 1.7-4.0% for *Robusta*).

While coffee is grown throughout the tropical and subtropical regions of the globe, most coffee is consumed in northern latitude countries (Brazil is the exception). With the deregulation of the coffee market in 1989, price volatility became a key feature of coffee markets where market power shifted to oligopoly-like buyers in consuming countries and away from producers. New producing countries entered the market (e.g. Vietnam) and others increased their coffee acreage (e.g. India and Uganda). Smallholder risk increased dramatically in these new boom and bust coffee cycles. The difference between the retail price of coffee and the price paid to growers increased 50% with the change largely favoring the value-added sector (i.e. roasting, wholesaling, retailing). In 2001, when real coffee prices fell to their lowest levels in 100 years, Jaffee (2007) reports that Mexican smallholder incomes declined by 70%, forcing smallholders to abandon their coffee plots and migrate out of coffee-producing regions, often to the United States.

Historically, traditional coffee products were regular, decaffeinated, and instant coffees. Demand was stagnant with roasters supplying customers with low-priced, low-quality homogenous coffee (Lewin, Giovannucci and Varangis 2004). Post deregulation the demand side of the coffee market began to undergo dramatic changes that are ongoing, particularly with specialty coffees. Specialty coffee provided a "third place" (i.e. not home or work) where consumers could meet their consumption and relational needs. The specialty market provided quality coffee where the product's origin and cultivation method was taken into account at the retail level. Although high quality *Arabica* beans are associated with specialty coffees, lower-cost *Robusta* beans, used in espresso-based coffees such as lattes and cappuccinos, became a dominant player in global coffee markets. Improved processing technologies for *Robusta* beans captured the interest of large food companies (e.g. Kraft, Sara Lee, Proctor and Gamble, Nestlé) who successfully developed more blended coffees.

Specialty coffees increased consumer awareness about the environmental and economic conditions and practices in the coffee industry. Media exposure, revealing questionable corporate practices in growing and consuming countries, stimulated the growth of socially conscious products. Coffees that promoted long-term environmental, social and economic sustainability,

and that are certified by an accredited third party, became known as sustainable coffees. Organic, shade-grown (or eco-friendly), and fair-trade coffees are all sustainable coffees, earning price premiums (Giovannucci and Koekoek 2003, ITC 2011). Research repeatedly has shown that out-of-home coffee buyers, particularly "ethical consumers", are willing to pay higher prices for sustainable coffees—their demand is inelastic in comparison with conventional coffee products (Arnot et al. 2006, Hainmueller 2014). Into this dynamic and challenging market environment, smallholders may introduce competitive strategies for their coffee beans in an effort to capture a portion, or all, of the accessible value-added beyond their farm gate.

Fair Trade

Fair trade, the market-based effort to connect producers and consumers through the use of social standards and price floors, emerged after World War II as faith-based groups and international relief agencies organized alternative trading organizations to sell handicrafts from recovering war-ravaged communities in Europe (Raynolds et al. 2007). For the next five decades, the network of these alternative-trading organizations challenged the conventional, "unequal and unethical" south-north trading relationships by promoting producer empowerment and poverty alleviation (Fridell 2004).

The Fair Trade Labeling Organization International (FLO) was established in 1997 to offer mainstream, conventional importers, processors and distributors access to an "ethical market" through the fair trade label. Although FLO is the largest and most widely recognized certification organization, other labeling initiatives that certify sustainable coffees include organic certification and Rainforest Alliance. To participate as certified fair trade coffee producers, smallholders are required to organize themselves into producer associations, usually cooperatives, and (1) have agricultural and environmental practices that are safe and sustainable, (2) conform to the conventions of the International Labor Organization, and (3) have democratic structures and transparent administration in place to ensure direct benefits to farmers (FLO 2011a, 2011b, 2011c). In return, smallholders are guaranteed a minimum price (i.e. price floor) for their coffee at $1.40 per pound and an additional premium ($0.30) is paid for organic-certified coffee (FLO 2012). In addition to the coffee price, FLO requires traders to pay a fair trade premium of $0.20 per pound with at least $0.05 per pound invested—at the individual or cooperative level—to improve productivity and/or quality. Fair trade coffee remains a small percentage of total coffee traded with most fair trade certified coffee not sold as a fair trade certified product at the retail level (FLO 2011b).

Analyses of fair trade coffee regimes range from widely enthusiastic to severely critical. Bacon (2005) found that participation in alternative coffee trade networks (e.g. eco-labels, organic, fair trade, specialty) reduced smallholders' vulnerability to low coffee prices. Enhanced awareness of management strategies for reducing vulnerability encouraged Nicaraguan producers to diversity their farming activities and respond to market opportunities (e.g. emphasis on quality). Wollni and Zeller (2007) found in their research in Costa Rica that coffee growers participating in the specialty markets (i.e. gourmet, estate, organic, shade-grown, fair trade coffees) receive higher farm gate prices than they would through conventional channels. If smallholders participated in coffee cooperatives they were more likely to participate in specialty markets and hence experience the benefits of price premiums. Murray et al. (2006) argue that fair trade coffee

enterprises mitigate migration off smallholder farms and provide opportunities for rural economic development throughout Mexico and Central America. However, these benefits will occur only when the dilemmas of a slow-growing Northern coffee market, substandard bean quality and lower than anticipated participation in fair trade networks by producers and buyers are overcome. Other analyzes find little evidence that fair trade has significant impact on farmers' living standards (Ruben et al.2009, Johannessen and Wilhite 2010). Data-driven doubts arise about the ability of fair trade cooperatives to efficiently and effectively replace existing players in the coffee value chain. Fair trade benefits largely accrue to retailers through higher prices with smallholders only receiving 5-15% of the retail price for a cup of fair trade coffee. Any direct smallholder benefits attributable to fair trade are modest, or non-existent, and largely are due to the price floor. The most significant economic gains may be the development of stronger cooperative organizations in rural areas.

Vertical Integration

The coffee trading system is a complex network of producers, traders, exporters, importers, roasters, wholesalers, retailers and consumers (Fitter and Kaplinsky 2001, Daviron and Ponte 2005). Coffee cherries on the tree have no economic value so each activity, from harvesting to retail sales, adds value to the product. The decision by the smallholders to dry or wet process their coffee cherries determines the value of green coffee. With the dry process all cherries are harvested, sorted, cleaned and dried and sold at the farm gate as dry cherries. The wet process involves sorting, cleaning/floating, de-pulping, fermenting, washing, and drying—the resulting beans are sold as parchment coffee at the farm gate and receive a higher price than dry cherries. The highest value added in the coffee value chain occurs at the roaster stage where green coffee is blended, roasted, ground, and packaged into a wide variety of coffee products, including instant coffee. Roasting generally takes place near or in the importing country. Retailing represents the second most value added stage in the value chain.

Because the smallholder coffee producer receives, at the farm gate, only 5-15% of the retail price for a cup of coffee, their incentive is to investigate activities that will capture some or all of the value added beyond the farm gate (Wilson et al. 2013). Perceived gains from vertical integration emerge from the analysis of transactions along the supply chain, assuming that markets fail at most if not at all stages. Monopsony and monopoly power throughout the trading regime, often referred to as multiple marginalization, implies that coffee producers will receive a lower price, and coffee consumers will pay a higher price, than would exist in more competitive transactions (Joskow 2010, Vettas 2010). A single firm, at least conceptually, could enter this supply chain and capture all the profit and deadweight losses associated with these market failures. In contrast, Williamson (1985) argues that firms with a high level of asset specificity will vertically integrate when the transaction costs associated with working in the conventional supply chain threatens their overall cost structure and competitiveness. Coffee trees have asset specificity "locked-in" characteristics. Therefore, incentives exist for coffee growers to seek organizational structures that allow them to maintain some control of their commodity downstream. Possibly the most famous example of successful vertical integration by a federation of small cooperatives is the *Federación Nacional de Cafeteros de Colombia* (the Juan Valdez marketing campaign) that grew, over nearly a century, into a major competitor in the international coffee market (www.federaciondecafeteros.org).

Evaluations of smallholder vertical integration remain rare in the academic literature. Murekezi et al. (2012) report that Rwandan coffee farmers selling to their cooperatives failed to gain any incremental benefits over selling their crop to private processing plants. Private buyers operated in a competitive market environment with little empirical evidence of monopsony power in the transactions. The key to success in either regime, according to the authors, was maintaining a high quality product that met the demands of the buyer-driven value chain. Other researchers argue that vertical coordination, rather than vertical integration, holds the greatest promise for smallholder producers (Muradian and Pelupessy 2005). A farm gate price premium is realistic by working closely with non-governmental organizations and corporate buyers to develop a branded product. These premiums increase smallholder incomes, enable on-farm investments, finance the educational expenses of children, and may, in the case of cooperatives, contribute to social improvements in the community.

Data Sources and Analytical Methods

Mexico occupies the 8th place in global coffee production, 3rd in *Arabica* production, 3rd in organic-fair trade coffee certified, 10th in coffee exports, and 13th in coffee consumption (SAGARPA 2010). Chiapas, in southern Mexico along the Guatemalan border, ranks first among Mexico's states in coffee production. About 77% of Chiapas' population falls below the poverty line, with many citizens having limited access to basic human needs such as education, health, and nutrition (CONEVAL 2009). Therefore, Chiapas represents a fertile environment to explore the role alternative coffee trading regimes play in smallholder incomes and in the development their families and communities. Three regimes are analyzed: smallholders as members of a fair trade cooperative, growers participating in a vertically integrated cooperative, and conventional, non-affiliated growers.

Fair Trade Cooperative (FT): Campesinos Ecológicos de la Sierra Madre de Chiapas (CESMACH)[1]

The cooperative CESMACH, located in Jaltenango, was founded in 1992 when a group of twenty-five coffee farmers, concerned about low coffee prices, attended a community education program that offered workshops on quality control, environmental literacy, community development, and organic coffee production. In 1994 CESMACH received its legal registration and two years later the cooperative acquired its first organic certification; today the cooperative has five organic certifications. CESMACH's 478 members grow *Arabica* coffee exclusively in the buffer zone of the Biosphere Reserve "El Triunfo" in the Sierra Madre de Chiapas at an elevation of 1000-1400 meters.

From 1999 to 2002, CESMACH collaborated with Conservation International (CI) to commercialize its organic, shade-grown coffee in Starbucks locations in the United States. CESMACH and other groups supplied the coffee and *Agroindustrias Unidas de Mexico* (AMSA) processed the coffee for Starbucks. Although Starbucks guaranteed that they would buy the entire coffee harvest at good prices, in 2002 CI began to demand larger quantities of coffee that CESMACH could not meet without increasing yields by using commercial fertilizer. Proposals to source coffee from other cooperatives, vertically integrate (i.e. eliminate AMSA in the value

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[1] (www.cesmach.com.mx)

chain), or sell directly to Starbucks all failed to materialize. CESMACH obtained fair trade certification in 2002, walked away from the CI-AMSA-Starbucks partnership, and today the cooperative partners with twenty importers from the United States, Europe and Japan who buy its high quality, shade-grown, organically certified, fair trade coffee.

Vertically Integrated Cooperative (VI): Café Justo[2]

The cooperative Café Justo grew out of the vision that smallholder coffee growers would have no incentive to migrate to other parts of Mexico or to the United States if they had a sustainable source of income in their local communities (Adam and Bassett III 2009). In 2000, during a period of low coffee prices and in the aftermath of Hurricane Mitch, coffee growers in the small community of Salvador Urbina (near Tapachula), with technical and financial assistance from the Presbyterian Church in the United States, designed and implemented a business plan to capture the entire value-added in the supply chain for their coffee. Café Justo received its legal registration in 2002 and in 2005 obtained organic certification and became a member of the Fair Trade Federation. However, Café Justo could not use the fair trade label because the cooperative failed to meet the export green coffee requirement; the cooperative exports processed, packaged coffee in whole bean or ground form, both *Arabica* and *Robusta*. With recent changes in fair trade regulations overcoming this issue, in 2012 Café Justo received permission to utilize the fair trade label but has yet to make a change in their packaging, choosing to use the words "fair trade" but not the label. Sixty growers in three communities participate in the cooperative.

Café Justo members, through the cooperative structure, maintain control of their coffee from their farms until it is sold at the retail level in the United States (Figure 1). Member growers take their dry cherry or parchment coffee to the cooperative's factory in Salvador Urbina where the coffee is hulled, cleaned, sorted, and bagged into 60kg sacks of green coffee. The farmer-owned factory roasts and grinds some coffee for the local market but most green coffee is sent by bus to Café Justo's main roasting facility in Agua Prieta, Sonora, a border community near Douglas, Arizona. Here the coffee is roasted and processed into a variety of coffee products. Packaged coffee is sold on-line to individuals, organizations, and churches in the United States. Cooperative members also participate in coffee tourism when delegations from the United States travel to Salvador Urbina to learn about the production of fair trade coffee. Visitors lodge and eat with Café Justo members at the cost of $20/person/day, which represents an important additional source of income for these families.

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[2] (www.justcoffee.org)
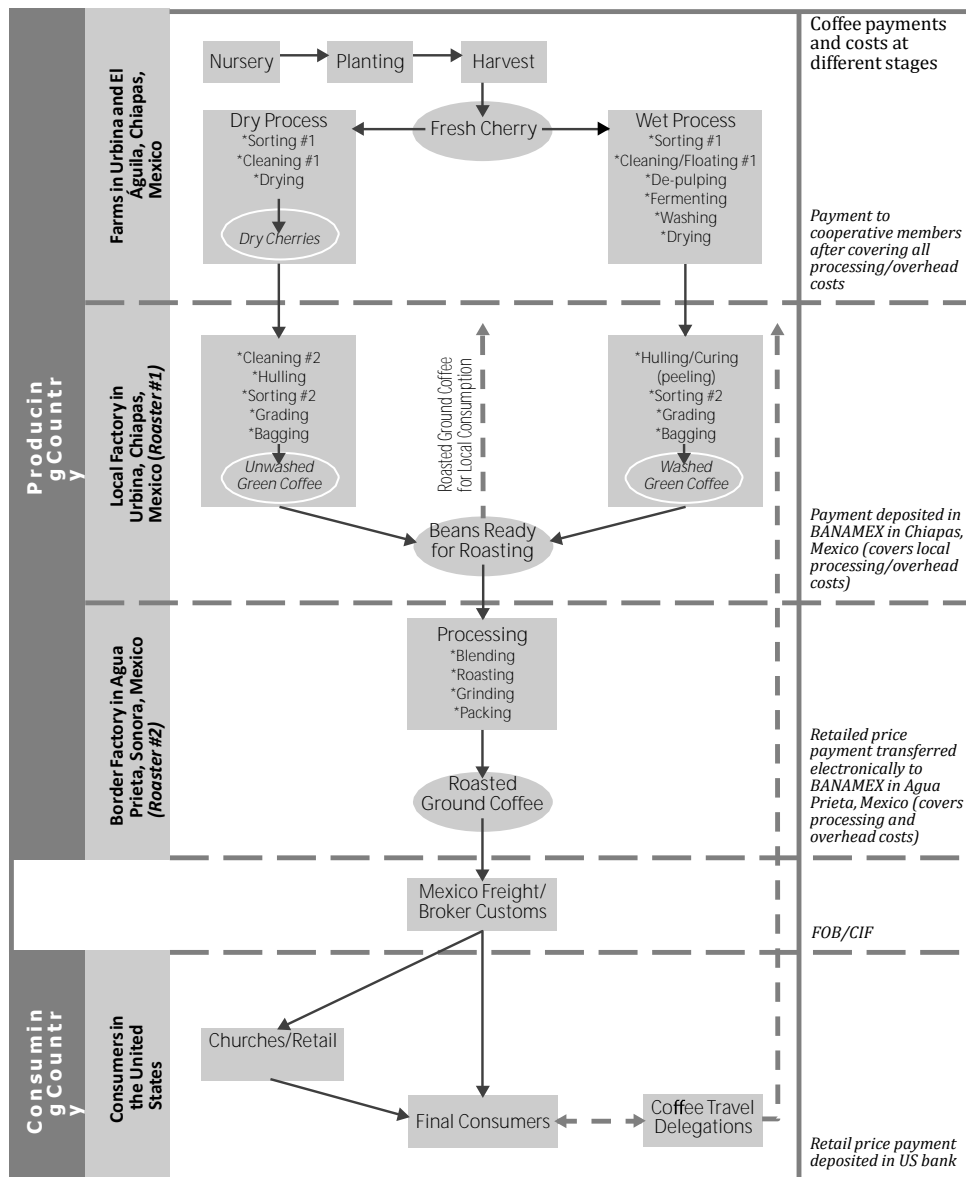
Figure 1. Café Justo's Value Chain
Source. Bassett 2012

Non-Affiliated Coffee Growers (NA)

The independent, smallholder coffee growers who sell coffee directly into the conventional supply chain at the farm gate represent the baseline for this study. These growers sell their coffee as dry cherries or parchment to local *coyotes*, middlemen or intermediaries, who serve the value chain both as buyers and credit providers. Most *coyotes* have the resources (i.e. equipment and cash) to add value by transporting, hulling, cleaning, sorting, grading, and sacking green coffee for export. Others resell the unprocessed coffee cherries or beans to local processors. The key competitive advantage *coyotes* have over cooperatives is their ability to pay full, but low prices at the farm gate and provide growers with financing, particularly during "*los meses flacos*" (skinny months) of June to September when growers have low financial reserves and no food

crop production due to the heavy rains. Although smallholders are only required to liquidate their credit balances with a portion of their harvest, often the operating assumption is that farmers must sell their entire harvest to the credit provider (*coyote*) as a sign of loyalty and to insure future credit availability. Non-affiliated farmers with financial reserves can negotiate higher prices at the farm gate because of their coffee storage capabilities and their ability to force *coyotes* to compete with each other on the farm gate price.

Mixed Method Analysis

The analysis of the FT, VI and NA trading regimes utilized a mixed method approach where qualitative and quantitative data was collected through semi-structured interviews, participant observation, and a household survey. Preliminary discussions with CESMACH and Café Justo leadership began in April of 2011 when the research project was introduced; a preliminary site visit and pre-test of the household survey was conducted in December 2011 in Salvador Urbina. With a trustworthy working relationship established, a two-person team conducted the fieldwork in January 2012.

Interviews were conducted with key leaders in these coffee-trading regimes: a *coyote*, the manager of FT, and the founder and multiple managers of VI. These individuals provided the research team with valuable historical and current competitive information on the local coffee economy, their organizations, and the global coffee market. The FT and VI respondents shared selected data from their operations.

Participant observation involved immersing the research team in the local community by living with a smallholder coffee producing family. Conversations provided useful insights on the history of the communities, the development of the local coffee industry, and concerns smallholders share about the local economy. The research team attended multiple FT and VI meetings where coffee production, sales, prices, overall economic performance, fair trade premium use, and payment arrangements were discussed openly.

The principal data-gathering tool was a household survey administered to the key person in the family with decision-making responsibilities. The survey consisted of two parts. First, the respondent was asked questions quantifying coffee production, coffee prices, farming system, and quality of life (e.g. house size, source of water, etc.). These questions were asked for the 2007/08 and 2011/2012 crop years in an effort to measure and explain the change in smallholder welfare over that period of time using a multiple regression model. The second part of the survey asked FT, VI and NA participants to identify the advantages and disadvantages associated with their participation in their respective trading regime (internal evaluation), followed by a complementary line of questioning that asked FT and VI participants to evaluate the NA regime and vice versa (external evaluation).

The results are based on a non-random, purposive sample of 118 smallholders. Forty smallholders from FT (8% of total membership), thirty-nine households from VI (65% of total membership and 100% of active membership), and thirty-nine NA growers were interviewed. The participation of NA respondents was obtained using the snowball method of field surveying; VI participants recommended their NA neighbors who in turn introduced the research team to

93

other NA neighbors. The fact that both field team members were native Spanish speakers was influential in gaining participants' trust. Time to conduct each survey averaged 45 minutes with a range from ten minutes to over three hours.

We recognize the statistical limitations (i.e. selection bias) of our non-random sampling approach, but given that we had no functional list of growers in any of the three groups, a random sample was infeasible. For this reason the internal/external analysis (Appendices 1 and 2) of the three groups of growers is valuable to our understanding of how the farmers perceive and experience these three value chains.

Results and Discussion

Comparative Statistics

The households participating in the three trading regimes over the two time periods of this study, 2007/08 and 2011/12 reveal valuable comparisons (See Appendix 1). FT growers are, on average, younger, less educated, have larger households, and have fewer female-headed households that the VI or NA smallholder households. VI farmers have the largest percentage of married household heads (81%) followed by the FT households (78%) and the NA (69%) households. Married heads of households declined significantly between the two crop years in NA and VI. NA grower households, on average, have larger houses (an indicator of wealth) than the other two groups. A small decline in total land area across the three trading regimes reflects the reality of the *ejido* system where parents transfer land to the oldest son and daughter as an inheritance, thereby reducing the household's land holdings.

FT household responses reveal a greater degree of self-sufficiency in food crops (beans, corn). Historically, the VI and NA households (located in communities near Tapachula) grew basic crops to survive *los meses flacos* (skinny months) of diminished coffee income reserves. However, VI and NA respondents report that young men have begun to steal cash crops (bananas) and livestock (pigs, chickens) from these smallholders. Smallholders speculate that these men have recently returned from the United States or U.S.-Mexico border communities where they were unsuccessful in finding or maintaining employment. Upon return to their home communities they have struggled to integrate back into an agricultural economy. Because "the time, energy and money spent cultivating these crops is enjoyed by thieves", many VI and NA households have reduced land areas devoted to these activities. This phenomenon was unreported by the FT households.

An important finding centers on the *Arabica-Robusta* mix in the VI and NA households. Both groups produced more *Robusta* than *Arabica* coffee over the study period with declining yields, while as noted earlier the FT smallholders specialize in *Arabica* coffee. This changing crop mix is due to (1) the increase in coffee berry borer (*broca*) and coffee rust (*rolla*) that attack *Arabica* trees more than *Robusta* plantings, and (2) hurricane Stan in 2005 that damaged *Arabica* plantations more than *Robusta* trees. FT growers' *Arabica* trees, although suffering losses from Stan, received greater protection from the diverse/complex overhead vegetation of the reserve that protected their coffee plants.

As expected, FT smallholders sell virtually all their coffee to CESMACH while by definition NA growers sell all their coffee production to *coyotes*. But unexpectedly, VI farmers sell a high percentage of their coffee to *coyotes* as well. *Café Justo* does not have the capacity to process all of its members' *Robusta* and the cooperative did not buy *Robusta* until 2011. Although VI farmers produce more *Robusta* than *Arabica*, *Café Justo* does not have a large demand in their United States market for *Robusta* coffee. In addition, VI growers diversify their coffee commercialization between the cooperative and *coyotes* because *coyotes* buy their *Robusta* and provide credit for the grower's business and household. Finally, a small percentage of growers in all three trading regimes complement their coffee incomes with some off-farm income or with other entrepreneurial activities (e.g. their own business).

Internal Evaluation

Smallholders were asked to evaluate their coffee-trading regime (advantages, disadvantages, improvements) (See Appendix 2). FT growers rank the availability of credit as a key advantage. CESMACH obtains credit for its members through (1) importer pre-financing, (2) bank loans to the cooperative, and (3) self-capitalization from the small contribution made to the loan fund for each kilogram of coffee sold to the cooperative. High and known coffee prices are an important advantage. Because FT growers are members of a legally recognized organization, they and their organization are eligible for a wide range of government programs (e.g. subsidies, education, health care) that are not as accessible by the NA growers. The encouragement for organic production practices, access to machinery, the social premium, and commercial and social networking all received favorable mention by the FT smallholders. Only the fact that coffee revenues are paid to growers in installments during the crop year was listed as a major disadvantage. All FT growers would like the cooperative to take on more commercial and community development projects.

Like FT farmers, the VI growers appreciate higher prices for the coffee they sell to the cooperative. They also appreciate access to government services and programs due to their membership in a legally recognized organization. Interestingly, a third of the VI smallholders viewed the installment payment system as an advantage because it forced them to budget household and business expenses throughout the year yet over 50% of the respondents regarded the installment system as a disadvantage of the VI trading regime. A majority of the VI coffee growers noted that the cooperative could be managed more efficiently and effectively, increasing the final price received by the growers. The lack of credit was a major problem for nearly half the VI respondents.

Independent growers responded that full and prompt cash payment at the farm gate and the availability of credit were the two most important advantages of the NA system. Low coffee prices, the lack of any market control, inaccurate scales, and no proof of sale represent the major disadvantages of the regime. Without a proof of sale, NA growers cannot participate in the *Fomento Productivo* program of *AMECAFE* (the Mexican Association of the Coffee Production Chain) or the *Fondo de Compensacion de Precios* de Café (Coffee Prices Compensation Fund) that increase farmer incomes via coffee buyer rebates or price floors. Most *coyotes* are not registered buyers with AMECAFE because of they do want to pay the yearly fee and see no personal benefit. NA farmers list low-cost credit as the most desired improvement and ironically expressed a need for a coalition of NA growers, organized by the government, to counter the buying power of the *coyotes*.

External Evaluation

As noted earlier, researchers have found some evidence that active participation in a well-managed cooperative can produce pecuniary and non-pecuniary benefits to its members. As a validation check on the internal evaluation responses, each respondent was asked to evaluate the other trading regime (Table 1). In this case the two cooperative-based regimes (FT and VI) were combined and compared to the non-affiliated, independent growers (NA). NA smallholders list higher prices, credit in the case of CESMACH, pooled resources and other economic services (input supply) as advantages of the cooperative system. As expected, the cash flow challenge associated with payment installments is not appealing to NA growers. A surprising external criticism from NA farmers is that not all cooperative members are committed to the cooperative principles and operational philosophy. Members sell their coffee to the cooperative when prices are low and to the *coyotes* when prices are high thereby placing in jeopardy the supply chain for the cooperative. Relatedly, NA farmers are averse to the joint liability characteristic of cooperatives. One NA smallholder remarked "*en las coperativas pagan justos por pecadores*" (in cooperatives good people pay for the sins of others).

Table 1. Advantages and Disadvantages from Outside Viewers on Non-Affiliated and Alternative Coffee Trading Systems

Non-Affiliated Growers' (NA) Perspectives on Cooperatives (FT and VI) (n=39)			
Advantages	**%**	**Disadvantages**	**%**
better price	49	payment installments	33
credit	31	low member commitment	13
pooled resources	26	favoritism	8
economic services	18	low buying capacity	8
access to government programs	10	restrictive production practices	8
direct exports	8	entry/entrance barriers	*none*
none	*3*	must find their buyers/importers	3
Cooperative Members' (FT and VI) Perspective on Non-Affiliated (NA) Coffee Trading System (n=79)			
Advantages	**%**	**Disadvantages**	**%**
cash payment	30	fluctuating/low prices	65
credit	20	no proof of sale	18
non-selective coffee buying	8	conveniently-calibrated scales	16
high price for quality coffee and/or large quantities	6	little/no credit	11
non-restrictive production practices	4	no control in value chain	6
none	*16*	no access to machinery	4
		no projects	1
		locked-in relationship	1

Cooperative members (FT and VI) note that two major advantages of the NA trading regime is the immediate full cash payment and the availability of credit from the *coyote*. Significant disadvantages of the NA system, from the perspective of cooperative members, are low and variable prices, no proof of sale, and inaccurate scales for weighing coffee.

Farm Gate Price Determinants

A weighted average farm gate coffee price (WP) represents the chosen measure of smallholder benefit across the three trading regimes. WP captures the varying total coffee production across all farmers and the price received for each coffee variety (*Arabica*, *Robusta*). Both specialization and variety drive smallholder incomes in Chiapas. WP is:

1) $\ln(WP) = \ln[(P_{A\_coop}*(Q_{A\_coop}/Q_T)) + (P_{R\_coop}*(Q_{R\_coop}/Q_T)) + (P_{A\_coy}*(Q_{A\_coy}/Q_T)) + (P_{R\_coy}*(Q_{R\_coy}/Q_T))]$

where Q_{A_coop}, Q_{A_coy}, Q_{R_coop}, and Q_{R_coy} represent the quantity of *Arabica* and *Robusta* coffee sold to the cooperative or *coyote*. P_{A_coop}, P_{A_coy}, P_{R_coop}, and P_{R_coy} are the prices paid by the cooperative or *coyote* for *Arabica* and *Robusta* coffee. Total coffee production, represented by Q_T, includes *Arabica* and *Robusta* coffee production sold to both buyers (e.g. $Q_T = Q_{A\_coop} + Q_{A\_coy} + Q_{R\_coop} + Q_{R\_coy}$). The natural log of WP was taken to better simulate a normal distribution and to correct for skewness in the error distribution. The descriptive statistics of the WP dependent variable indicate that FT farmers clearly have, on average, a higher WP than VI and NA smallholders (Table 2). VI smallholder benefit surpasses that of the NA grower but the WP price differential is smaller than the FT vs. VI differential.

Table 2. Descriptive Statistics for Weighted Average Price

An ordinary least squares (OLS) multiple regression model analyzes the key determinants for these price differentials. Age of the household head was hypothesized to have a positive effect on WP as older farmers have gained experience with production techniques that may improve the quality and therefore the price of their coffee. Education (educ), defined as the years of education

		Mean	Median	Min	Max
NA	2007	1.15	0.96	0.27	5.57
n=39	2011	1.80	1.53	1.21	3.73
FT	2007	3.18	3.15	1.91	4.46
n=40	2011	3.75	3.78	3.25	3.81
VI	2007	1.40	1.40	0.36	2.84
n=39	2011	2.16	1.87	1.39	4.34

completed, is expected to have a positive effect on economic benefit because the literature has shown that more educated farmers have higher unobserved managerial competencies and cognitive capacity that enable them to strategically make on- and off-farm decisions to improve their economic welfare. In addition, because education enhances the ability of farmers to receive, interpret and understand new information, educated farmers are more likely to adopt new technology and boost productivity. The effect of gender, that is being a female household head, is ambiguous reflecting the ambiguity in the research literature on prices received for farm commodities based on gender. The influence of coffee specialization (coffee_ha), measured by the hectares of coffee cultivated with respect to total productive land (e.g. farm size), also is ambiguous. Coffee specialization can have a positive effect on the farmers' economic welfare to the extent that coffee production is a profitable practice, however full specialization can also increase the farmers' vulnerability to climatic and market shocks. Both Arabica coffee yield (arabica_yld) and the percentage of *Arabica* coffee sold to the cooperative (coop_arabica) are

expected to have a positive effect on WP. The coop_arabica variable is defined as the percent of *Arabica* coffee sold to the cooperative with respect to the total coffee production. The size of the house (home_size), measured in squared meters, was used as a wealth indicator and it is expected to have a positive effect on WP because households with greater wealth (e.g. larger homes) can afford agricultural inputs that increase the quality and quantity of their coffee plantings. FT and VI (categorical variables) represent the farmers' participation in a fair trade and vertically integrated cooperative and are hypothesized to have a positive effect on the farmers' farm gate price.

Provided that off-farm income can be an important source of income for many small-scale farmers, off-farm employment (employment) and business ownership (business-owner) were included in the analysis. The effect of these two off-farm income variables is ambiguous. Off-farm income can be a strategy for meeting subsistence needs, smooth household consumption, absorb shocks to agricultural income, and ease credit constraints. In addition, off-farm income can increase the household capacity to purchase farm inputs and make investments to improve yield and labor productivity. Smallholders with off-farm income will not sell or harvest their crops before they are fully ripe for the purpose of meeting urgent household cash needs, thereby receiving a higher price. On the other hand, off-farm income can have a negative effect on the farmers' well-being to the extent that off-farm wages are low and unstable, and constitute a high opportunity cost of household labor (i.e. less available time to work on the farm).

The results from three OLS models reveal the key determinants of WP for this data set (Table 3). Only data for the crop year 2011/12 is reported because efforts to explain change in WP between the two crop years produced inconclusive results due to a lack of variability over the two periods. All three models indicate that age, education, gender, specialization and wealth (house size) have no statistically significant influence on WP when comparing the three trading regimes. In Model A, the percent of *Arabica* coffee sold to a cooperative has a strong, positive influence on WP. This result is confirmed in Model C. Model B's results complement the other two models by indicating that participating in the FT or VI trading regimes positively impacts the WP. FT smallholders are better off because they sell all specialty coffee (*Arabica*, organic, rain forest, eco-label) to CESMACH while VI growers only sell twenty-seven percent of their coffee to Café Justo with the remainder, a blend of *Arabica* and *Robusta* green coffee, sold to *coyotes*.

Off-farm employment negatively affects WP. The qualitative analysis indicated that non-agricultural employment involves opportunity costs for farm work. The level of maintenance of the coffee plantation and the processing method used by the farmer are direct indicators of the price farmers receive for their coffee. Smallholders who keep their coffee trees in excellent condition and use appropriate processing equipment produce higher quality coffee, which translates into higher prices. However, off-farm employment improves the risk position of the smallholder by stabilizing the cash income for the family.

Table 3. Ordinary Least Square Estimation: Log of Weighted Average Price (WP)

Explanatory Variables	(A)		(B)		(C)	
	Beta	**s.e.**	**Beta**	**s.e.**	**Beta**	**s.e.**
constant	0.471***	0.116	0.419**	0.138	0.425**	0.108
age	0.001	0.002	0.001	0.002	0.001	0.001
educ	-0.008	0.006	-0.010	0.007	-0.007	0.006
female	-0.071	0.064	-0.086	0.067	-0.069	0.062
coffee_ha	0.073	0.072	0.125	0.088	0.089	0.070
home_size	-0.00003	0.000	-0.00002	0.000	-0.00002	0.000
Arabica_yld	0.0001	0.000	0.0001*	0.000	0.0001	0.000
coop_Arabica	0.971***	0.102			0.809***	0.054
FT	-0.181	0.117	0.734***	0.067		
VI	-0.022	0.057	0.169**	0.064		
employment	-0.059*	0.028	-0.087**	0.033	-0.064**	0.027
business_owner	0.129+	0.074	0.080	0.080	0.123+	0.074
N	118		118		118	
R^2	0.7885		0.6935		0.7850	
F-statistic	35.92***		24.21***		43.82***	

Significant at levels: ******* <.01% , ****** 1%, ***** 5% , **+** 10%

Conclusions

Policies and programs promoting the economic development of smallholder agriculture confront the competitive reality of local, regional, and global markets. As the fourth most traded commodity in the world and the main source of income for twenty-five million smallholders and their harvest workers, coffee-trading regimes represent a compelling area of study. This mixed method research approach in Chiapas, Mexico first reveals that product differentiation matters for smallholder agriculture. Due to geographical location, the members and management of CESMACH (FT) have captured a wide range of price premiums for their *Arabica* coffee. A portfolio of differentiable labeling such as organic, fair trade, and rain forest has enabled CESMACH, over time, to develop, maintain, and grow positive trading relationships with importers in the United States, Europe and Japan willing to pay a premium price for this coffee. Café Justo enjoys a similar environment but on a much smaller and less diversified scale. These results imply that vertical integration produces a smaller benefit at the farm gate than specialized coffee labeling.

Secondly, scale matters for the smallholder organization (Meskela and Teshome 2014). Trading volume enables the grower or the cooperative to negotiate from a stronger position with importers and profitably move down the value chain. CESMACH specializes in *Arabica* coffee but has the wherewithal to purchase all of its members' coffee and market it throughout the world. Café Justo has a much smaller market and even though it now sells both *Arabica* and *Robusta* coffee in the U.S. market, Café Justo can only sell approximately one-third of its members' coffee production.

Thirdly, because smallholders affiliated with a coffee cooperative receive higher farm gate prices than NA growers, organization matters (Lyon 2007, Kaganzi 2009). Granted, independent coffee growers with storage capacity, financial and credit reserves, and high quality production garner higher than average prices from *coyotes*. But our sample of smallholders benefited from well-managed organizations that represented and advocated for their members in the marketplace and with the government. Higher farm gate prices were the result of an affiliation as well as access to a wider range of private sector inputs (i.e. credit), long-term buyer loyalty (i.e. Green Mountain Coffee Roasters), and government programs and services (i.e. health care). Organizations provide an educational venue for technical/managerial training and classes on how to compete in a consumer-oriented, global market.

Finally, few coffee-dependent smallholders have the financial and credit reserves to carry their families through a crop year. *Los meses flacos* are an economic reality and growers are willing to accept lower farm gate prices for the production and consumption financing throughout the year that *coyotes* willingly provide. Business organizations promoting the economic development of smallholder agriculture must efficiently and effectively support grower cash flow stability with affordable credit programs.

References

Adams, M. and T. Bassett III. 2009. *Just coffee: Caffeine with a conscience*. Douglas, Arizona: Just Trade Development Center.

Arnot, C., P.C. Boxall, and S.B. Cash. 2006. Do ethical consumers care about price? A revealed preference analysis of fair trade coffee purchases. *Canadian Journal of Agricultural Economics* 54(4): 555-565.

Bacon, C. 2005. Confronting the coffee crisis: Can fair trade, organic, and specialty coffees reduce small-scale farmer vulnerability in northern Nicaragua? *World Development* 33(3): 497-511.

Bassett III, T. 2012. Personal Communication.

Calo, M. and T.A. Wise. 2005. *Revaluing peasant coffee production: Organic and fair trade markets in Mexico*. Medford, MA: Global Development and Environment Institute.

Consejo Nacional de Evaluación de la Política de Desarrollo Social(CONEVAL). 2009. *CONEVAL discloses the official methodology for multidimensional measurement of poverty in Mexico*. http://www.ophi.org.uk/wp-content/uploads/English-press-release-CONEVAL.pdf?cda6c1

Daviron, B. and S. Ponte. 2005. *The coffee paradox: Global markets, commodity trade and the elusive promise of development*. London: Zed Books.

Dicum, G. and N. Luttinger. 1999. *The coffee book: Anatomy of an industry from crop to thelast drop*. New York: The New Press.

Fan, S., J. Brzeska, M. Keyzer, and A. Halsema. 2013. *From subsistence to profit: Transforming smallholder farms*. Food Policy Report, International Food Policy Research Institute, Washington, DC.

Fair Trade Labelling Organization. 2011a. *Fair trade standard for small producer organizations*. http://www.fairtrade.net/fileadmin/user_upload/content/2011-127_SPO_EN_FINAL.pdf

_____2011b. *Monitoring the scope and benefits of fair trade*. http://www.fairtrade.net/ fileadmin/user_upload/content/2009/resources/Monitoring_the_scope_and_benefits_of_ fair_trade_2011.pdf

_____2011c. *Fair trade standard for hired labor*. http://www.fairtrade.net/ fileadmin/user_upload/content/2011-12-29-HL_EN.pdf.

_____2012. *Minimum price and premium information*. http://www.fairtrade.net/793.html

Fisher, E. and M. Qaim. 2012. Linking smallholders to markets: Determinants and impacts of farmer collective action in Kenya. *World Development* 40(6): 1255-1268.

Fitter, R. and R. Kaplinsky. 2001. *Who gains from product rents as the coffee market becomes more differentiated? A value chain analysis*. IDS Bulletin Paper, Institute of Development Studies, University of Sussex, United Kingdom.

Fridell, G. 2004. The fair trade network in historical perspective. *Canadian Journal of Development Studies* 15(3): 411-428.

Fridell, G. 2007. *Fair trade coffee: The prospects and pitfalls of market-driven social justice*. Toronto: University of Toronto Press.

Giovannucci, D. and F.J. Koekoek. 2003. *The state of sustainable coffee: A study of twelve major markets*. Philadelphia, PA: International Institute for Sustainable Development.

Hainmueller, J., M.J. Hiscox, and S. Sequeria. 2014. Consumer demand for the fair trade label: Evidence from a multi-store field experiment. *Review of Economics and Statistics* (forthcoming).

International Trade Center (ITC). 2011. *Trends in the trade of certified coffees*. Technical Paper. Geneva, Switzerland.

Jaffee, D. 2007. *Brewing justice: Fair trade coffee, sustainability and survival*. Berkeley, CA: University of California Press.

Johannessen, S. and H. Wilhite. 2010. Who really benefits from fairtrade? An analysis of value distribution in fairtrade coffee. *Globalizations* 7(4): 525-544.

Joskow, P. 2010. *Vertical integration*. Unpublished paper, Department of Economics and Management, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Kaganzi, E., S. Ferris, J. Barham, A. Abenakyo, P. Sanginga, and J. Njuki. 2009. Sustaining linkages to high value markets through collective action. *Food Policy* 34: 23-30.

Lewin, B., D. Giovannucci, and P. Varangis. 2004. *Coffee markets: New paradigms in global supply and demand*. Agriculture and Rural Development Discussion Paper 3, World Bank, Washington, D.C.

Lyon, S. 2007. Maya coffee farmers and fair trade: Assessing the benefits and limitations of alternative markets. *Culture & Agriculture* 29(2): 100-112.

Meskela, T. and Y. Teshome. 2014. From economic vulnerability to sustainable livelihoods: The case of the Oromia Coffee Farmers Cooperatives Union (OCFCU) in Ethiopia. *International Food and Agribusiness Management Review* 17: 103-108.

Muradian, R. and W. Pelupessy. 2005. Governing the coffee chain: The role of voluntary regulatory systems. *World Development* 33(12): 2029-2044.

Murekezi, A., S. Jin and S. Loveridge. 2012. Do organizational forms of the coffee supply chain matter in poverty reduction? *Development in Practice* 22(7): 962-977.

Murray, D.L., L.T. Raynolds, and P.L. Taylor. 2006. The future of fair trade coffee: Dilemmas facing Latin America's small-scale producers. *Development in Practice* 16(2): 179-192.

Petchers, S. and S. Harris. 2008. The roots of the coffee crisis. in *Confronting the coffee crisis: Fair trade, sustainable livelihoods and ecosystems in Mexico and Central America*. C.M. Bacon, V.E. Mendez, S.R. Gliessman, D. Goodman and J.A. Fox (eds.), Cambridge, MA: The MIT Press.

Raynolds, L., D. Murray, and J. Wilkinson. 2007. *Fair trade. The challenge of transforming globalization*. London: Routledge Taylor and Francis Group.

Ruben, R., R. Fort, and G. Zúñiga-Arias. 2009. Measuring the impact of fair trade on development. *Development in Practice* 19(6): 777-788.

Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentación (SAGARPA). 2010. *Escenario actual del café*. http://www.aserca.gob.mx/sicsa/fichas/ficha29-Cafe20100716.pdf

Talbot, J.M. 2002. Tropical commodity chains, forward integration strategies and international inequality: Coffee, cocoa and tea. *Review of International Political Economy* 9(4): 701-734.

Tuvhad, E. 2008. *A value chain analysis of fairtrade coffee: With special focus on income and vertical integration*. MS Thesis, Lund University, Sweden.

Vettas, N. 2010. *Market control and competition issues along the commodity value chain*. Proceedings of the FAO Workshop on Governance, Coordination and Distribution along Commodity Value Chains, Food and Agriculture Organization (FAO), United Nations, Rome.

Wiggins, S., J. Kirsten, and L. Llambí. 2010. The future of small farms. *World Development* 38(10): 1341-1348.

Williamson, O.E. 1985. *The economic institutions of capitalism*. New York: The Free Press.

Wilson, N.L.W., A. Wilson and K. Whittingham. 2013. Helping consumers "know who grows" their coffee: The case of THRIVE farmers coffee. *International Food and Agribusiness Management Review* 16(3): 177-190.

Wollni, M. and M. Zeller. 2007. Do farmers benefit from participating in specialty markets and cooperatives? The case of coffee marketing in Costa Rica. *Agricultural Economics* 37: 243-248.

Appendix 1. Descriptive Statistics by Group (*means)

Descriptive Statistics by Group (*means)

Variable	Mnemonic	Unit	NA (n=39) 2007/08	NA (n=39) 2011/12	FT (n=40) 2007/08	FT (n=40) 2011/12	VI (n=39) 2007/08	VI (n=39) 2011/12	POOLED GROUP (n=118) 2007/08	POOLED GROUP (n=118) 2011/12
Household Characteristics										
Age of household head	age	Years	53.44	58.44	41.05	46.05	52.79	57.79	49.03	54.03
Education of household head	educ	No. years	5.18	5.18	4.20	4.20	5.95	5.95	5.10	5.10
Gender of household head	female	% of females	0.23	0.23	0.08	0.08	0.10	0.10	0.14	0.14
Household size	Hh_size	No. people in house	5.15	5.36	6.45	6.08	5.59	4.69	5.74	5.38
Marital status of household head	married	% of married	0.87	0.69	0.68	0.78	0.85	0.81	0.81	0.77
Wealth Indicator										
Home size	home_size	m^2	134.59	143.63	72.63	90.68	135.31	149.14	113.82	127.50
Diversification										
Total productive land	total_land	ha	2.90	2.99	9.01	9.24	4.44	4.03	5.48	5.45
Hectares cultivated with coffee	coffee	ha	2.32	2.49	4.23	4.91	3.43	3.18	3.36	3.54
Hectares cultivated with basic crops	basic_crop	ha	0.09	0.01	0.66	0.67	0.15	0.04	0.30	0.24
Hectares cultivated with (non-coffee) cash crops	cash_crop	ha	0.34	0.42	0.18	0.06	0.56	0.54	0.36	0.33
Fallow land	fallow	ha	0.14	0.08	3.94	3.60	0.31	0.27	1.48	1.34
Productivity										
Percentage of cultivated Arabica coffee	arabica_pct	% of coffee area	0.24	0.17	1.00	1.00	0.42	0.30	0.56	0.50
Percentage of cultivated Robusta coffee	robusta_pct	% of coffee area	0.76	0.83	0.00	0.00	0.58	0.70	0.44	0.50
Yield of Arabica coffee	arabica_yld	kg/ha	194.35	81.79	549.99	550.33	315.88	169.65	355.07	269.66
Yield of Robusta coffee	robusta_yld	kg/ha	1062.24	1034.03	0.00	0.00	820.20	732.30	622.16	583.79
Market										
Percent of total Arabica coffee sold to the cooperative	coop_arabica	%	N/A	N/A	0.92	0.97	0.2	0.20	0.39	0.40
Percent of total Robusta coffee sold to the cooperative	coop_robusta	%	N/A	N/A	0.00	0.00	0.00	0.10	0.00	0.03
Percent of total Arabica coffee sold to the *coyote*	coyote_arabica	%	0.23	0.16	0.08	0.03	0.20	0.10	0.16	0.09
Percent of total Robusta coffee sold to the *coyote*	coyote_robusta	%	0.76	0.83	0.00	0.00	0.60	0.60	0.45	0.48
Off-Farm Income										
Household head out of farm employment	employment	% of farmers employed	0.36	0.15	0.08	0.18	0.10	0.13	0.18	0.15
Household head business owner	business_owner	% of business owners	0.08	0.15	0.10	0.10	0.08	0.15	0.08	0.14

*Means. The variables female, married, employment, business_owner are binary variables for which percentages are presented. The rest of the variables are continuous variables presented with their means N/A = Not Applicable

Appendix 2. Advantages, Disadvantages and Suggested Improvements (percentage of respondents)

Advantages, Disadvantages and Suggested Improvements (percentage of respondents)

NA (n=39)						FT (n=40)						VI (n=39)					
Advantages	%	Disadvantages	%	Improvements	%	Advantages	%	Disadvantages	%	Improvements	%	Advantages	%	Disadvantages	%	Improvements	%
Prompt cash payment	38	fluctuating-low prices	54	credit at low/no interest rates	38	credit with low interest rate	85	payments by installments	18	increase projects	10	higher/fixed price	87	payments by installments	56	Restructuring	79
credit	36	no control after farm-gate level	15	form a coalition	36	higher/fixed output prices	55	High commitment levels	8	higher prices	30	social security	41	no credit	13	provide credit/ pre-financing	46
non-selective coffee buyer	26	no proof of sale	15	higher output prices	31	access to government programs	45	selective coffee buying	5	restructuring	28	better money administration due to payment system	31	unequal benefits (social security)	13	higher prices	31
If not indebted, liberty to sell to highest bidder	15	conveniently-calibrated scales	15	provide proof of sale	10	organic production practices	30	Disconnection between staff & farmers	3	increase credit with low/no interest rate	13	access to government programs	23	transportation cost	5	Prompt cash payments	23
no transportation cost	10	high interest rate	13	more equitable trading terms	10	access to machinery	23	no social security	3	increase buying capacity	8	direct trading partnerships	20	disconnection between roaster & farmers	3	increase membership base	21
		Damage farmers' coffee sacks	7			price/social premium	23	low prices	3	awareness on organic production environment & sustainability	3	access to machinery	18	Low commitment	3	Increase projects	18
						sustainable & direct trading relationships	21	None	43			organic production practices	10	selective coffee buyer	3	Increase Robusta buying capacity	8
						better money administration due to payment system	18					community network	5	None	21	equal benefits (social security)	5
						pre-financing	13					democratic & transparent practices	3				
						democratic & transparent practices	13										

Determinants of Profit Efficiency among Smallholder Beef Producers in Botswana

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Abstract

The livestock sector is vital to Botswana's rural economy comprising nearly two-thirds to the national agricultural sector. The goal of this research is to measure competitiveness and identify the factors affecting it, so as to advocate change in Botswana's smallholder livestock systems. The study examines a cross section of farm-level data gathered from 556 randomly selected livestock producers to investigate the profit efficiency and competitiveness of three farm size categories of small holder livestock farmers. Results found a considerable capacity to improve beef profitability. Scale effects on profit efficiency are generally positive, but the results indicate a number of interactions between scale and other variables such as off-farm income and the use of credit. Policy analysis and commercial decisions using models that assume efficiency are therefore presenting a misleading picture, particularly on the elusive subject of Botswana smallholders' beef supply response.

Keywords: competitiveness, stochastic frontier function, profit efficiency; inefficiency, policy, Botswana

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Introduction

Botswana's livestock sector provides about two thirds of national agricultural value added. Beef production is vital to the rural economy as a source of income and employment, and has been presented as a key investment and economic diversification opportunity (BIDPA 2006). Beef is moreover the country's major agricultural source of foreign exchange and generates about 80% of agriculture's contribution to GDP (NDP 2010), notably due to quota access to European markets.

Declining beef productivity during recent decades is seen as the basis of an erosion of competitiveness. Causal factors include many supply-side limitations surfacing as low off-take rates and high stock losses. Climatic constraints on arable crop production serve both to reinforce livestock's dominance of agricultural statistics and to limit options available for animal feeding. Beyond the farm gate, there is significant overcapacity in processing, with consequent low profitability in processing operations (FAO and MoA 2013, BIDPA 2006). Throughout the value chain, high costs of Sanitary and Phyto-sanitary (SPS) compliance are apparent, and on the demand side, reductions in EU beef support prices have adversely affected competitiveness. These factors have contributed in turn to the country's inability to utilize fully its preferential access to EU import markets.

The traditional livestock sector (featuring smallholder production), accounts for more than 80% of all Botswana's cattle (Nkhori 2004). However it faces numerous problems in production and marketing into export channels, which along with growing domestic beef demand result in an on-going shortage of beef for export. Constraints include high transaction costs, farmers' preferences for keeping animals to an advanced age, and lack of understanding of the various markets' quality requirements (Bahta et al. 2013).

Past studies of Botswana's beef competitiveness or profitability have investigated performance under various projected price regimes and trade agreements (BIDPA 2006, Jefferis 2007, ODI 2007), enterprise budgeting (Panin and Mahabile 1997, BIDPA 2006, FAO and MoA 2013), estimating multifactor productivity and technical inefficiency (Thirtle et al. 2000, Irz and Thirtle 2004) and exploring the beef value chain (FAO and MoA 2013, Bahta et al. 2013). Limitations of these studies include that they either failed to account for farmers' management-related adjustments to farm budgets in the presence of broader economic change, and/or that they assumed technical efficiency in terms of input use and production technology. Hence, efficiency has not been estimated and examined for its actual and potential influence on competitiveness and the factors affecting it. A further limitation of past work is the common treatment of the co-existing production systems: FAO and MoA (2013) demonstrates substantial differences in profitability across different technological models, but the analysis was based on a deterministic treatment of constructed household types rather than estimated from representative data. These limitations have meant that studies have not been made the basis for advocacy in terms of policy, technology, on-farm management, nor rural and regional policy.

The current study employs the profit efficiency approach (Delgado et al. 2008) to address these shortcomings using farm-level cross sectional survey data collected under the auspices of a

development research project.[1] The survey was implemented in three districts (Southeast, Chobe and Central) of Botswana. It collected detailed information on costs of and returns to livestock production, along with selected technical, physical and demographic variables for farm household operations across a range of farm sizes.

The goal of this study is to measure competitiveness and identify the factors affecting it, so as to advocate change in Botswana's smallholder livestock systems. The approach taken is to derive a statistical measure of profit efficiency, using a stochastic profit frontier approach as a yardstick. The profit frontier represents a "best case", and results' shortfall within the frontier representing inefficiencies as a distance "below" the frontier. This approach in turn provides information that is useful in assessing the effect of social and economic indicators on profit inefficiency. The identification of the determinants of profitability/profit efficiency will assist in determining commercial and policy options for enhancing profitability of beef production and hence competitiveness at farm level. In order to understand better the underlying drivers of efficiency and inefficiency, and to motivate advocacy in pursuit of competitiveness, the study estimates profit efficiency separately for three farm size groups.

Subsequent parts of the paper are organized into as follows: literature review is discussed in section two, while the methodological approach, which includes the empirical estimation followed in the study and the descriptive analysis, is explained in the third section. Results are presented and discussed in section four. Finally some conclusions and policy implications of such findings are offered as a fifth section.

Literature Review

In agribusiness, a competitive firm/farm is one that has the ability to produce and sell quality products in a given market at a profit, over the life of the firm. Kennedy et al. (1998) define competitiveness as the ability of a business to profitably create and deliver value at prices equal to or lower than those offered by other sellers in a given market. Latruffe (2010) defines it as the ability to sell products that meet demand requirements in terms of price, quality and quantity and at the same time ensure profits over time that enable the firm to thrive. Agriculture Canada (1991) defines it as a sustained ability to profitably gain and maintain market share. Numerous studies have been undertaken to determine profitability of different agricultural enterprises, including livestock in both emerging and developing countries (Banse et al. 1999; Delgado et al. 2008; Emam and Salih 2011; Longwe-Ngwira et al. 2012; Staal 2002; Thorne et al. 2002). Productivity and efficiency are also often cited as indicators or measures of competitiveness or profitability (OECD 2011), and this is reflected in empirical approaches to the measurement of efficiency: essentially measuring the potential input reduction or potential output increase relative to a benchmark, or frontier (Alvarez and Arias 2014).

The frontier can be technically identified by non-parametric and parametric methods (Latruffe 2010). The non-parametric approach uses mathematical programming techniques, of which the

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most widely used is data envelopment analysis (DEA) (Mester 2003). This has the desirable empirical attributes of imposing neither functional form specification, nor assumptions about the nature of an error term (Tran 2009). However, its limitations include non-inclusion of prices so as to account only for technical inefficiency in the form of using too many inputs or producing too few outputs (Mester 2003); and its implicit assumption of the absence of random errors. The DEA technique uses two-stage estimation procedure where the production (or profit) function is estimated to derive the efficiency scores in the first stage. In the second stage the derived efficiency scores are used as explanatory variables in a profit function to be estimated econometrically. Further, DEA ignores a management-related issue in that the firm's input choices are potentially affected by that firm's knowledge of its level of technical efficiency (Chirwa 2007). Wang and Schmidt (2002) extend this reasoning to criticize the two-stage estimation process.

Parametric analysis of efficiency uses econometric techniques to estimate a frontier function. The stochastic frontier analysis (SFA) (Aigner et al. 1977) is the most commonly used parametric approach. SFA requires specification of a functional firm for the frontier production function. However, the major distinguishing feature between these two approaches lies on the assumptions about the distributions of the error terms (Hyuha 2006). SFA's major advantages are its estimation using a single-step procedure and its accommodation of measurement errors and other noise in the data (Kolawole 2006), and this is an important consideration in the current study which uses farm-level survey data.

The SFA approach estimates the frontier production (or profit) function and an inefficiency model simultaneously, in which inefficiency effects are specified as a function of other variables (Chirwa 2007). It effectively specifies the relationship between output and input levels and decomposes the error term into separate components representing random errors and inefficiency. The random error is assumed to be normally distributed with zero mean and a constant variance. Importantly, the random error term's distribution is symmetric, in contrast to that of the (asymmetric) inefficiency term which is expressed as a half-normal (truncated normal) exponential or two-parameter gamma distribution. Empirically, this approach distinguishes a functional form for the cost, profit, or production functions.

Selection of the SFA method then requires a choice between the direct (primal) and dual specification of the estimation (Mohammed et al. 2013). The direct approach specifies the production function, extended onwards to derive input demand and product supply functions with a priori specification of the production function. In contrast, these derived functions are obtained in the dual specification with no *a priori* specification of the production function. The current study adopts the SFA approach and the dual approach, due to the nature of the data. A profit, rather than cost, function is estimated because of the limitation of the latter in that it assumes output levels are unaffected by factor price changes (Lopez 1982). In addition, in the cost function, the dependent variable (by definition) does not allow consideration of revenues (Mester 2003). Development of advocacy from SFA studies is discussed by Alvarez and Arias (2014). Enterprises' movement toward the frontier by way of the most direct route (i.e. closing the distance by the shortest route) may in fact not enhance efficiency *per se* due to firms' unique resource endowment and unique price and cost environment. Rather, those authors discuss mechanisms for identification of peer groups of firms, albeit nearer the frontier, migration

towards which may offer greater increases in efficiency. These considerations are valid in Botswana's cattle production systems where categorization has traditionally been by land tenure type, which has loosely approximated large and small sizes of operation. The current study offers an advance in this regard by first further subdividing farm size categories for separate SFA estimation, and second by rigorously examining between-farm differences for their influence on efficiency.

Methodological Approach

Empirical Model

The stochastic profit frontier, as explained above, requires two stages of reasoning. The first explains each observation's unit profit performance in terms of technical and allocative efficiency and the second stage explains differences in efficiency in terms of farm-specific variation.

The data set revealed few farms with zero or negative profit for the survey year, but where this occurred, the addition of a constant scalar *n* to the profit data was used to meet the requirement of non-zero positive profit values imposed by logarithmic transformation. This step was seen to be preferable to dropping observations, and the resulting bias from a non-linear transformation of the data is judged to be of minor importance (Delgado et al. 2008) compared to the bias that would arise from using a less appropriate functional form or arbitrarily dropping the sample's least efficient members.

Profit efficiency, in this study, is defined as profit gain from operating on the profit frontier, taking into account farm-specific prices and factors. And, considering a beef farm that operates to maximize its profit subject to perfectly competitive input and output markets and a singular output technology that is quasi-concave in the (n x 1) vector of variable inputs, and the (m x 1) vector of fixed factors, Z, the actual normalized profit function which is assumed to be well behaved can then be derived as follows:

Farm profit from beef is measured in terms of gross margin (GM)[2] which equals the difference between the total revenue (TR) and total variable cost (TVC) and is given by:

(1) $GM\,(\pi) = \sum(TR - TVC) = \sum(PQ - WX_i)$
   $\frac{\pi}{P}(P, Z) = \frac{\sum(PQ - WX_i)}{P} = Q - \frac{WX_i}{P} = f(X_i, Z) - \sum P_i X_i$

   $GM(\pi) = \sum(TR - TVC) = \sum(PQ - WX_i)$

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[2] Considering the inclusion of fixed costs as independent variable in the equation, π is gross margin which is used as a proxy for profit. However, for the sake of consistency with the literature we referred π as profit as profit subsequently.

To normalize the profit function, gross margin (π) is divided throughout by P (the market price of beef output) to obtain:

(2) $\frac{\pi}{P}(P,Z) = \frac{\sum(PQ-WX_i)}{P} = Q - \frac{WX_i}{P} = f(X_i,Z) - \sum P_i X_i$

Where TR is the total revenue from cattle activity, TVC are total variable costs (feeds, fodder, hired labor, electricity, medicines and vaccines, water, transport etc.), of securing revenue (excluding family labor) per farm i; Q is beef output; X represents the (optimal) quantity of input used; Z represents fixed inputs, p_i = W/P which represents normalized price of input X_i while f (X_i, Z) represents the production function.

The attempt to use a translog production function approach used in Delgado et al. (2008) is failed due to high multicollinearity between the interaction and individual variables. In fact, Delgado et al. (2008) have neither mentioned any incidence of collinearity of independent variables nor indicated any treatments used in their work to avoid such cases.

Although the second order flexible form, such as translog function, quadratic e.tc, provide more flexibility due to supplementary parameters to estimate, it may give rise also to econometric difficulties (e.g., multicollinearity) (Coli et al. 2005). It is expected that the great number of parameters that have to be estimated in functional forms such as translog production function impose hard constraints on the result feasibility, since the occurrence of an extended collinearity is favored (Pavelescu 2011).

Our preliminary analysis[3] of translog production function showed the presence of high multicollinearity between interaction and individual variables, thus a Cobb-Douglas production function is considered for this study.

The Cobb-Douglas profit function was employed, which is expressed as:

(3) $\pi_i = f(p_i, Z)exp(v_i - u_i) \ \forall i = 1, 2, ... n$

where π, p_i, and Z are as defined above. The v_i is assumed to be independent and identically distributed random error, having normal $N(0, \sigma^2)$ distribution, independent of the u_i. The u_i is profit inefficiency effect, which is assumed to be non-negative truncation of the half-normal distribution$N(\mu, \sigma^2)$. In estimation we seek to capture, or assign to individual farms, farm-specific effects on inefficiency, following Battesse and Coelli (1995).
The Cobb-Douglas functional form for estimation is specified as:

(4) $ln\pi = ln\beta_0 + \beta_1 lnp_{1i} + \beta_1 lnp_{2i} + \beta_1 lnp_{3i} + \beta_1 lnZ_{1i} + \beta_1 lnZ_{2i} + \beta_1 lnxZ_{3i} + (v_i - u_i)$

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[3] Prior test of multicollinearity in STATA 11 show the presence of high multicollinearity between interaction and individual variables. (As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation. Tolerance, defined as 1/VIF, is used by many researchers to check on the degree of collinearity (STATA Web books 2013)).

Where π represents the normalized profit, p_1 represents feed prices, p_2 represents veterinary prices, p_3 represents the wage prices, Z_1 represents total fixed capital, Z_2 represents total family labor hours, Z_3 represents crop land sizes and β's are the unknown parameters be estimated.

As indicated above the non-negative random variable (u_i) is independently distributed with a truncation at zero of the normal distribution, $u_i \sim {}^+N\ (\mu,\ \sigma^2{}_u)$ with mean μ, where $\mu_i = M_{ik}\delta_k$ as defined below.

The technical inefficiency effects (u_i) in equation (4), can then be specified as:

$$(5) \quad ui = \delta_0 + \sum_{k=0}^{l} M_{ik}\, \delta_k + v_i$$

where v_i is the inefficiency error term as defined earlier and the M_{ik} are k socio-economic and farm enterprise explanatory variables (age of household head, education of household head, annual household non-farm income, average distance to commonly used market, herd size measured in beef equivalent[4]and a dummy variables for gender, information access, farm location in FMD disease zone classification, access to income from crop activities and access to credit) observed for farm i, and δ is a vector of unknown coefficients to be estimated simultaneously with equation (4).

The variance of the random errors, σ_v^2 and that of the profit inefficiency effect σ_u^2, and the overall variance of the model σ^2 are related as follows: $\sigma^2 = \sigma_v^2 + \sigma_u^2$, which measures the total variation in the deviation of profit from the frontier (Battese and Corra 1977). The Likelihood Ratio of the errors in equation (4) provides the log likelihood function (Battese and Coelli 1995) and estimates:

$$(6) \quad \gamma = \sigma_u^2/(\sigma_v^2 + \sigma_u^2)$$

where γ (gamma) represents the share of inefficiency in the overall residual variance with values in the 0, 1 interval. Gamma between 0 and 1 indicates the presence of inefficiency. A value of 1 suggests a deterministic frontier and, that inefficiency effects are important explainers of profit across farms. Conversely a γ value of 0 indicates the absence of inefficiency. Such absence of inefficiency favors OLS estimation due to the absence of u_i in (3): this property of the specification is utilized below in model validation.

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[4]Following (Otieno 2012; Hayami and Ruttan 1970; O'Donnell et al. 2008), beef cattle equivalents were computed by multiplying the number of cattle of various types by conversion factors. Following insights from discussions with BMC (Botswana Meat Commission), the conversion factors were calculated as the ratio of average slaughter weight of different cattle types to the average slaughter weight of a mature beef bull. The average slaughter weight of mature bull, considered to be suitable for beef in Botswana, is between 452-500kg. according to BMC, the average slaughter weights for castrated adult males (oxen>3 years), Immature males (< 3 years), Cows (calved at least once), Heifers(female ≥1yr,have not calved), Male calves (between 8 weeks&<1year),Female calves (between 8 weeks&<1year), , Pre weaning males (<8 weeks), Pre weaning females (<8 weeks) are 400kg, 350kg, 390kg,300kg,250kg, 220kg,95kg and 95 kg, respectively. The calculated average slaughter conversion factors were then: 1.0, 0.86, 0.76, 0.84, 0.65, 0.48, 0.54,0.21 and 0.21, for Bulls, castrated adult males, Immature males , Cows, heifers, Male calves, Female calves, Pre weaning males and Pre weaning females, respectively.

The profit frontier and inefficiency functions specified in equations (4) and (5) were jointly estimated using FRONTIER 4.1 (Coelli 1996), which combines the two-stage procedure into one: the maximum likelihood method estimates the parameters of the profit function, and those of the inefficiency model. Two estimation procedures, OLS and ML were used to establish whether or not profit efficiency in beef production in Botswana is affected by farm-specific characteristics. The first model is the traditional OLS response function in which the efficiency effects are not present ($u_i=0$), which is a special case of a stochastic frontier production function model in which the total variation of output due to technical inefficiency is zero, recorded as $\gamma=0$. The second model is the general model with $\gamma\neq0$. The two models were compared for the presence of profit inefficiency effects using the generalized likelihood ratio test which is defined by the chi-square test statistic $\chi^2=-2\ln\{H_o/H_a\}$, where χ^2 has a mixed Chi-square distribution set at $\alpha\%$ per cent level of significance and k+1 degrees of freedom, where k is equal to the number of parameters (M_k) used in the inefficiency model (Ngwenya et al. 1997). H_o is the model under the null hypothesis that $\gamma=0$, and is entered as the value of the likelihood function for the frontier model under H_o. H_a has similar interpretation under the alternative hypothesis that $\gamma\neq0$.

Determinants of Competitiveness and Profit Efficiency

Several researchers have identified an inverse relationship between farm size and productivity (Buckwell and Davidova 1993, Cornia 1985; and, Staal 2002), with supporting arguments involving small farms' not requiring labor supervision and other organisational delegation, and also the clear profit motivation of family labor. Lapar et al. (2005) focused on cost structures to find that small dairy farms were more cost efficient than were large ones, and hence more profit efficient. However, a counter-argument in the developing country context draws on large farms' available economies of scale and superior access to both output and input markets. Correlation between farm size and profitability and/or efficiency has on this basis been demonstrated (Delgado et al. 2008, Hall and LeVeen 1978, Kolawole et al. 2006, Nganga et al. 2010). A continuum of farm size may also be associated to some degree with forms of production systems, and indeed this is the way in which FAO and MoA (2013) chose to subdivide farms into deterministic subsets. Social capital has been used to explain farm performance as a proxy for farmer's management capacities which are not directly observable (Latruffe 2010). Evidence on the effect of farm managers' ages on technical efficiency or productivity is ambiguous. Negative effects may be due to older farmers' resistance to change and unwillingness and inability to adopt technological innovations (Brummer and Loy 2000). Moreover, older farmers are at or near their exit stage may reduce their commitment to business and profit maximisation as other priorities appear (Rakipova et al. 2003, Nganga et al. 2010). Age may also influence farm performance positively as older farmers are more experienced, and notably, can apply accumulated knowledge to the efficient use of inputs (Kalowole et al. 2006, Lapar et al. 2005, Mathijs and Vranken 2001, Otieno et al. 2012, Amara et al. 1999).

Farmers' education level is expected to positively influence farm performance. Kolawole et al. (2006), Latruffe (2010), Nganga et al. (2010), Mathijs and Vranken (2001), and Otieno et al. (2012) found a positive relationship between education and technical efficiency. Stonikov (1998) however, found the opposite and explains this counter-intuitive relationship on the specificity of agricultural education in Russia at that time, which concentrated more on technological aspects of production than on management practices.

Chavas et al. (2005) found that gender cannot explain differences in farm technical efficiency. However, Timothy and Adoti (2006) found that female cassava farmers in Nigeria showed superior technical efficiency than did their male counterparts, but lower allocative efficiency. These latter authors attribute differences in efficiency between female and male farmers to differential access to inputs.

Off-farm work is likely to influence the efficiency of a farm, but the sign of the relationship may be disputed: farmers who spend time doing off-farm work reduce their time spent on efficiency-improving managerial activities. Conversely, spending time off the farm might improve farmer's ability through the acquisition of information and knowledge and hence farm performance. Further, off-farm work can assist in accumulating capital which when invested on the farm can increase efficiency. Otieno et al. (2012) found a positive relationship between off farm income and profit efficiency and argue that this suggests that there is considerable re-investment of off-farm earnings into farm production. Rakipova et al. (2003) argue that this is consistent with the hypothesis that producers with off-farm work must compensate for the time they spend off-farm, making more efficient use of their own labor and management. Thus, they become better managers and are more efficient in the use of resources.

Descriptive Analysis of the Study Area

A multi-stage cluster (area) sampling approach (Horppila and Peltonen 1992) was used to select a sample from the population. First, to account the differences in farming system, ecology and soil type, to form six clusters, the Central district (Botswana's largest district) was divided into four sub districts, namely Serowe, Letlhakane, Selebi-Phikwe and Nata.[5] Within a cluster, extension areas[6] were randomly selected from lists of all extension areas, taking into account the general distribution of cattle in the study area. Subsequent stages involved a random selection of crushes[7] or sample of locations, from which a number of farmers were randomly selected.

The Central agricultural district as a whole kept 25.9 per cent of the national cattle herd in the traditional sector. The reason for this is that the region has vast tracts of land suitable for cattle farming, and that some parts of the region, around Nata and Selebi-Phikwe, are largely free of transboundary diseases.

The South East administrative region is adjacent to Gaborone, the capital of Botswana, and its district headquarters (Ramotswa) is about 40 kilometres from Gaborone. The agricultural district is known as Bamelete/Tlokweng and is one of the five districts forming the Gaborone Agricultural Region (Statistics Botswana 2014). The district held 32,433 cattle which represented 1.6 per cent of Botswana's total cattle herd, while the cattle holdings represented 3.6 per cent of the total cattle holdings (Table 1).

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[5] The data for the study was collected from three districts in the agricultural region; Serowe, Selebi-Phikwe, Letlhakane and Nata in Central Administrative District, but falling under Tutume Agricultural District in Francistown Agricultural Region. The Central Agricultural Region had a total of 654,058 cattle of which 125,086 in Serowe, 207,681 in Letlhakane, 71,144 were in Selibe-Phikwe, and 181,411 in Nata (Table 1).

[6] Extension areas are areas with in districts that are classified based on delivery of agricultural extension services.

[7] A crush is essentially an administrative area for national livestock administration. Normally the veterinary district offices keep list of farmers by crushes. Thus, list of farmers was provided by crushes for each extension area in respective district/sub district.

The Chobe district lies on the north western part of Botswana and is predominately a tourist area with rich wildlife resources. The district forms the Maun Agricultural Region, together with Ngamiland East and Ngamiland West. Table 1 show that in 2012 the proportion of the national cattle herd held in the district was 0.15 per cent.

Table 1. Cattle Holdings and Population District and Region

District/region	Cattle Holdings	Cattle Population	Traditional Cattle Holdings (%)	Traditional Cattle Population (%)
Southeast	1,379	32,433	3.6	1.6
Serowe	2,727	125,086	3.8	5.5
Letlhakane	2,497	207,681	3.5	9.2
Selebi-Phikwe	1,392	71,144	1.9	3.1
Nata	6,632	181,411	9.2	8.0
Central region*	13,248	654,058	18.4	25.9
Chobe	253	3,348	0.4	0.15
Total in sampled area	14,880	675,052	22.3	27.6
Botswana total	72,116	2,260,262	100.0	100.0

This figure for central district includes the in the figures in Nata, which falls under Tutume Agricultural Region.
Source. Statistics Botswana (2014)

This low proportion of cattle in the Chobe area is due to the large national parks and forest conservation areas, and Tsetse fly infestation. Lastly, the area is home to buffaloes, which carry Foot and Mouth Disease (FMD) and so is considered a "red zone" or "FMD area" by the World Organization of Animal Health (OIE) and Botswana's Department of Veterinary Services in association with export market access conditions. Farmers in the area are not allowed to trade to other regions, nor deliver to BMC, without 21 days' quarantine. The Chobe area was included in this study to explore the differences in competitiveness of farmers in FMD and non-FMD areas. The locations sampled, and details of cattle numbers, are presented in Table 1.

Figure 1 show the share of cattle outflows in the total cattle population of smallholder and commercial ranches for the year 2012. During the period under review, the traditional (smallholder) farms experienced higher mortality than the commercial farms. Cattle sales in the traditional sector are very low; accounting for less than half of commercial sector's sales. The larger share of sales and lower shares of losses, in the commercial sector are relevant to efficiency considerations.

During the study period[8], the traditional (smallholder) farms experienced higher mortality than did the commercial farms. Cattle off-take rates and sales in the traditional sector are very low; accounting for less than half of the commercial sector's off-take rate and sales, respectively. The larger share of sales and lower shares of losses in the commercial sector are relevant to efficiency considerations.

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[8] The field survey was conducted from June to end of July 2013. The information collected is based on the past 12 months (June-July 2012- June-July 2013).
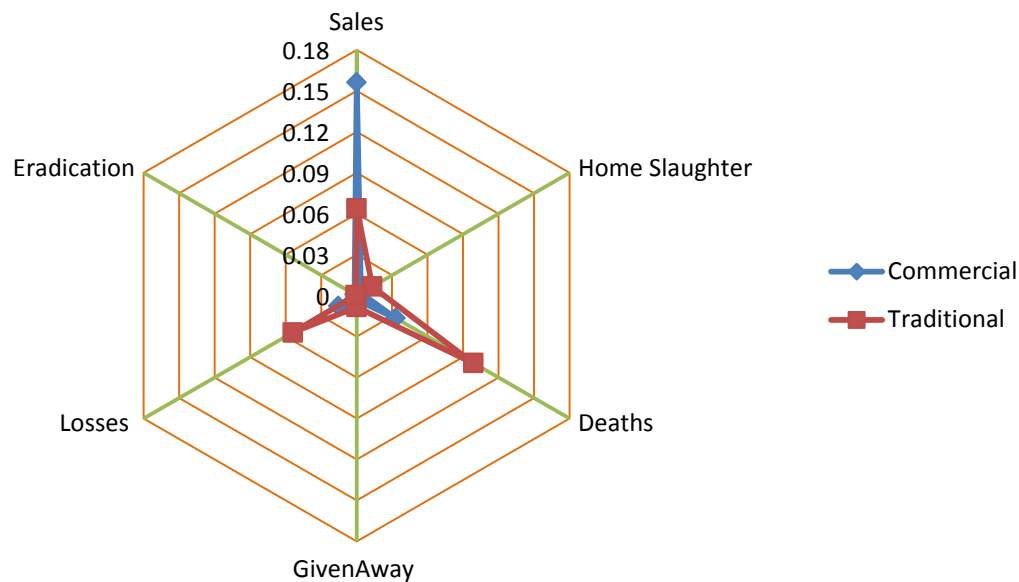
Figure 1. Cattle outflow in smallholder and commercial livestock farms in Botswana

Source. 2012 Annual Agricultural Survey Report (2014)

A structured questionnaire was used to record data. The main variables captured included detailed information on costs of production inputs such as feeds, veterinary supplies and advisory services and labor and fixed inputs, and returns to beef farming. Information on input costs was collected based on farm households' expenditures. Output prices on each type of animal sold in the various market channels are used to calculate an average output price and hence returns to beef production. In addition to the cost and revenue information necessary to calculate profits, the questionnaire elicited information on cattle breeding method, disease prevalence and mitigation, access to extension services and markets, and household demographic characteristics.

Selected characteristics of the farm survey sample, subdivided according to herd size[9], are shown in Table 2. Farmers who own more than 20 beef equivalent (herd size category 3 =HS3) have significantly higher annual values of beef cattle output than do those in other size groups. Similarly, as shown by ANOVA analysis indicated by F-Statistic value, average prices received per head (beef equivalent) varies significantly across the three categories of herd sizes.

Costs of variable inputs for livestock production significantly increase with increasing herd size with farms with over 20 beef equivalent cattle (HS3) incurring highest input costs. Across the whole sample, an average household/farm annually spends P605.57[10] for feed, P650.89 for veterinary requisites and P2853.32 for paid labor. Expressed per month, paid labor amounts to about 238 Pula, which is lower than the government-approved farm workers' minimum wage of P408 for 2011/12 and P445 for 2012/13. The reason for this could be explained by non-monetary

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[9] The sample is divided in to four groups of herd size. Herd size 1 (HS1) include farms that own less than 10 beef equivalent cattle, Herd size 2 (HS2) include farms who own between 10 to 20 beef equivalent cattle and Herd size 3 (HS3) includes farms who own above 20 beef equivalent cattle. The pooled sample is sample that includes all observations.

[10] Pula abbreviated by P is the currency Botswana with the exchange rate to USD at 1P=0.1159USD (FNB, 2013)

rewards and the known widespread use of family labor, with each farm reporting 210 hours spent monthly.

About 48% of the survey respondents reported that they have received income from crop farming and on average a farm household reports owning about 6.19 ha of crop land. Income from crop production and land size for crop production both slightly increase with the increase in herd size categories, however, there are no significant differences among the three farm groups in this regard. On average a farm household has an annual non-farm income of about 54,815.57 Pula with herd size group 3 receiving almost twice that of herd size group one. Generally farmers have little access to credit: just 2.3% of farmers report having accessed credit during the study period.

Table 2. Sample Summary Characteristics

Variables	HS1 (N=238)	HS2 (N=140)	HS3 (N=178)	Pooled (N=556)	F- statistics
Value of beef Cattle output (Pula per year)	2,076.4	58,60.1	11,215.8	5,955.0	0.000
Average Beef cattle price (Pula)	1,772.3	2,081.4	2,218.7	1,993.0	0.000
Feed cost (Pula per year)	264.6	782.71	922.18	605.6	0.002
Veterinary cost (Pula per year)	296.0	565.92	1,192.2	650.9	0.000
Paid labor cost (Pula per year)	1,450.5	2,765.83	4,797.8	2,853.3	0.000
Cost of other inputs (Pula per year)	3,53.9	725.36	1158.0	704.9	
Value of fixed capital (Pula)	22,170.9	48,869.9	343,544.6	131,779.5	0.006
Total crop land area (Hectares)	4.9	6.88	7.30	6.19	0.198
Family labor (hours per month)	201.5	226.85	209.17	210.3	0.585
Age of household head (Years)	58.9	59.9	60.9	59.8	0.440
Gender (% female farmers)	31.1%	22.1%	10.1%	22.1%	0.000
Education of Household head (years)	4.1	4.24	6.62	4.95	0.000
Household Off farm income (Pula per year)	41,372.6	48,535.9	77,728.8	54,815.6	0.000
Distance to market (Km)	28.9	29.58	61.83	39.7	0.000
Herd size (Beef cattle equivalent)	5.3	14.45	55.99	23.9	0.000
Information access (Yes=1, No=2)	73.5%	79.3%	79.2%	76.8%	0.288
FMD disease zone (Yes=1, No=2)	36.6%	39.3%	53.9%	42.8%	0.001
Crop income (Yes=1, No=2)	43.3%	52.9%	51.7%	48.4%	0.112
Credit access	1.3%	2.9%	3.4%	2.3%	0.333

Note. [1] Pula = 0.1159 USD (FNB, 2013)

In terms of demographic characteristics, Table 2 shows that the average age of the household head is 59.79 years with no significant differences across the farm groups, implying that the majority of the farmers are elderly.

The respondents report on average 4.95 years of schooling. Farmers in herd size category 3 (the largest operations) have significantly more educational background (6.62 years) than the other groups. However, overall it appears that the majority did not attend schooling or attended only up to primary school level (which takes seven years).

The overwhelming majority are male (69, 78 and 90 per cent in herd size category 1, 2 and 3, respectively), suggesting that cattle farming is predominately a male activity. This figure is however, higher than the figure reported by the 2012 Annual Agricultural Statistics (Statistics Botswana 2014) survey which reported national average of 65 per cent cattle holdings being held by males.

When asked about access to information on their livestock enterprises and marketing, the majority (76.8 per cent) indicated that they had such access. The average distance from the commonly-used market is 42.8 kilometres, but farmers owning less than 10 (HS1) and 10-20 (HS2) beef equivalent cattle report accessing markets within 30 kilometres while farmers who own large size of herds (HS3) report much greater distances to markets, as far away as about 62 kilometres. On one hand this implies that smaller scale livestock farmers do not use distant markets as they are less endowed with assets such as car/truck, but may also suggest that distance to an attractive market is a constraint for larger farms. The sizeable proportion (43 per cent in the pooled sample and 53% in HS3) of farms located in FMD areas (Chobe, Selibe-Phikwe, and Nata) also may suffer from isolation from markets due to exclusion from supply to BMC and quarantine-related movement control as described above.

Results and Discussion

Profit Frontier Estimates

Profit inefficiency as indicated by the value of value of gamma (γ) was detected by the generalized Log Likelihood Ratio test as described above. Table 3 shows that the estimated value of γ is significantly different from zero, suggesting that, depending on the magnitude of γ, the profit variations occur both as a result of farmer inefficiency and exogenous factors outside the farmers' control. This effect strongly dominates measurement error and other random disturbances.

Table 3. Stochastic Profit Frontier Estimates

Variables	HS1	HS2	HS3	Pooled
Constant	-0.08	1.11	2.01	2.61
Ln (Feed)	-0.24*	-0.30**	-0.23	-0.26***
Ln (Veterinary costs)	-0.23	-0.43**	-0.43**	-0.44***
Ln (Labor)	-0.15***	-0.11	-0.18**	-0.004
Ln (Fixed capital)	0.03**	0.02	0.02	0.01
Ln (Family labor Hours)	0.06*	-0.07	-0.16*	0.003
Ln (Crop land area)	0.05	0.05**	0.08*	0.05***
σ^2	0.21***	0.44***	0.69***	0.44***
Gamma (γ)	0.72***	0.65*	0.68*	0.74***
log likelihood function	-147.6	-138.59	-219.35	-561.98
LR test of the one-sided error	-24.6	17.12186	21.20	70.25

Notes. Statistical significance levels: ***1%; **5%; *10%. HS1= Herd size group, HS2=Herd size group1and HS3= Herd size group[1]

That is, the variation in actual profit from maximum profit (profit frontier) between farms (about 72%, 65%, 68% and 74% per cent in HS1, HS2, HS3 and pooled sample, respectively.) mainly arises from differences in farmers'practices rather than from random variation.

The generalized Log Likelihood Ratio test defined by a Chi-square (x^2) distribution set at 1% level of significance and 11 degrees of freedom was significantly different from zero in all models (Kodde and Palm 1986). The null hypothesis was thus rejected indicating that the stochastic frontier production function fits the data. The value of σ^2 is also significant implying that the technical efficiency equation can explain the differences between each farm's profit and the profit on the frontier function.

Table 3 further shows that the parameter estimates for the first stage explanatory variables have the expected signs and are statistically significant, except family labor in the herd category three (HS3).

The effects of all input prices (except labor) are negative and statistically significant in the pooled sample. Feed prices have a significantly negative effect on profits in all herd size categories. The parameter estimates for fixed factors: capital (fixed capital); family labor (family labor); and crop land size (crop land area); have the expected signs except that family labor is negative in both herd sizes category 2 and 3.

However, statistical significance is apparent for just fixed capital in HS1, family labor in HS1 and HS3, and crop land size in all herd size categories except HS1.

This latter result is presumably due to small land areas being used for subsistence crops rather than for feed production. The positive and significant impact of crop land size on profit in herd size categories 2 and 3 and in the pooled sample implies an increase in crop land size increases farm profit significantly. It is common in rural Botswana that farmers who have large size of crop land have more farm crop residues available to feed their animal, which serves to abate feed costs.

Determinants of Profit Inefficiency

Table 4 presents the estimates of the coefficients for the efficiency drivers, expressed as δ in (4) above. It should be noted that a positive coefficient on δs signifies profit inefficiency because the value of *u* would be higher when the farm is further away below the profit frontier (Delgado et al. 2008).

The coefficient of age of the household head is positive and statistically significant in HS1 and HS2, from which we infer that profit inefficiency increases with increasing farmer age. In other words younger farmers are more efficient than older ones. This finding is consistent with previously published work, as outlined above. However, age is not statistically significant when the whole sample is considered, nor for the herd size category HS3 (larger herds). This result suggests that within the sub-sample for larger herd sizes, older farmers are no more efficient than younger ones possibly because of their degree of commercial establishment, utilisation of human and social capital by way of delegation and effective input and product marketing management.

Across the entire sample, it is likely that these two contradictory influences of age on profitability are both in evidence and cancel each other out to the extent that the parameter estimate is not significantly different from zero. The parameter estimates for gender show mixed results and are not statistically significant.

The coefficient for education of the household head is negative as expected, and statistically significant for large farms and the pooled sample. This confirms an intuitive result that more educated farmers are more efficient, and is also likely to affect social and human capital effects that education can help mobilize.

Farmers (only in HS1) who earn high non-farm income are more efficient than other farmers, *ceteris paribus*. This result confirms the importance of non-farm income among subsistence farmers, who are relatively less endowed with household assets which might be mobilised in abating transaction and other costs faced by the farm.

Table 4. Determinants of Profit Inefficiency among Beef Farmers

Variables	HS1	HS2	HS3	Pooled
Constant	-0.10	0.30	2.09	2.80
Age of household head	0.15***	0.89**	0.07	0.02
Education of household head	-0.01	0.02	-0.04**	-0.04*
Annual household non-farm income	-0.02**	0.01	0.04	0.004
Distance market (commonly used)	0.02	-0.14*	-0.12**	-0.03**
Herd size	-0.09	-1.27**	-0.53***	-0.23***
Gender (% female farmers)	-0.13	-0.06	0.07	0.10
Information access (Yes=1, No=0)	0.10*	0.08	0.33	0.11*
FMD disease zone (Yes=1, No=0)	-0.35***	-0.16	0.09	0.04
Crop income (Yes=1, No=0)	-0.03	-0.23	-0.31**	-0.17***
Credit access (Yes=1, No=0)	-0.14	0.26	-0.08	-0.17

Notes. Statistical significance levels: ***1%; **5%; *10%.

It is also worth noting that off-farm earnings may be re-introduced to farm enterprises as fixed or working capital, which may in turn boost farm efficiency in the short term, and more profoundly in the long term. The parameter estimates for credit access show mixed results in terms of the direction of their impact on profit efficiency but are in any case not statistically significant: this provides some indication that off-farm employment may substitute for borrowing by farmers. Although Botswana's farmers are known to engage in other businesses and income generation from non-farm activities, differential effects across size grouping of farms have not before been identified.

The parameter estimate for distance to the most commonly-used market is negative and significant for all farm size categories except HS1. This confirms an intuitive result that farmers who access distant markets are more efficient, in that despite transport costs, efficient farmers access distant markets in search of better prices for their animals. Bahta et al. (2013) report that when farmers sell their animals near to their villages, they prefer to sell to individuals (other farmers, consumers) as price is agreed by mutual negotiation and payment is immediate and in cash. However, the same study also showed that this transaction channel is available for small

numbers of animals only. Therefore, farmers who want to access more profitable market channels or sell larger numbers of animals (such as would occur for HS2 and HS3), do so in distant towns, where BMC[11] collection points and other potential buyers such as butcheries are located. The coefficient on herd size (again except in HS1) is negative and statistically significant. This implies that farmers who own large cattle herds are more efficient in terms of profit, suggesting economies of scale. However, the relation between herd size and gross margin in Botswana is a complex one, probably governed by differences in technology and associated management systems, labor management, and other factors revealed in the current study to differ amongst size class groups (Bahta et al. 2013, BIDPA 2006). The effect may be due to latent variables depicting technology, management or an aspect of constraints that corresponds, more or less, to herd class.

The results in Table 4 depict a positive relationship between access to market information and inefficiency in HS1 and the pooled sample. This is unexpected as it implies that farmers with less access to market information are more efficient. A possible reason for this finding could be associated with the quality of information dissemination to farmers in the study area, particularly those with small herds.

A further unexpected result is that farmers within the FMD zones are more efficient (except for the herd size category 2) than are farmers outside the FMD zone in HS1. This is likely to be because farmers within the FMD zone are accessing alternative buyers, such as butcheries (see Bahta et al. 2013). If farmers from FMD areas want to sell to BMC, they need to deliver their animals to BMC collection points for further quarantine procedures which can last up to 90 days. The coefficient of crop income is negative and statistically significant only for large size farms and the pooled sample. This implies that farmers who earn income from crop production are more efficient than those who earn less or no income from crop production. It may be that income from crop farming is reinvested into livestock farming. Moreover, farmers who have crop farms could also use crop residues to feed their animals, thereby reducing feed costs. As suggested by the parameter estimates, this effect is likely to be particularly important when farmers own large herds.

Figure 2 shows estimates of inefficiencies of beef cattle producers within herd size groups, and for the whole sample.

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[11] The BMC agents (including feedlot operators) regularly visit cattle posts and villages to buy only young animals (weaners) and purchase older animals only if farmers delivered the animals to local BMC collection points (Bahta et al. 2013)
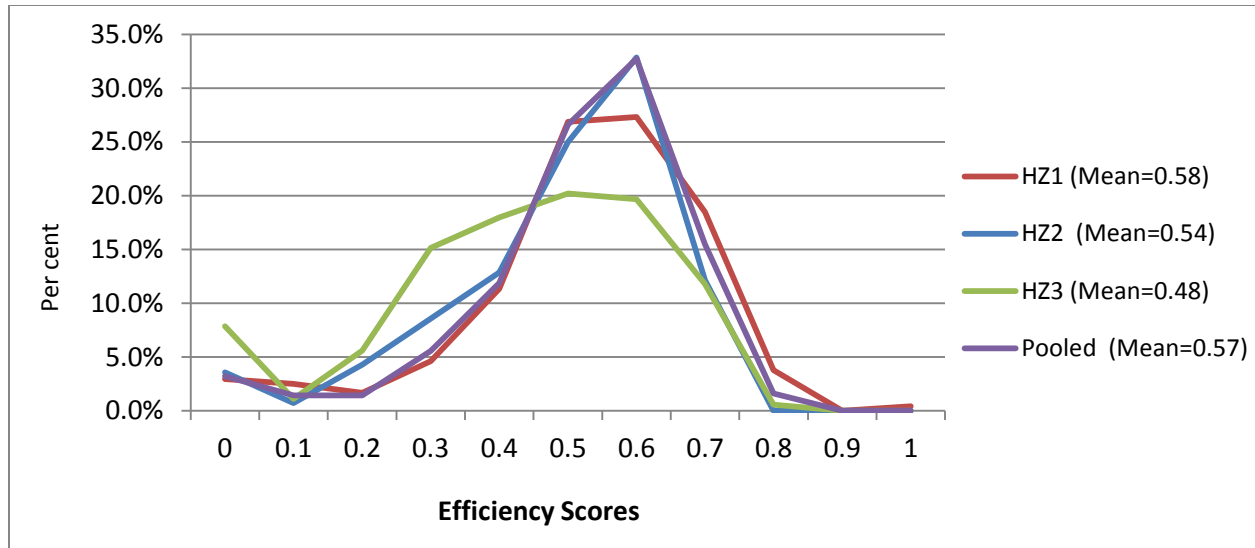
Figure 2. Distribution of Profit Efficiency Estimates for Beef Cattle Farmers

The average profit efficiency score is 0.58 for the whole sample and 0.56, 0.62, and 0.68 for the herd size category one, two, and three, respectively, with the majority of the farms' efficiency scores lying between 0.3 to 0.8. This indicates that there is a considerable scope to improve beef farm profitability under the prevailing input mix and production technology among beef cattle producers in Botswana.

Conclusion and Policy Implications

This paper applied a stochastic profit frontier model to a large sample of beef-producing households to identify the drivers of profit efficiency in smallholder beef production in Botswana. The model preforms well in identifying inefficiency, and in explaining it in terms of farm-specific variables as identified in similar studies in other countries. Building on previous work in Botswana, the current study sub-divides the sample by herd size so as to examine the hypothesised influences on profit efficiency both within and between herd size classes. This reflects the apparent differences in technology and organisation, as well as in asset ownership and human capital, between size classes. Such subdivisions, and others that may be revealed in future research, provide a much-needed counterpoint to past policy commentary on Botswana's beef production systems which have focused only on labels such as "traditional" and "commercial".

Predictably, the profit model suggests that profit of smallholder beef producers can be increased through and reduction of input prices. This is particularly the case for feed prices. In a related result, access to crop lands is positively related to profits and this effect is particularly strong for the larger farm enterprises for whom feed requirements are both greater and more regular during the season. A further effect of access to crop land is that crop revenues offer a source of working and fixed capital to the livestock enterprise that is likely to enhance its profitability. Despite substantial government efforts to enhance animal health, veterinary costs appear to have significantly impacted the profits of all herd size categories. This result was not found to be the case for the smallest farms, probably because they use few veterinary inputs.

Examination of the influence of scale on profitability yielded mixed results which suggest that the relationship differs between herd size groups. This result is vital in utilising historical analyses in Botswana addressing scale, and the details of how boundaries are drawn between size classes and production systems should be examined in further research. Scale also affects the availability of crop residues, and patterns of input use: these in turn influence response to prices and investments. An understanding of these mechanisms would greatly enhance the capacity for provision of management advice to producers, particularly of the form generated by efficiency analysis.

The influences of off-farm employment on efficiency are presented, and mostly focus on the smaller herd size groups. This is of substantial interest to smallholder studies, for several reasons. First, farmers with the smallest herds are likely to be more available for off-farm employment than are their peers with larger herds. Second, the capital-providing roles of off-farm employment show some evidence of interaction with credit markets and so offer alternative mechanisms for loan-based sources of capital for those that are least equipped for commercial borrowing. Third, efficiency effects of distance from the market, the management decision for which is likely to be influenced by payment delays, is also likely to be related to the cash flow situation on the farm. It follows that off-farm employment may better equip smaller farmers to supply more distant markets, or others with payment delays such as the BMC sales channels for export markets. Lastly, this study's findings on the importance of crop activities on profit efficiency may have different implications for the various herd size classes if the role of off-farm labor also differs. This last point requires further research not only for crop-livestock interaction but also for small farms' livestock mix as small stock might be expected to be more labor intensive than are cattle.

The presence of inefficiency detected in the study lends support to the proposition that production models that assume absolute efficiency could lead to misleading conclusions. This was indicated by the Likelihood Ratio test result in all models which rejected the model without inefficiency in favour of the one that incorporates inefficiency. Moreover, the study showed that the variation in actual profit from maximum profit (profit frontier) between farms, ranged from 65 to 74 per cent, mainly arose from differences in farmers' practices rather than from random variation.

The calculated mean profit efficiency scores are 0.58 for the whole sample and 0.56, 0.62 and 0.68 for the herd size category 1, 2 and 3, respectively. The study's results identify efficiency drivers, including education level, distance to commonly-used market, herd size, access to information and income from crop production. These results revealed some interesting commonalities and differences across the herd size sub-groups used in the study. One such result is that referring to location in the FMD zone, which is apparently associated with higher profits than location elsewhere, *ceteris paribus*. Although such results should be interpreted with caution, they do support two important lines of advocacy. First, that training and education are vital routes to improved efficiency and second, that peer groups of producers which occur both within and across arbitrary size groupings may offer models for application to less efficient producers. The abovementioned impact of cost items on profitability is also relevant in terms of potential collective action that may be centred on such peer groupings.

Several elements of this analysis of profit efficiency indicate that improved infrastructure and government services can contribute to beef producers' profit efficiency. Marketing improved infrastructure such as roads and collection points of livestock, market information, and technical aspects of access to crop lands and feed production, are all of apparent high priority. Such results suggest avenues for improving the efficiency of smallholder beef farms in Botswana without necessarily requiring changes in the current technological package of production inputs. Notably, this study has highlighted several differences in these impacts, across the herd size categories used. An example is the apparent efficiency-reducing influence of market information for farmers with the smallest herds. This argues for differential formulation of information packages to achieve better uptake and use by such farmers.

Acknowledgements

References

Alvarez, A. and C. Arias. 2014. A selection of relevant issues in applied stochastic frontier analysis. *Economics and Business Letters* 3 (1): 3-11.

Agriculture Canada. 1991. Task force on Competitiveness in Agro-Food Industry: Growing Together, Report to Ministers of Agriculture, Ottawa: Agriculture Canada.

Aigner, D.J., C.A.K. Lovell and P. Schmidt. 1977 Formulation and Estimation of stochastic frontier production models. *Journal of Econometrics* 6:21-37.

Amara, N., N. Traore, R. Landry, and R. Romain. 1999. Technical efficiency and farmers' attitudes toward technical innovation: The case of the potato farmers in Quebec. *Canadian Journal of Agricultural Economics* 47(1): 31-43.

Bahta, S., D. Baker, B. Podisi and O. Marobela. 2013. Competitive smallholder livestock in Botswana: Results of a livestock value chain survey in the Central district of Botswana. ILRI Project Report. Nairobi, Kenya:

Battese, G.E., and T.J. Coelli. 1995. A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics* 20(2): 325-332.

Battese, G.E., and G.S. Corra. 1977. Estimation of a Production Function Model with Applied to the Pastoral Zone of Eastern Australia. *Australian Journal of Agricultural Economics* 21(3):169-179.

Banse, M., M. Gordon, J. Hartell, J, G. Hughes, J. Kockler, T. Mollman, and W. Munch. 1999. The evolution of competitiveness in Hungarian Agriculture: from transition to accession. Paper presented at IXth EAAE Congress in Warsaw, August.

BIDPA. 2006. Final Report on the Viability and Long-term Development Strategy for the Livestock (Beef) sub-sector in Botswana. Botswana Institute for Development and Policy Analysis, Gaborone.

Brummer, B., and J.P. Loy. 2000. The technical efficiency impact of farm credit programmes: A case study in Northern Germany. *Journal of Agricultural Economics* 51(3): 405-418.

Buckwell, A., and S. Davidova. 1993. Potential implications for productivity of land reform in Bulgaria. *Food Policy* 18(6): 493-506.

Coelli, T.J., D.S.P. Rao, C.J. O'Donnell and G.E. Battese. 2005. *An Introduction to Efficiency and Productivity Analysis*. USA: Springer.

Coelli, T.J. 1996. *A guide to FRONTIER VERSION 4.1c*. A computer program for stochastic frontier production and cost function Estimation, mimeo, Department of Econometrics University of New England, Armidale, Australia.

Cornia, G. A. 1985. Farm size, land yields and the agricultural production function: An analysis of fifteen developing countries. *World Development*-13(4):513-534.

Chavas, J.P., R. Petrie and M. Roth. 2005. Farm household production efficiency: Evidence from the Gambia. *American Journal of Agricultural Economics* 87(1): 160-179.

Chirwa, E.W. 2007. Sources of technical efficiency among smallholder maize farmers in Southern Malawi. *AERC Research* 172. http://dspace.africaportal.org/jspui/bitstream/123456789/32355/1/RP172.pdf?1

Delgado, C.L., C.A. Narrod, M.M. Tiongco and G.S.A. de Camargo Barros. 2008. Determinants and Implications of the Growing Scale of Livestock Farms in Four Fast-Growing Developing Countries. International Food Policy Research Institute. Washington DC.

Emam, A.A., and M.H. Salih. 2011. Measuring competitiveness of Sudanese Sheep Exports. *American Journal of Experimental Agriculture* 1(3): 69-78.

Food and Agriculture Organisation (FAO) and Ministry of Agriculture (MoA). 2013. *Botswana Agrifood Value Chain Project: Beef Value Chain Study*. Rome, Italy and Gaborone, Botswana.

Hall, B., and P. LeVeen. 1978. Farm size and economic efficiency: The case of California. *American Journal of Agricultural Economics* 60(4): 79-93.

Hayami, Y., and V. W. Ruttan. 1970. Agricultural productivity differences among countries. *American Economic Review* 60(5): 895-911.

Hyuha, T.S. 2006. Analysis of Profit Efficiency in Rice Production in Eastern and Northern Uganda. A Ph.D. Diss. Department of Agricultural Economics and Agribusiness Makerere University, Uganda. 146.

Horppila, J., and H. Peltonen. 1992. Optimizing sampling from trawl catches: Contemporaneous multistage sampling for age and length structures. *Canadian Journal of Fisheries and Aquatic Science* 49(8): 1555-1559.

Irz, X., and C. Thirtle. 2004. Dual Technological development in Botswana agriculture: a stochastic input distance function approach. *Journal of Agricultural Economics* 55(3): 455-478.

Jefferis, K. 2007. The Impact of Cattle/beef prices on incomes and poverty in Botswana: Report submitted to USAID / Southern Africa, Gaborone, Botswana, February.

Kennedy, P.L., R.W. Harrison and M. A. Piedra. 1998.Analysing Agribusiness competitiveness: the case of United States Sugar Industry. *International Food and Agribusiness Review* 1(2): 245-253.

Kodde, D.A., and Palm, F.C. 1986. 'Wald Criteria for Jointly Testing Equality and Inequality Restrictions'. *Econometrica* 54:243-1248.

Kolawole, O. 2006. Determinants of profit efficiency among small scale rice farmers in Nigeria: A profit function approach. Poster paper for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August.

Lapar, A.L. Ma., A. Garcia, S. Aditto, and P. Suriya, 2005. Measuring cost efficiency in smallholder dairy: empirical evidence from Northeast Thailand. Paper presented at American Agricultural Economics Association Annual Meeting. Rhode Island, USA. July.

Lopez, R.E. 1982. Applications of duality theory to agriculture. *Western Journal of Agricultural Economics* 21: 353–365.

Latruffe, L. 2010. Competitiveness, Productivity and Efficiency in Agricultural and Agri-Food Sectors. *OECD Food, Agriculture and Fisheries Papers*. No. 30. OECD Publishing. http://dx.doi.org/10.1787/5km91nkdt6d6-en.

Longwe-Ngwira, A., F. Simtowe and M. Scambi. 2012. Assessing the competitiveness of groundnut production in Malawi: a Policy Analysis Matrix Approach. Selected paper for presentation at the International Association of Agricultural Economists (IAAE), Triennial Conference, Foz do lguana, Brazil, August.

Mathijs, E., and L. Vranken. 2001. Human capital, gender and organisation in transition agriculture: Measuring and explaining technical efficiency of Bulgarian and Hungarian farms. *Post-Communist Economies* 13(2): 171-187.

Mester, L.J. 2003. Applying Efficiency Measurement Techniques to Central Banks. Paper Presented at the Workshop on Central Bank Efficiency. Warton Financial Institutional Center. Working Paper. No. 03-13. http://fic.wharton.upenn.edu/fic/papers/03/0325.pdf

Mohammed, S.T., Y. Bila and P.S. Amaza. 2013. Application of Stochastic Frontier Function in Estimating Production Efficiency: A Dual Approach. *Global Journal of Biodiversity Science and Management* 3(1): 11-19.

National Development Plan (NDP) 10. 2010. *Botswana's National Development Plan* Online: http://www.finance.gov.bw

Nganga, S.K., J. Kungu, N. de Ridder and M. Herrero. 2010. Profit efficiency among Kenyan smallholders milk producers: a case study of Meru-South district, Kenya. *African Journal of Agricultural Research* 5(3): 332-337.

Nkhori, P.A. 2004. The impact of transaction costs on the choice of cattle markets in Mahalapye District Botswana. . Unpublished Diss. University of Pretoria, Pretoria.

ODI (Overseas Development Institute). 2007. Analysis of the economic and social effects of Botswana's loss of preferential market access for beef exports to the European Union. London. http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4154.pdf

OECD. 2011. *Fostering Productivity and Competitiveness in Agriculture.* OECD Publishing. Paris. http://dx.doi.org/10.1787/9789264166820-en

O'Donnell, C.J., D.S.P. Rao and G.E. Battese. 2008. Metafrontier frameworks for the study of firm-level efficiencies and technology ratios. *Empirical Economics* 34(2): 231-255.

Otieno, D.J., L. Hubbard and E. Ruto. 2012. Determinants of technical efficiency in beef cattle production in Kenya. Paper presented at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguacu, Brazil, August.

Panin, A., and Mahabile, M. 1997. Profitability and household income contribution of small ruminant production in Botswana. *Small Ruminant Research* 25(1):9-15.

Pavelescu, F. 2011. Some aspects of the translog production function estimation. *Romanian Journal of Economics* 32 (1):131-150.

Rakipova, A.N., J.M. Gillespie and D.E. Franke. 2003. Determinants of technical efficiency in Louisiana beef cattle production. *Journal of the ASFMRA* 99-107. http://www.asfmra.org/2003-journal-of-the-asfmra/

Statistics Botswana. 2014. *2012 Annual Agricultural Survey*. Gaborone. Botswana. http://www.cso.gov.bw/templates/cso/file/File/Agriculture%20Main%20Report%202012 _Apr%204%202014.pdf

Staal, S.J. 2002. The competitiveness of smallholder dairy production: Evidence from Sub-Sahara Africa, Asia and Latin America. In *Smallholder dairy production and marketing-Opportunities and constraints. Proceedings of a South–South workshop*, edited by D. Rangnekar, D. and Thorpe, 250-264. NDDB (National Dairy Development Board), Anand, India, and ILRI (International Livestock Research Institute), Nairobi, Kenya.

Stonikov, S. 1998. Evaluating the effects of price and trade liberalisation on the technical efficiency of agricultural production in a transition economy. The case of Russia. *European Review of Agricultural Economics* 25(3): 412-431.

Thirtle, C., Lusigi, A., Piesse, J., K. Suhariyanto. 2000. Multi-factor productivity and convergence in Botswana, 1981–96. *Agrekon* 39: 686–698.

Thorne, F.S., Kelly, P.W., Maher, M.J. and L.N. Harte. 2002. The Irish Hardy Nursery Stock Industry: Recent Trends and Competitive Position. Dublin: Reports. http://www.teagasc.ie/research/reports/ruraldevelopment/4748/eopr-4748.asp

Timothy, A., and A. Adeoti. 2006. Gender inequalities and economic efficiency: New evidence from cassava-based farm holdings in rural southern Nigeria. *African Development Review* 18(3): 428-443.

Tran, N.D. 2009. Transition to Organic Tea Production in Thai Nguyen Province, Vietnam: Economic and Environmental Impacts. EEPSEA Research Report (2008-RR8). http://www.eepsea.org/pub/rr/12446029131Tran_FINAL(Feb_09).pdf

Wang, H.J., and P. Schmidt. 2002. One-step and two-step estimation of the effects of exogenous variables in technical efficiency levels. *Journal of Productivity Analysis*. 18: 129-144.

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Capturing Consumer Preferences for Value Chain Improvements in the Mango Industry of Pakistan

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Abstract

This study seeks to capture the mango value preferences of consumers in Pakistan with a view to identifying potential improvements in value chain practices in the mango industry. Data were collected through five focus group discussions and an intercept survey of 450 consumers in four cities of Pakistan. Three consumer clusters were identified through cluster analysis. These clusters had significant differences in terms of their search, experience, safety and marketing attributes. Given the existing consumer value preferences and likely changes in consumer behavior, the study suggested that value chain actors can improve their practices so as to improve consumer value and achieve higher returns.

Keywords: consumer value, consumer segmentation, cluster analysis, mango industry, Pakistan

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Introduction

The mango (*Mangifera Indica L.*), popularly known as the '*King of Fruits*' in Pakistan, holds a prominent position in the economy due to its strong domestic demand and export potential (Ghafoor et al. 2009, Mohy-ud-Din and Badar 2011). Pakistan is one of the leading mango producing and exporting countries of the world. During the summer season, domestic demand for mangoes is very high. They are popularly consumed both as fresh and in processed forms such as jams, juices, nectars, squashes, milk-shakes and jellies (CSF 2007). Many mango varieties with different harvesting times and quality attributes, such as sweetness, color and size, are grown and consumed in Pakistan (Sun et al. 2011). However, the two most popular varieties are Chaunsa and Sindhri (Collins and Iqbal 2011, Ghafoor et al. 2010).

Pakistan's mango industry is mainly located in two provinces, Punjab and Sindh. The structure of the industry is heterogeneous and the country's estimated 387,000 mango orchards range in size from less than two hectares to more than 400 hectares (PHDEB 2005, Collins et al. 2006, Government of Punjab 2006). The industry's main value chain actors are orchard owners/growers, pre-harvest contractors, commission agents, exporters, wholesalers and retailers (Khushk and Smith 1996). Production and marketing of mangoes for both domestic and export markets is handled by the private sector (Aujla et al. 2007). The role of the public sector is limited to facilitation through its various research and development, market promotion and extension institutions.

Although over time the area under cultivation, production and exports of mango have significantly increased, the performance of the Pakistani mango industry is suboptimal due to a range of production, postharvest and marketing related inefficiencies (UNIDO 2006, Collins and Iqbal 2011). More recently, a lack of knowledge of how consumers value mangoes has also been recognized as a contributing factor (Hanif, Khan, and Nauman 2004, SDPI 2004, Ghafoor et al. 2009). As a result, consumers in Pakistan rarely receive the value they desire in mangoes which in turns lead to low profitability, poor returns to farmers and poor performance of the mango industry in general (Collins and Iqbal 2011).

Indeed, strong domestic demand for any agri-food product such as mangoes in Pakistan implies an incentive for growers and middlemen to enhance their supplies in the market (Gunden and Thomas 2012), so long as they can align their supply with the requirements of consumers (Collins 2009). Some authors have claimed that agri-food industries can only be developed by adequately understanding and responding to consumer demands (Soosay, Fearne, and Dent 2012). Similarly, public sector policies and business practices should also be consistent with the needs of different consumer segments so as to ensure healthy consumer food choices (Pieniak et al. 2010, Alamanos, Bourlakis, and Tzimitra-Kalogianni 2013, Honkanen and Frewer 2009, Campbell-Gibbons 2011).

Thus, consumers are now being considered as the primary driving force in any agribusiness and greater emphasis is being placed on identification of consumer value (O'Keeffe and Fearne 2009, Vermeulen et al. 2008, Soosay, Fearne, and Dent 2012). This necessitates that value chain actors in agri-food industries should not only be cognizant of overall consumer value preferences but also understand the characteristics and preferences of each consumer segment (Walters and

Lancaster 2000, Mowat and Collins 2000, Gao et al. 2011). It is argued that such an approach can inform the development of agri-food industries as a whole, particularly in developing countries (Macharia, Collins, and Sun 2013).

Given this scenario, a deeper understanding of consumers of mango could be important for the sustainable development of the Pakistani mango industry. There is dearth of published literature on assessing consumer value preferences of mango and addressing how such preferences can be met along value chains (Sabbe, Verbeke, and Damme 2008). Such a lack of knowledge of consumer value can hinder further development of the mango industry and may explain the low value generated for both consumers and value chain participants. Thus, this study was carried out to explore how an understanding of the value preferences of consumers of mango in Pakistan could help to identify improvements through aligning value chain practices with consumer value preferences. The specific objectives of the study were to:

1. Understand mango consumer value preferences in Pakistan and identify consumer segments based on these preferences, and

2. Determine the implications of these consumer preferences for value chain improvements in the mango industry of Pakistan.

Literature Review

Understanding consumer value preferences is considered important in agri-food industry development, both from private and public sector perspectives (Mora et al. 2011, Gao et al. 2011, Mowat and Collins 2000, Skreli and Imami 2012). Consumer value is generally defined as the net perceived benefits a consumer receives from the consumption of a product (Collins 2009, Walters and Lancaster 2000, Woodruff 1997). Over time, consumer value preferences have diversified and expanded due to globalization, income growth and lifestyle changes (Gooch 2005, Trienekens et al. 2012). In the case of fruits and vegetables, for example, consumers now consider as important not only the core product attributes, but also attributes such as food safety, ethical production, provenance and attributes related to marketing along the whole value chain (Trienekens et al. 2012, Akkerman, Farahani, and Grunow 2010, Ali, Kapoor, and Moorthy 2010, Larsen 2014).

As pointed out by Moser, Raffaelli, and Thilmany-McFadden (2011), these attributes can be broadly categorized into intrinsic and extrinsic quality attributes. Intrinsic attributes refer to the physical characteristics or composition of products and are difficult to alter without manipulating the nature of the products (Espejel, Fandos, and Flavián 2007, Jiménez-Guerrero et al. 2012, Alonso, Paquin, and Mangin 2002). These are further characterized as search attributes such as freshness, colour, size and variety that consumers inspect and examine before making a purchase (Mora et al. 2011, Moser, Raffaelli, and Thilmany-McFadden 2011) and experience attributes such as taste, aroma and ripeness that consumers identify or realize only after consuming the product (Poole, Martı´nez, and Giménez 2007, Mora et al. 2011).

On the other hand, while extrinsic attributes do not constitute a physical part of the product, consumers consider them important during the purchase process (Espejel, Fandos, and Flavián 2007, Jiménez-Guerrero et al. 2012, Alonso, Paquin, and Mangin 2002). They include safety and

attributes related to marketing. Safety attributes, also called credence attributes, are those that may have health implications and cannot be easily determined without incurring information costs (Wirth, Stanton, and Wiley 2011, Moser, Raffaelli, and Thilmany-McFadden 2011). Marketing attributes such as price, retailer strategies and certifications are mainly concerned with the circumstances of sale (Mora et al. 2011).

However, knowing what consumers precisely value in a product is complex given the heterogeneity in consumer behaviour influenced by individual socio-economic backgrounds, attitudes and behaviours (Schiffman and Kanuk 2009, Kotler et al. 2010, Ares and Gámbaro 2008). As different segments among consumers have different value preferences relating to consumption, purchase and quality attributes of products (Verbeke, Vermeir, and Brunsø 2007), the identification of different consumer segments is considered important in the sustainable development of agri-food industries (Gunden and Thomas 2012). According to Buckley and Cowan (2007) and Pieniak et al. (2010), this provides information about the needs and consumption patterns of different consumer segments so that value chain actors can align their products and services accordingly.

Some researchers have used choice experiments to explore consumer value preferences (Moser, Raffaelli, and Thilmany-McFadden 2011, Krishnakumar and Chan-Halbrendt 2010), but this technique seeks to capture consumer preferences about various attributes in an existing situation against an alternate hypothetical situation (Moser, Raffaelli, and Thilmany-McFadden 2011). Cluster analysis is a widely applied technique for identification of different segments with identical consumer preferences in agri-food marketing studies (Adhikari, Collins, and Sun 2012, Alamanos, Bourlakis, and Tzimitra-Kalogianni 2013, Pieniak et al. 2010, Everitt et al. 2011). Using this technique, objects or individuals are classified into different meaningful groups on the basis of pre-defined characteristics (Hair et al. 2010, Gunden and Thomas 2012). These groups are internally homogeneous but externally heterogeneous with other groups (Hair et al. 2010, Everitt et al. 2011). Furthermore, this technique is widely used in consumer preference related studies because of the ease of interpreting the results (Schilling and Coggins 2007, Zhang et al. 2010).

Research Methodology

The study was conducted in two stages. In the first stage, five focus group discussions with consumers belonging to different social strata were held in the city of Faisalabad to explore consumer value attributes of mango. These focus group meetings identified key consumer concerns associated with the industry and provided input in developing the survey questionnaire that was used in the second stage (Krueger and Casey 2009, Chambers et al. 2007). In the second stage, an intercept survey was conducted in four major cities of Pakistan - Karachi, Lahore, Faisalabad and Multan. These cities are highly populated and hence most mango consumption takes place there (Sabbe, Verbeke, and Damme 2008).

The questionnaire used in this survey had three sections. The first section sought information on consumption preferences and the second examined the buying preferences of mango consumers. The third section was designed to gather data on mango attribute preferences. Twenty mango attributes were identified and measured on a five point Likert Scale where 5 = very important

and 1 = not at all important. These attributes included six search attributes (color, size, freshness, variety, damage free and blemish free), six experience attributes (firmness, taste, juiciness, ripeness, fiber free and aroma), three safety attributes (mango cleanliness, chemical free ripening and pesticide free production) and five marketing related attributes (price, retailer cleanliness, information provision, packaging and certifications) (Wirth, Stanton, and Wiley 2011, Poole, Martı´nez, and Giménez 2007, Mora et al. 2011).

Before proceeding with the survey, ethical approval was obtained from The University of Queensland, Australia. The questionnaire was pre-tested with 20 consumers in Faisalabad and modified in the light of consumer feedback. The services of trained enumerators were required due to the large sample size and time constraints to accomplish the consumer survey. Reliability issues that can emerge when using enumerators were dealt with by training and close supervision (Macharia, Collins, and Sun 2013).

Intercept surveys of 450 consumers were conducted in selected cities in 2012. Consumers buying mangoes from all types of retailers such as street vendors, temporary and permanent stall holders, supermarkets, super stores and specialty stores were randomly selected and interviewed face to face. Of the 450 consumers interviewed, 120 each were drawn from Karachi and Lahore and 110 each from Faisalabad and Multan. Questionnaires were examined and improperly completed or incomplete questionnaires were discarded, mostly on the same day.

Data were analyzed using IBM SPSS Statistics 22. Descriptive statistics such as percentages, frequency distributions and cross tabulations were used to explore basic facts about consumption and buying preferences of mango consumers. A hierarchical clustering technique using Ward's Method with Squared Euclidean Distance was employed to identify different consumer clusters (Pieniak et al. 2010, Kennedy et al. 2008, Bond, Thilmany, and Bond 2008, Ares and Gámbaro 2008). This technique is generally considered efficient because it examines the distances among clusters using an analysis of variance. The 20 mango attributes were subjected to cluster analysis. Cronbach's Alpha value of the 20 attributes was 0.7, suggesting that the scale used was internally reliable. The appropriate number of clusters was identified on the basis of an agglomeration schedule and dendrogram (Kennedy et al. 2008). Cluster comparisons were performed to identify significant differences across mango attribute preferences, consumption and buying preferences, and socio-economic characteristics of the respondents. For this purpose, cross tabulation, ANOVA, post-hoc tests with Fisher's Least Significance Difference (LSD), and the Kruskal-Wallis test were used (Macharia, Collins, and Sun 2013, Alamanos, Bourlakis, and Tzimitra-Kalogianni 2013).

Results and Discussion

In keeping with shopping habits in Pakistan, survey respondents predominantly comprised of males (93.3 percent) aged below 40 years (Table 1), representing all income groups. This is consistent with Channa and Channa (2013) and Badar (2008), who highlighted that fruit shopping is mainly done by male members of the family as females rarely go out to shop for fruit in several South Asian countries. Most respondents had large families comprising of five or more members. In terms of education, more than half were graduates or postgraduates. The higher

incidence of educated respondents can be attributed to relatively high general education levels in the surveyed cities.

The survey revealed that consumers like mangoes both fresh and processed (Sivakumar, Jiang, and Yahia 2011). However, fresh mango consumption was the most popular with nearly 80 percent of consumers indicating it as their first choice (Table 2). Major reasons for this preference included good taste, a liking for pure fruit, ease of consumption and less cost. This pattern was more or less the same across all cities. Mango milkshake was the most popular processed form due to its taste, nutritional value, children's preference for it and its cooling qualities during summer. Much lower preferences were cited for other processed forms such as pickles, juices, squashes, jams, ice-creams and chutneys. Whereas fresh mangoes can be consumed only in the season, consumer demand for processed items highlights a need for availability of value added processed mango products throughout the year.

Table 1. Socio-Economic Characteristics of the Sample (percentage)

Characteristic	Category	City				Overall
		Karachi	**Lahore**	**Faisalabad**	**Multan**	
Gender	Male	85.0	93.3	96.4	100	93.3
	Female	15.0	6.7	3.6	0	6.7
Age	Up to 30	31.7	25.9	27.3	32.0	29.1
(years)	31-40	33.3	27.5	29.1	41.0	32.4
	41-50	23.3	25.8	24.5	16.0	22.7
	51-60	10.8	13.3	13.6	10.0	12.0
	Above 60	0.8	7.5	5.5	1.0	3.8
Family size	1-2	1.7	1.7	4.5	1.0	2.2
(no.)	3-4	25.8	23.3	20.0	30.0	24.7
	5-6	38.3	37.5	48.2	38.0	40.4
	Above 6	34.2	37.5	27.3	31.0	32.7
Education	No education	10.0	7.5	1.8	7.0	6.7
	Primary[1]	1.7	8.3	4.5	16.0	7.3
	Secondary[2]	10.0	23.3	14.5	24.0	17.8
	Intermediate[3]	17.5	12.5	17.4	23.0	17.3
	Graduate	35.8	29.2	37.3	25.0	32.0
	Post-graduate	25.0	19.2	24.5	5.0	18.9
Family income	< 10,000	6.7	10.8	6.4	19.0	10.4
(PKR4/month)	10,001-20,000	17.5	20.0	20.9	25.0	20.7
	20,001-30,000	15.0	16.7	17.3	17.0	16.4
	30,001-40,000	21.7	16.7	13.6	24.0	18.9
	40,001-50,000	16.7	7.5	14.5	6.0	11.3
	> 50,000	22.5	28.3	27.3	9.0	22.2

Note. [1]Grade 5 equivalent, [2]Grade 10 equivalent, [3]Grade 12 equivalent, [4]Pakistani Rupee (1USD = 100 PKR)

Although a number of mango varieties are available in Pakistan, Chaunsa was the most popular. Around 57 percent of consumers indicated that it had good taste, aroma, more flesh and was readily available. Anwar Ratol was ranked as the second most preferred variety with more than

17 percent consumers preferring it due to its unique taste and aroma. In Multan city, consumer preferences for this variety were comparatively high due to its availability at relatively lower prices. Sindhri and Dusehri were the third and fourth ranked mango varieties. Consumers liked Sindhri for its taste, large size, greater flesh and its association with Sindhi culture. Dusehri was preferred due to its taste, soft skin, normal size (not too large or too small) and good flesh color (Table 2).

Mango is consumed more frequently during the summer season in Pakistan. More than 50 percent of respondents consumed mangoes a few times a week and 32 percent consumed mangoes on daily basis. The level of consumption was measured by using the number of mango pieces consumed per person at one time. Three consumer groups were identified based on the consumption level i.e. light consumers (1-2 mangoes), medium consumers (3-4 mangoes) and heavy consumers (5 and above mangoes). The majority of consumers were identified as light consumers (71.5 percent) whereas medium and heavy consumers constituted 23.6 and 5 percent respectively (Table 2).

Table 2. Consumption Preferences – Percentage Distribution of Consumers

Consumption Preferences	Categories	City				Overall
		Karachi	**Lahore**	**Faisalabad**	**Multan**	
Preferred form of consumption	Fresh	75.0	83.3	78.2	80.0	79.1
	Milkshake	19.2	15.0	20.0	18.0	18.0
	Other processed forms	5.8	1.7	1.8	2.0	2.9
Preferred varieties	Chaunsa	40.0	63.3	60.0	66.0	56.9
	Anwar Ratol	11.7	15.8	16.4	27.0	17.3
	Sindhri	34.2	5.8	3.6	0.0	11.6
	Dusehri	8.3	14.0	16.4	7.0	11.6
	Langra	3.3	0.8	0.9	0	1.3
	Others	2.5	0.1	2.7	0	1.3
Consumption frequency	Daily	35.0	24.2	24.5	48.0	32.5
	Bi-weekly+	42.6	52.5	63.6	43.0	50.5
	Once a week	15.8	17.5	8.3	6.0	12.2
	Fortnightly	5.8	0.8	1.8	1.0	2.4
	Monthly	0.8	5.0	1.8	2.0	2.4
Consumption level	1-2 mangoes	86.7	63.4	64.6	71.0	71.5
	3-4 mangoes	11.7	31.6	29.1	22.0	23.6
	≥ 5 mangoes	1.6	5.0	6.3	7.0	4.9

The purchase pattern varied across the sample. A majority of respondents indicated that they purchased 1-2 kg or 3-4 kg of mangoes in one shopping. Most of the respondents (43.3 percent) spent PKR 201 to 500 (USD 2-5) in a week on purchasing mangoes. Around 21.1 percent reported their weekly expenditure on mangoes less than PKR 200 (USD 2) and 35.6 percent stated it was above PKR 500 (USD 5). Although mango prices vary from city to city, this pattern was similar in all surveyed cities except Lahore where the majority (51.7 percent) of respondents spent more than PKR 500 (USD 5) weekly on buying mangoes (Table 3).

In Pakistan, mangoes are sold by both traditional retailers such as street vendors, roadside sellers, wholesale markets and modern retailers like supermarkets, modern stores and specialty stores. However, more than 90 percent of respondents preferred to purchase from traditional retailers. Among them, nearly 80 percent preferred roadside sellers over others due to easy availability of good quality fresh mangoes at reasonable prices (Table 3). A similar purchase pattern was observed in India by Ali, Kapoor, and Moorthy (2010). Around 10 percent of respondents ranked modern retailers as their most preferred retail outlet due to good quality, convenience, fixed prices and freedom to pick fruit. The remainder of the respondents viewed these stores as meant only for richer classes where mostly prices were high and quality was not as good compared to traditional retailers. Although a lower percentage of consumers indicated their preference to shop at modern retailers, results show that as in other developing countries, the retail sector in Pakistan is experiencing a gradual transformation with the increasing presence of modern retailers such as supermarkets, superstores and specialty shops (Aman and Hopkinson 2010).

Table 3. Buying Preferences – Percentage Distribution of Consumers

Buying Preferences	Categories	City				Overall
		Karachi	Lahore	Faisalabad	Multan	
Purchase quantity	1-2 Kg	32.5	36.6	33.6	50.0	37.8
	3-4 Kg	42.5	38.4	35.4	32.0	37.3
	≥ 5 Kg	25.0	25.0	31.0	18.0	24.9
Weekly expenditure (PKR*)	≤ 200	38.3	17.5	14.5	12.0	21.1
	201-500	45.8	30.8	45.5	53.0	43.3
	≥ 500	15.8	51.7	40.0	35.0	35.6
Preferred retailers	Street vendors	5.8	3.3	3.6	0.0	3.3
	Roadside sellers	80.0	71.7	73.6	93.0	79.1
	Wholesale market	6.7	5.0	13.7	7.0	8.0
	Modern retailers	7.5	20.0	9.1	0.0	9.6

Note. *Pakistani Rupee (1USD = 100 PKR)

Hierarchical cluster analysis was performed to identify clusters of consumers based on their preferences for 20 mango attributes. The decision to select the appropriate number of clusters is difficult due to non-availability of any authentic technique and it is mostly based on the judgement of the researchers (Hair et al. 2010). However given the agglomeration schedule and dendrogram in this case, a three cluster solution appeared appropriate to represent different segments of mango consumers in Pakistan.

The results of ANOVA and post-hoc tests using Fisher's least significant difference (LSD) means separation test demonstrated that the three clusters significantly differed from each other across all quality attributes except price, which is not uncommon in the context of developing countries (Table 4). These findings concur with those of Alamanos, Bourlakis, and Tzimitra-Kalogianni (2013) who also found price non-significant while segmenting Greek tomato consumers.

The Kruskal-Wallis test further revealed statistically significant differences in consumption and buying preferences and socio-economic characteristics of the respondents belonging to the three clusters, which significantly differed in their mango consumption level, purchase quantities and

retailer preferences (Table 5). In terms of socio-economic characteristics, the three clusters significantly differed in education and income level. The age, gender and family size differences among clusters were insignificant (Table 6). This was obvious considering the liking of mangoes both by males and females of all groups regardless of family size. These findings are consistent with those of Sabbe, Verbeke, and Damme (2008) who also reported gender based non-significant differences in consumption behavior towards tropical fruit.

Table 4. Cluster Comparison Based on Mango Attributes – ANOVA

Category	Attribute Type	Attribute	Cluster 1 Mango Lovers (n =155)	Cluster 2 Value Seekers (n = 200)	Cluster 3 Safety Conscious (n =95)	*F*-Value	*p*-Value
Intrinsic	Search	Color	4.17[ab]	4.05[b]	4.32[a]	2.93	0.05*
		Size	3.26[a]	3.47[b]	3.65[b]	4.77	0.01*
		Freshness	4.30[a]	4.77[c]	4.47[b]	27.20	0.00**
		Variety	4.06[a]	4.44[b]	4.37[b]	8.70	0.00**
		Damage free	4.19[a]	4.75[b]	4.58[b]	24.05	0.00**
		Blemish free	4.28[a]	4.63[b]	4.47[b]	9.97	0.00**
	Experience	Firmness	3.74[a]	4.01[b]	4.07[b]	5.96	0.00**
		Sweet taste	4.31[a]	4.61[b]	4.65[b]	13.52	0.00**
		Juiciness	3.79[a]	3.88[c]	4.09[b]	3.44	0.03*
		Ripeness	4.00[a]	4.18[b]	4.31[b]	4.72	0.01*
		Fiber free	3.50[a]	3.92[b]	3.77[ab]	5.68	0.00**
		Aroma	4.08[a]	4.40[b]	4.31[b]	6.35	0.00**
	Safety	Mango cleanliness	3.81[a]	4.22[c]	4.44[b]	15.58	0.00**
		Chemical free ripening	2.97[a]	4.08[b]	4.32[b]	63.93	0.00**
		Pesticide free production	2.94[a]	4.08[b]	4.31[b]	71.86	0.00**
Extrinsic	Marketing	Price	3.81[a]	3.9[a]	4.09[a]	1.83	0.16[NS]
		Retailer cleanliness	3.07[a]	4.14[c]	4.40[b]	58.25	0.00**
		Information provision	2.32[a]	3.27[c]	3.73[b]	57.38	0.00**
		Packaging	1.93[a]	3.66[c]	2.89[b]	135.10	0.00**
		Certifications	1.43[a]	3.95[c]	1.23[b]	733.79	0.00**

Note. Alphabets in superscript indicate results of Post-Hoc Tests (Fisher's least significance difference LSD test). The same letters in each column in a row indicate that clusters against that specific attribute are not significantly different at α=0.05, Cronbach's Alpha= 0.7, **Highly significant (α ≤0.01), *Significant (α ≤0.05), [NS]Non-Significant

The three clusters were labelled "Mango lovers" (cluster one), "Value seekers" (cluster two) and "Safety conscious" (cluster three) on the basis of their preferences for 20 mango attributes. Related studies such as Adhikari, Collins, and Sun (2012), Gunden and Thomas (2012), Alamanos, Bourlakis, and Tzimitra-Kalogianni (2013) and Macharia, Collins, and Sun (2013) also adopted a similar approach to labelling clusters. Given the attribute preferences, consumption and buying preferences and socio-economic characteristics, the three clusters had the following profiles.

Mango Lovers (Cluster One)

Consumers in this cluster were merely concerned with consuming mangoes and hence considered few extrinsic and intrinsic attributes important while buying mangoes. Enjoyment of

mango taste regardless of other attributes appeared their main motive for consumption, thus this cluster was named *"Mango Lovers"*, comprising 34.45 percent of respondents.
Mango lovers had comparatively lower mean scores for all attributes, yet differed significantly from the other two clusters against all attributes. To this cluster all search attributes (freshness, damage free, blemish free, color and variety) were important except large mango size. The most valued experience attributes included taste, aroma and ripeness. This cluster was not very concerned about safety related attributes. This may be attributed to inadequate consumer understanding of health implications of food safety issues, common in preferences of some consumers in developing countries (Adhikari, Collins, and Sun 2012) (Table 4).

Although the majority in this cluster were light consumers, compared to other clusters the percentage of medium consumers (3-4 mangoes) was highest. Frequency of mango consumption was more or less the same as that of other clusters. This cluster mainly preferred to buy 1-2 Kg (38.7 percent) and 3-4 Kg (36.1 percent) of mangoes at once. The majority of members of this cluster (85.2 percent) liked to buy mangoes from traditional retailers and spend PKR 201-500 (USD 2-5) in a week on mangoes (Table 5). Consumers in this cluster comprised primarily of males across all age groups and mostly had relatively large family size. Educationally, this cluster was diverse and drew membership from all levels of education. Likewise, this cluster had representation from all income groups (Table 6).

Table 5. Cluster Comparison – Consumption and Buying Preferences

Preference	Category	Cluster 1 Mango Lovers	Cluster 2 Value Seekers	Cluster 3 Safety Conscious	Mean Rank	Chi-Squared Value	*p* Value
Mango consumption (no. of pieces)	1-2	67.7	73.0	74.8	233.84[a]		
	3-4	27.1	23.5	17.9	220.28[b]	6.25	0.04*
	≥ 5	5.2	3.5	7.4	221.52[c]		
Consumption frequency	Daily	27.1	37.0	31.6			
	Bi-Weekly+	51.6	50.0	49.5	241.54[a]		
	Once a week	16.1	10.0	10.5	231.06[b]	1.57	0.45[NS]
	Fortnightly	1.9	2.0	4.2	210.43[c]		
	Monthly	3.2	1.0	4.2			
Mango purchased (Kg/shopping)	1-2	38.7	31.5	49.5	224.31[a]		
	3-4	36.1	41.5	30.5	198.89[b]	7.02	0.03*
	5 and above	25.2	27.0	20.0	239.07[c]		
Weekly expenditure on mangoes (PKR)	≤ 200	22.6	21.0	18.9	218.66[a]		
	201-500	44.5	38.0	52.6	215.97[b]	2.41	0.30[NS]
	≥ 500	32.9	41.0	28.4	235.33[c]		
Retailer type	Traditional[1]	85.2	72.0	88.4	213.89[a]		
	Modern[2]	14.8	28.0	11.6	206.55[b]	14.79	0.00**
					243.50[c]		

[1]Traditional retailers refers to street vendors and temporary and permanent stallholders. [2]Modern retailers include specialty shops, modern stores and super markets with storage facilities. [a]Mango Lovers, [b]Safety Conscious, [c]Value Seekers,**Highly significant (α ≤0.01), *Significant (α ≤0.05), [NS] Non-Significant.

Value Seekers (Cluster Two)

Cluster two was the largest cluster and comprised 44.44 percent of respondents. This cluster considered almost all attributes important in making mango purchase decisions and hence was named *"Value Seekers"*. This cluster significantly differed from mango lovers across almost all attributes. By and large, this cluster had similar preferences as those of the safety conscious group but it significantly differed in the case of marketing related attributes.

Among search attributes, this cluster looked for fresh mangoes free of damage and blemish. Taste, aroma and ripeness were highly important for this cluster. Being value seekers, consumers in this cluster considered safety attributes and marketing related attributes also important. This is why the mean importance of certification for this cluster was the highest (Table 4).

Table 6. Cluster Comparison – Socio-Economic Characteristics

Characteristic	Categories	Cluster 1 Mango Lovers	Cluster 2 Value Seekers	Cluster 3 Safety Conscious	Mean Rank	Chi-Squared Value	p Value
Gender	Male	95.5	91.0	94.7	220.66[a] 222.34[b] 230.75[c]	3.20	0.20[NS]
	Female	4.5	9.0	5.3			
Age (years)	Up to 30	30.3	28.5	28.5	224.21[a] 231.34[b] 223.73[c]	0.262	0.87[NS]
	31-40	31.0	35.5	28.4			
	41-50	22.6	20.0	28.4			
	51-60	11.6	12.0	12.6			
	Above 60	4.5	4.0	2.1			
Family size	1-2	0.6	3.0	3.2	231.61a 230.53b 218.37c	1.23	0.54[NS]
	3-4	25.2	26.0	21.1			
	5-6	39.4	40.5	42.1			
	> 6	34.8	30.5	33.6			
Education	No education	7.1	6.5	6.3	200.64[a] 199.51[b] 257.11[c]	22.42	0.00**
	Primary[1]	9.0	4.5	10.5			
	Secondary[2]	25.2	11.0	20.0			
	Intermediate[3]	18.1	14.5	22.1			
	Graduate	25.8	37.5	30.5			
	Post-graduate	14.8	26.0	10.5			
Family income (PKR4/month)	<10,000	12.3	3.5	22.1	213.37[a] 171.08[b] 260.75[c]	33.81	0.00**
	10,001-20,000	23.9	15.0	27.4			
	20,001-30,000	16.8	18.5	11.6			
	30,001-40,000	16.8	19.0	22.1			
	40,001-50,000	8.4	16.0	6.3			
	> 50,000	21.9	28.0	10.5			

[1]Grade 5 equivalent, [2]Grade 10 equivalent, [3]Grade 12 equivalent, [4]Pakistani Rupee (1US $ = 100 PKR)
[a]Mango Lovers, [b]Safety Conscious, [c]Value Seekers, **Highly significant ($\alpha \leq 0.01$), *Significant ($\alpha \leq 0.05$), [NS]Non-Significant.

This cluster mostly comprised of respondents who purchased small and medium quantities of mangoes. It had comparatively greater representation of medium and heavy buyers. Consumers who used to spend more than PKR 500 (USD 5) per week on mango purchases (41 percent) were more common (Table 5). Like other clusters, value seekers were predominantly male but comparatively it had a higher female membership (9.0 percent). This cluster primarily comprised of educated consumers belonging to medium and high income classes, explaining why the highest percentage of consumers who buy mangoes from modern stores were value seekers (Table 6).

Safety Conscious (Cluster Three)

Safety conscious consumers constituted the smallest cluster (21.11 percent). From their preferences in terms of higher mean attribute scores to safety related attributes, this cluster appeared to be highly health conscious. Macharia, Collins, and Sun (2013) also identified a relatively small cluster of consumers who were highly concerned about safety aspects when purchasing fresh vegetables in Kenya.

The main preferences of consumers in this cluster were for the search attributes of freshness, freedom from damage and blemish, and color. Important experience attributes were sweet taste, aroma, ripeness, firmness and juiciness. All safety related attributes were very important. Among marketing related attributes, higher importance was attached to price and retailer cleanliness. Among the three clusters, mean score for information provision was the highest for this cluster, which may be attributed to their desire to know more about food safety (Table 4).

Most of the safety conscious consumers (74.8 percent) were light consumers and the majority of these (88.4 percent) preferred to buy mangoes from traditional retail outlets. Those who bought 1-2 kg mangoes were common (49.5 percent) in this cluster. Weekly expenditure on mango purchases of more than half (52.6 percent) ranged from PKR 201 to 500 (USD 2-5) (Table 4). The members of this cluster had large family size and medium to high level education. Consumers in this cluster mostly belonged to low and medium income classes. Nearly half had low income (i.e. up to PKR 20,000) indicating their preference for food safety despite income constraints (Table 6).

Conclusions and Implications

Given the lack of empirical literature, the information generated in this study contributes to limited knowledge on consumer value preferences in Pakistan for fresh fruits in general and mango in particular. The study findings confirm the strong demand for mangoes in Pakistan and the importance of both intrinsic quality attributes (search and experience) and extrinsic attributes such as safety and marketing considerations. The results of cluster analysis revealed that consumers in the three clusters - mango lovers, value seekers and safety conscious, distinctively differed from each other in their product preferences, consumption and buying preferences and socio-economic characteristics. Mango lovers were merely concerned with consuming mangoes and hence considered fewer (primarily search and experience) quality attributes as important. This cluster was not so concerned about food safety issues. Safety conscious consumers appeared to be more health conscious and attached more importance to safety related attributes. Value

seekers considered not only search and experience attributes important, as other clusters also do, but were also concerned about safety and marketing related attributes.

It is interesting to note that the largest cluster was the value seekers. Relatively higher weekly expenditure on mangoes suggests a willingness of consumers in this cluster to pay more if their desired value is delivered to them. This provides an opportunity for value chain participants to develop and strengthen their chains by improving practices that deliver appropriate levels of quality and safety, and developing more collaborative relationships along the chain. A significant portion of this cluster preferred to buy from modern stores, indicating other opportunities for value chain participants to re-focus their efforts on satisfying modern retail standards.

Nevertheless, consumers in the focus group discussions expressed apprehensions relating to the quality and prices of fruits sold in modern stores and supermarkets. To attract more consumers from all three clusters, modern stores should address these apprehensions through quality improvement practices and more competitive pricing. Such an approach in collaboration with the whole of the value chain could have a marked and immediate improvement on consumer satisfaction, sales, profits and greater market share in the future.

Most of the consumers had knowledge of food safety related issues and the existence of a cluster which attached more importance to it, bears testimony to this fact. Consumers strongly disapproved of the use of Calcium carbide for ripening of mangoes. During the focus group discussions, they described it harmful, dangerous and problematic due to health hazards associated with this chemical. However, non-availability of mangoes ripened through safe means indicates the insensitivity of chain members towards consumer needs. This requires the immediate attention of public sector stakeholders to ensure the role of legislative and regulatory measures in supplying safe good quality mangoes to consumers. As suggested by Gunden and Thomas (2012), value chain actors, particularly growers, should improve quality attributes of their mangoes by aligning their practices with specific needs of different consumer segments. Consumers also expressed strong reservations about various retailing practices such as high prices, topping of cartons of poor quality fruit with better quality fruit and quality mixing. In this respect, training of retailers, particularly traditional retailers, on how to ensure consumers get clean safe and well graded fruit is essential (Chamhuri and Batt 2013).

Finally, it can be concluded that the value desired by consumers cannot be delivered profitably by mango suppliers without developing and strengthening value chains and adopting whole of chain approaches. In this regard, value chain actors need to play an active role by improving their practices and developing collaboration among themselves. Since value chains in Pakistan are not well organized and mostly fragmented in nature, relevant public sector institutions should support these chains through appropriate value chain improvements and enforcement of relevant rules and regulations.

Limitations and Future Research

This study focuses on urban consumers and its results may not be generalized to consumers living in rural areas, whose mango consumption patterns may differ. Future research could further examine the presence and relative size of the three identified consumer segments given

the current development stage of Pakistan. It would be interesting to explore possible changes in the size of these segments with improvement in the development stage of the country and examine how the mango industry in Pakistan should respond to these changes.

Acknowledgements

References

Adhikari, R. P., R. Collins, and X. Sun. 2012. Segmenting consumers to inform agri-food value chain development in Nepal. *International Food and Agribusiness Management Review* 15 (4):93-114.

Akkerman, R., P. Farahani, and M. Grunow. 2010. Quality, safety and sustainability in food distribution: a review of quantitative operations management approaches and challenges. *OR Spectrum* 32 (4):863-904.

Alamanos, E., M. Bourlakis, and I.Tzimitra-Kalogianni. 2013. Segmenting Greek tomato consumers: policy and marketing insights towards a healthy diet. *British Food Journal* 115 (4):488-507.

Ali, J., S. Kapoor, and J. Moorthy. 2010. Buying behaviour of consumers for food products in an emerging economy. *British Food Journal* 112 (2):109-124.

Alonso, M. S., J-P. Paquin, and J-P. L. Mangin. 2002. Modelling perceived quality in fruit products. *Journal of Food Products Marketing* 8 (1):29-48.

Aman, A., and G. Hopkinson. 2010. The changing structure of distribution channels in Pakistan. *International Journal of Retail & Distribution Management* 38 (5):341-359.

Ares, G., and A. Gámbaro. 2008. Food choice and food consumption frequency for Uruguayan consumers. *International Journal of Food Sciences and Nutrition* 59 (3):211-223.

Aujla, K. M., M. Abbas, K. Mahmood, and S. Saadullah. 2007. Marketing system of fruits, margins and export potential in Pakistan. *Pakistan Journal of Life and Social Sciences* 5 (1-2):34-39.

Badar, H.. 2008. An exploration of female shopping behaviour: a case study in city Faisalabad (Pakistan). *Pakistan Journal of Life and Social Sciences* 6 (2):75-79.

Bond, C. A., D. Thilmany, and J. K. Bond. 2008. Understanding consumer interest in product and process-based attributes for fresh produce. *Agribusiness* 24 (2):231-252.

Buckley, M., and C. Cowan. 2007. Consumer attitudes towards convenience foods. In *Understanding consumers of food products*, edited by Lynn Frewer and Hans van Trijp. Cambridge England: Woodhead Publishing Limited.

Campbell-Gibbons, H. 2011. Securing a sustainable British horticulture industry. *Nutrition Bulletin* 36 (4):443-448.

Chambers, S., A. Lobb, L. Butler, K. Harvey, and W. Bruce Traill. 2007. Local, national and imported foods: a qualitative study. *Appetite* 49 (1):208-213.

Chamhuri, N., and P. J. Batt. 2013. Exploring the factors influencing consumers' choice of retail store when purchasing fresh meat in Malaysia. *International Food and Agribusiness Management Review* 16 (3):99-122.

Channa, S. M., and S. Channa. 2013. *Gender in South Asia*: Cambridge University Press.

Collins, R. 2009. Value chain management and postharvest handling: partners in competitiveness, in *Postharvest Handling (Second Edition)*, edited by Florkowski, Wojciech, J. Robert L. Shewfelt, Bernhard Brueckner and Stanley E. Prussia A2: 107-128. San Diego: Academic Press.

Collins, R., T. Dunne, J. Campbell, P. Johnson, and A. U. Malik. 2006. A constraint analysis of Pakistan mango supply chains. Australian Centre for International Agricultural Research (ACIAR), Australia.

Collins, R., and M. Iqbal. 2011. Integrating postharvest, marketing and supply chain systems for sustainable industry development: the Pakistan mango industry as work-in-progress, in *Acta Horticulturae 895*, edited by P.J. Batt, 91-97. Kuala Lumpur, Malaysia International Society of Horticulture Science (ISHS).

CSF. 2007. Horticulture action plan: background paper July 2007. Islamabad: Competititve Support Fund, Ministry of Finance, Government of Pakistan.

Espejel, J., C. Fandos, and C. Flavián. 2007. The role of intrinsic and extrinsic quality attributes on consumer behaviour for traditional food products. *Managing Service Quality* 17 (6):681-701.

Everitt, B. S., S. Landau, M. Leese, and D. Stahl. 2011. *Cluster analysis*: John Wiley & Sons, Ltd.

Gao, Z., L. O. House, F. G. Gmitter Jr., M. Filomena Valim, A. Plotto, and E. A. Baldwin. 2011. "Consumer preferences for fresh citrus: impacts of demographic and behavioral characteristics. *International Food and Agribusiness Management Review* 14 (1):23-39.

Ghafoor, A., K. Mustafa, K. Mushtaq, and Abedullah. 2009. Cointegration and causality: an application to major mango markets in Pakistan. *The Lahore Journal of Economics* 14 (1):85-113.

Ghafoor, A., K. Mustafa, I. Zafar, and K. Mushtaq. 2010. Determinants of mango exports from Pakistan. *Journal of Agricultural Research* 48 (01).

Gooch, M. 2005. Drivers, benefits and critical success factors of developing closely aligned agri-food value chains. George Morris Centre, Canada.

Government of Punjab. 2006. Mango production and marketing. Directorate of Agriculture (Economics and Marketing) Punjab, Lahore.

Gunden, C., and T. Thomas. 2012. Assessing consumer attitudes towards fresh fruit and vegetable attributes. *Journal of Food, Agriculture & Environment* 10 (2):85-88.

Hair, J. F., W. Black, B. J. Babin, and R. E. Anderson. 2010. *Multivariate data analysis*: Prentice Hall Higher Education.

Hanif, M., S. A. Khan, and F. A. Nauman. 2004. Agricultural perspective and policy. Islamabad: Ministry of Food, Agriculture and Livestock, Government of Pakistan

Honkanen, P., and L. Frewer. 2009. Russian consumers' motives for food choice. *Appetite* 52 (2):363-371.

Jiménez-Guerrero, J. F., J. C. Gázquez-Abad, R. Huertas-García, and J. A. Mondéjar-Jiménez. 2012. Estimating consumer preferences for extrinsic and intrinsic attributes of vegetables. A study of German consumers. *Spanish Journal of Agricultural Research* 10 (3):539-551.

Kennedy, J, M Worosz, E C. Todd, and M. K. Lapinski. 2008. Segmentation of US consumers based on food safety attitudes. *British Food Journal* 110 (7):691-705.

Khushk, A M, and L. E. D. Smith. 1996. A preliminary analysis of the marketing of mango in Sindh province, Pakistan. *The Pakistan Development Review* 35 (03):241-255.

Kotler, P., G. Armstrong, V. Wong, and J. A. Saunders. 2010. *Principles of marketing*: Pearson Education, Prentice Hall.

Krishnakumar, J., and C. Chan-Halbrendt. 2010. Consumer preferences for imported Kona Coffee in South India: a latent class analysis. *International Food and Agribusiness Managment Reveiew* 13 (4):97-116.

Krueger, R. A., and M. A. Casey. 2009. *Focus groups: a practical guide for applied research*: SAGE Publications.

Larsen, H. B. 2014. Governance, quality conventions, and product innovation in a value chain: the case of the Spanish salted fish market. *Growth and Change* 45 (3):412-429.

Macharia, J., R. Collins, and T. Sun. 2013. Value-based consumer segmentation: the key to sustainable agri-food chains. *British Food Journal* 115 (9):1313-1328.

Mohy-ud-Din, Q., and H. Badar. 2011. *Marketing of agricultural products in Pakistan: theory & practice*: Higher Education Commission of Pakistan, Islamabad.

Mora, M., J. Espinoza, B. Schnettler, G. Echeverría, S. Predieri, and R. Infante. 2011. Perceived quality in fresh peaches: an approach through structural equation modeling. *Ciencia e Investigación Agraria* 38 (2):179-190.

Moser, R., R. Raffaelli, and D. Thilmany-McFadden. 2011. Consumer preferences for fruit and vegetables with credence-based attributes: a review. *International Food and Agribusiness Management Review* 14 (2):121-142.

Mowat, A., and R. Collins. 2000. Consumer behaviour and fruit quality: supply chain management in an emerging industry. *Supply Chain Management: An International Journal* 5 (1):45-54.

O'Keeffe, M., and A. Fearne. 2009. Food value chains: oppourtunity and performance. Department of Primary Industries and Resources SA (PIRSA), Government of South Australia, Australia.

PHDEB. 2005. Mango marketing strategy. Lahore, Pakistan: Pakistan Horticulture Development and Export Board.

Pieniak, Z., W.Verbeke, S. O. Olsen, K. B. Hansen, and K. Brunsø. 2010. Health-related attitudes as a basis for segmenting European fish consumers. *Food Policy* 35 (5):448-455.

Poole, N. D., L. M. Martı´nez, and F. Vidal Giménez. 2007. Quality perceptions under evolving information conditions: implications for diet, health and consumer satisfaction. *Food Policy* 32 (2):175-188.

Sabbe, S., W. Verbeke, and P.Van Damme. 2008. Familiarity and purchasing intention of Belgian consumers for fresh and processed tropical fruit products. *British Food Journal* 110 (8):805-818.

Schiffman, L. G., and L. L. Kanuk. 2009. *Consumer behavior*. 10 ed. USA: Pearson Higher Education.

Schilling, M. W., and P. C. Coggins. 2007. Utilization of agglomerative hierarchical clustering in the analysis of hedonic scaled consumer acceptability data. *Journal of Sensory Studies* 22 (4):477-491.

SDPI. 2004. Regoverning markets: securing small producer participation in restructured national and regional agri-food systems with a special emphasis on the milk, mango & citrus markets. Islamabad, Pakistan: Sustainable Development Policy Institute.

Sivakumar, D., Y. Jiang, and E. M. Yahia. 2011. Maintaining mango (Mangifera indica L.) fruit quality during the export chain. *Food Research International* 44 (5):1254-1263.

Skreli, E., and D. Imami. 2012. Analyzing consumers' preferences for apple attributes in Tirana, Albania. *International Food and Agribusiness Managment Reveiew* 15 (4):137-156.

Soosay, C. A., A. Fearne, and B. Dent. 2012. Sustainable value chain analysis: a case study of Oxford landing, from 'vine to dine'. *Supply Chain Management: An International Journal* 17 (1):68-77.

Sun, X., R. Collins, A. Dunne, B. Bajwa, S. Mazhar, and M. Iqbal. 2011. A whole of supply chain approach to developing a new market for Pakistan mangoes: the case of China, in *Acta Horticulturae 895*, edited by P.J. Batt, 277-282. Kuala Lumpur, Malaysia International Society of Horticulture Science (ISHS).

Trienekens, J. H., P. M. Wognuma, A. J. M. Beulens, and J. G. A. J. van der Vorst. 2012. Transparency in complex dynamic food supply chains. *Advanced Engineering Informatics* 26 (1):55-65.

UNIDO. 2006. Pakistan's agro-based exports and sanitary and phyto-sanitary (SPS) compliance. Islamabad: The World Bank and United Nations Industrial Organisation.

Verbeke, W., I. Vermeir, and K. Brunsø. 2007. Consumer evaluation of fish quality as basis for fish market segmentation. *Food Quality and Preference* 18 (4):651-661.

Vermeulen, S., J. Woodhill, F. Proctor, and R. Delnoye. 2008. *Chain-wide learning for inclusive agrifood market development: a guide to multi-stakeholder processes for linking small-scale producers with modern markets*: International Institute for Environment and Development, London, UK, and Wageningen University and Research Centre, Wageningen, the Netherlands.

Walters, D., and G. Lancaster. 2000. Implementing value strategy through the value chain." *Management Decision* 38 (3):160-178.

Wirth, F. F., J. L. Stanton, and J. B. Wiley. 2011. The relative importance of search versus credence product attributes: organic and locally grown. *Agricultural and Resource Economics Review* 40 (1):48-62.

Woodruff, R. B. 1997. Customer value: the next source for competitive advantage. *Journal of the Academy of Marketing Science* 25 (2):139-153.

Zhang, X., J. Huang, H. Qiu, and Z. Huang. 2010. A consumer segmentation study with regards to genetically modified food in urban China. *Food Policy* 35:456–462.

An Analysis of the Decision Structure for Food Innovation on the Basis of Consumer Age

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Abstract

Food innovations have high failure rates. One reason is due to not understanding what motivates consumers' product selections. This study analyzes consumer decision making strategies according to age ranges and their preferences for novel food products. Utilizing the means-end chain theory, our results show age is not a factor in consumption decisions with familiar products. However, the structure becomes more complex in the case of novel food items, especially among young consumers.

Keywords: novel foods, age, means-end chain, laddering, coffee

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Introduction

The food market has high levels of competition and saturation, which requires companies to keep developing new strategies in order to improve, sustain their market share, or even survive (Baregheh et al. 2009, Naidoo 2010). One strategy used to gain the competitive advantage is product innovation aimed at satisfying consumers' needs, and targeting niche markets with specific needs. While product innovation is important in terms of business strategy and growth, success rates for newly launched products are relatively low, with failure rates between 40 - 90% (Gourville 2006, Gresham et al. 2006). This is often caused by a failure to understand consumers, a lack of market orientation from the businesses, and by consumer neophobia[1].

Consumers are becoming more variable and less predictable for many reasons due to significant changes in lifestyles, demographics, cultural exchanges and high communication levels. (Imram 1999, Capitanio et al. 2009, Fortuin and Omta 2009, Kühne et al. 2010). In view of this, better knowledge of what consumers want, their changing needs, and how these changes can be immediately addressed through market orientation, becomes not only a key to success but a key to survival for agro-food industries (Costa et al. 2004). Innovation success is a combination of understanding consumers, the features and benefits they are looking for in the products they purchase and consume—and the aspects of their own personalities they project through product usage.

Means-end chain (MEC) theory allows us to establish relationships between the features or specifications considered in a given product, with the benefits they symbolize, and the personal values consumers are striving to personify through them. Thus, this approach gives us an idea of the aspects consumers consider when it comes to buying a given product. This means that understanding consumers' adoption process and cognitive structure can help improve positioning and launch strategies related to food innovations. Consumer-behavior research on innovation has focused on the analysis of the mental, behavior and demographic traits associated with willingness to adopt novel products. Some studies relate adoption of novel products to consumers' personal traits (Dickerson and Gentry 1983, Michon et al. 2010). The variables normally include: income, age, family-group size, education level, etc. Although some studies show that the effect of demographic variables tend to be mild, generally, there is consensus that consumers who innovate tend to have higher income and education levels, are young, have higher social mobility, prone to making risky decisions, and have higher opinion leadership (Dickerson and Gentry 1983, Gatignon and Robertson 1991, Rogers 1995, Im et al. 2003).

The age variable generally appears in marketing literature dealing with market segmentation and consumer behavior. The specific phase in the cycle of life that people are going through accounts for the general structure of certain consumer choices (Grande 1993), which means that companies cannot work in the same way for all age segments if they want to succeed at getting consumers to adopt new goods and services. Life-span Developmental Theory argues that

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[1] The reluctance to try unfamiliar foods or dislike for the flavor of unfamiliar foods is called food neophobia (Pelchat and Pliner 1995; Pliner 1994; Pliner and Loewen 1997).

personal values change normatively with age (Robinson, 2013) and that the objectives pursued in products consequently change with age too (Heckhausen et al. 2010). There is a broad-based consensus in the literature on the fact that age has an adverse effect over consumers' innovation drive. Younger consumers tend to be more innovative (Rogers 2003) and older consumers are more reluctant to innovate (Leek et al. 2001, Tellis et al. 2009).

Age generally affects innovation; young people are less risk-averse (Assael 1987). This trend is seen in the ecological food market (Tsakiridou et al. 2008, Bartels and Reinders 2010), the functional food market (Leek et al. 2001, Krystallis et al. 2010) and the ethnic food market (Pelchat and Pliner 1995, Xu et al. 2004).

Lunsford and Burnett (1992) considered a series of potential barriers to the adoption of novel products among older consumers and suggested there are a number of incompatibility limitations with these products. Psychologically, older consumers often fail to see clear benefits, resonate with a brand image or a product that is inconsistent with the older consumers' self-image. Our study attempts to analyze consumers' decision strategies according to their age and in relation to a novel food product in order to determine differentiating elements. This knowledge will help us identify the key elements for each age group and establish guidelines leading to improved rates of novel food product adoption. Although the age factor in relation to the adoption of novel food products has been widely analyzed, there are currently no studies establishing differences in decision structure according to age using means-end chain theory. That is to say, there are no studies analyzing the extent to which the desired specifications in a product, the benefits pursued and the personal values in play vary according to consumers' age when a novel food product is bought; and this is the differentiating element in our study.

Means-end chain theory, the theoretical basis of our research is presented in the next section. Section 3 explains the methodology used and Section 4 presents the primary results. Finally, the main conclusions and implications are presented, as well as the limitations of the study.

Theoretical Framework

Means-End Chain (MEC)

Gutman (1982) introduced means-end chain (MEC) theory into the field of marketing and consumer research, as a way of explaining the relationship between consumer knowledge and consumer behavior. MEC is a cognitive structure that links consumers' knowledge of products to their knowledge of certain consequences and values connected with those products (Ter Hofstede et al. 1998).

The main premise of MEC is that consumers learn to select those products that feature the attributes that allow them to achieve their desired ends (Reynolds and Gutman 1984, Ter Hofstede et al. 1998, Walker and Olson 1991, Olson and Reynolds 2001). MEC theory assumes that people base their purchase choices not on the products themselves but on the benefits to be gained from their consumption. A means-end chain begins with a product, service or performance attribute and establishes a sequence of links with personal values through the consumer's perceptions from which the consequences or benefits are derived.

Means-end chain theory suggests that product knowledge in consumers is hierarchically organized by level of abstraction (Young and Feigin 1975; Gutman 1982). The higher the level of abstraction, the stronger and more direct the relationship with the person (Olson and Reynolds 1983). In the analysis of mental images, each basic level of abstraction can be subdivided into distinct categories of abstraction. In this respect, Walker and Olson (1991) propose a six-level MEC. The three lower levels (concrete attributes, abstract attributes and functional consequences) form the consumer's product knowledge, while the three upper levels (psychosocial consequences, instrumental values and terminal values) comprise the consumer's self-knowledge. *Concrete attributes* are those properties or characteristics of the product, service or performance that may be desired or pursued by consumers. *Abstract attributes* are those that cannot be checked prior to consumption of the product and must therefore be inferred from internal or external cues. *Functional consequences* are the tangible benefits that consumers derive from product or service attributes as a direct result of consumption. *Psychosocial consequences* are benefits of a more personal, social and less tangible nature. *Instrumental values* represent desirable modes of behavior for the attainment of desirable end-states, and finally, *terminal values* represent desirable end-states. Having presented our theoretical framework, we will focus our attention in the next section on the methodology used in this research.

In relation to age and the use of the means-end chain, life-span developmental theory claims that personal values vary with age and therefore the objectives and benefits pursued in products change throughout life (Robinson 2013; Heckhausen et al. 2010). A further theory which confirms the aforementioned is the one proposed by Erikson (1980); young people aim to establish successful relationships. Thus, they value and prioritize autonomy, improvement and new experiences (Arnett 2000). Adults focus more on family so their pursued values and objectives focus on the people around them. As age increases, people are more concerned with maintaining traditions and are reluctant to change (Robinson 2013). These theories confirm that attributes-consequences-values and relationships can change with age. Furthermore, a number of MEC studies have analyzed variations according to age group. Roininen et al (2004) analyze the fruit and vegetables consumption habits of two different age groups in Finland and the UK. Flight et al. (2003) studied the perception of attributes, consequences and values of red meat consumption of middle-age and early old-age people. The text now includes a limitation regarding the issue of potential differences in the level of involvement and behavior between young people and adults.

Methodology

Product Choice

Two products were selected to determine the role played by consumers' ages in the acceptance of food innovations and the potential differences in decision structure when consumers of different ages are presented with a novel food product. We chose a traditional product as the control product (coffee) and a novel coffee-derived product (Nespresso type coffee capsules). Given that coffee consumers are increasingly more demanding and care more for quality and presentation, coffee capsules offer them the opportunity to enjoy different types of specialized establishment grade coffee in their homes without needing to spend large sums of money on

coffee makers or cafés (Resa 2011). In other words, capsules make consumers feel like coffee experts and cosmopolitan consumers etc., which are intangible values associated with consumption of the new product. These two products were chosen bearing in mind that coffee - both in its traditional and innovative formats - is a popular and widely consumed product among the Spanish population. According to data from the Spanish Ministerio de Agricultura, Alimentación y Medio Ambiente (MARM) [Ministry of Agriculture, Food and the Environment], 82% of the population drink brewed coffee. The proposed innovation (coffee capsules) was launched in 2004-2005[2], and its penetration in the Spanish market has tripled over the last two years to reach over 1.5 million regular consumers (8% of the total coffee consumption volume). This product is expected to amount to 20% of total coffee sales in the next five years (MARM 2011).

Laddering Interviews

The usual method used to obtain means-end chains is a qualitative interviewing technique known as laddering. Laddering interviews are personal, individual, in-depth, semi-structured interviews aimed at revealing the attribute-consequence-value associations made by consumers with respect to a particular product. Laddering interviews comprise a three-stage process. In the first stage, the researcher identifies the relevant attributes of the test product. In the second stage, subjects are invited through a series of questions of the type 'Why is that important to you?' to explain why the attributes chosen in the first stage are relevant in terms of their associated consequences and values. In the third stage, the associations or linkages are used to form an implication matrix from which to generate a hierarchical value map (HVM) (Nielsen et al. 1998, Ter Hofstede et al. 1998).

One of the key issues to be considered when constructing a HVM is the choice of cut-off level, as only associations above this level will be mapped (Leppard et al. 2004). The method adopted to determine the cut-off point in our case is known as 'top-down ranking', originally proposed by Leppard et al. (2004). This method is based on the premise that all participants in a survey will not necessarily make the same number of links between two levels of abstraction. Usually, larger numbers of links are more common at lower levels of abstraction than at higher levels. Therefore, it may not be appropriate to use the same cut-off point when the number of links varies between different levels of abstraction. The strategy underlining this method fixes the cut-off point according to a concept known as the 'importance link'. The most important link is the one most often repeated. Using this approach, one obtains different HVMs for different orderings. HVM1 represents the 'most important' or 'best' linkages, in the sense that any other choice of cut-off value or values must produce a HVM based on smaller and thus less strongly associated linkages between levels of abstraction. HVM1 is also the least complicated and most easily interpreted of all possible HVMs as it has the least number of elements displayed. Similarly, a HVM2 is constructed by repeating the above process but defining the relevant cut-off levels at the second largest cell entry at each level of abstraction. Thus, additional linkages are created by using a less stringent requirement (second highest vs. first highest) which results in a more complex HVM. Continuing in this way, choosing successively smaller cell entries in the manner described above, a sequence of HVMs can be created. The advantage of this method

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[2]Coffee capsules were launched in 1986. In Spain, however, it is a novel food product as it entered Spanish market much later (Nesspreso 2012).

is that it allows one to observe how the most important links between different levels of abstraction gradually emerge, while also allowing for the comparison of groups with the same cut-off point. That is to say, the same level may have different cut-off points between the groups but this allows us to know which elements (attributes, consequences and values) are relevant at each level and whether they are similar or different for the different groups established. Furthermore, this cut-off level captures a reasonable amount of the initial data shown in the final variance of the model.

Data Collection

The data to achieve our objectives was collected by means of a personal survey carried out in Navarra in March-April, 2011. The three-section survey target was household food buyers. The first section comprised questions related to consumption frequency for novel food products and their valued qualities when it comes to purchasing them. The second part of the questionnaire focused on applying the methodology in order to find out the respondents' means-end chains (laddering interview). Finally, the third part was related to the respondents' socio-demographic characteristics and lifestyles.

This study uses hard laddering[3] because, as noted by Russell et al. (2004), the technique is easier to apply, as the interview is shorter and the respondent feels less pressure (Botschen and Hemetsberger 1998). The present study uses hard laddering, because, as noted by Russell et al. (2004), it yields higher levels of abstraction than soft laddering while conserving the richness and complexity of the data[4]. The specific technique chosen for this part of the questionnaire was the 'Association Pattern Technique' (APT), which was introduced by Ter Hofstede et al. (1998) and is generally approved for use with samples of more than 50 individuals (Russell et al. 2004). This method comprises two independent matrices: an Attribute–Consequence (AC) matrix and a Consequence–Value (CV) matrix; respondents have to establish relationships between these elements.

The attributes selected for the attribute-consequence and value-consequence matrices were drawn from the reviewed literature and consultation with experts (academic staff at the *Universidad Pública de Navarra*) and through a pilot survey carried on people there. This produced a set of 13 attributes for coffee (Table 1). In the same way, we extracted what we considered to be the 21 most relevant functional and psychological consequences associated with the consumption of coffee. Finally, we used the list of values (LOV) proposed by Kahle (1985), which incorporated nine new consumption-related instrumental and terminal personal values (Table 1).

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[3]There are two types of laddering: hard and soft (Grunert and Grunert, 1995; Botschen and Thelen, 1998). Hard laddering includes all those techniques in which subjects are required in a structured interview to generate or verify associations between elements on individual ladders in sequences showing increasing levels of abstraction. Soft laddering respects the respondent's natural flow of discourse throughout the interview and the attribute–consequence–value linkages have to be reconstructed afterwards.

[4]Therefore, Costa et al. (2004) recommend the use of hard laddering for samples of more than 50 respondents, which strengthens the rationale for our adoption of this type of laddering.

Table 1. Identification and Classification of Attributes, Consequences and Values Selected for the Analyzed Product.

Attributes	Consequences	Values
Concrete Attributes	*Functional Consequences*	*Instrumental Value*
▪ Price	▪ Appetizing and enjoyable to drink	▪ Provides fun, pleasure and enjoyment
▪ Taste	▪ It is a healthy food	▪ Enhances my quality of life and security
▪ Aroma	▪ Good value for money	▪ Gives me an emotional boost
▪ Brand	▪ I'm well informed	▪ Makes me feel more successful
▪ Label information	▪ Easy to purchase	
▪ Package	▪ Appeals to all the family	
▪ Geographic origin	▪ Makes life easier	
▪ Type of coffee	▪ It is familiar	
	▪ It saves me time	
	▪ My concentration is better and I feel more awake	
	▪ It make me nervous	
	▪ It helps me relax and rest	
Abstract Attributes	*Psychological Consequences*	*Terminal Values*
▪ Quality	▪ I'm consuming a quality product	▪ Gives me a sense of social belonging
▪ Ease of preparation	▪ Good eating habits	▪ Improves my relationships with others
▪ Familiarity	▪ Provides me happiness and satisfaction	▪ Gives me a sense of self-fulfillment and accomplishment
▪ Beneficial health effect	▪ Brings back memories	▪ Makes me feel more respected by others
▪ Caffeine content	▪ Gives me a sense of cultural identification	▪ Gives me peace of mind, dignity and self-respect
	▪ No health risk	
	▪ Status symbol	
	▪ I feel I'm doing right	
	▪ Makes me feel more cosmopolitan	

The study used a convenience sample of coffee purchasers and consumers. Vannopen et al. (1999), approve the use of convenience samples in laddering procedures, given the complexity of the process and the fact that respondents are familiar with the product and therefore capable of expressing more ideas on the subject. In this case the final sample consisted of 98 people in charge of buying household food who responded to a personal invitation sent by e-mail to *Universidad Pública de Navarra* staff (academics, non-academic staff and students).This size of sample is in line with the majority of the past surveys using this technique found in the review of the literature. The characteristics of the sample and of the population of Navarre are shown below in Table 2.

Table 2. Characteristics of the Sample and the Population of Navarre (Spanish region).

	Coffee Sample	Spanish Region Navarre
Gender		
Male	28.03%	49.77%
Female	71.97%	50.23%
Average age	40.03	40.50
Size of household	3.06	2.90
Level of Education		
Elementary	—	18.67%
Intermediate	17.99%	52.24%
Higher	82.10%	29.09%

Source. National Statistics Institute (INE Spain) (2007) and authors' own calculations

It shows that the biggest difference is the higher percentage of participants with higher education in the two samples analyzed, because the surveys were conducted in the university.

The table also shows a higher number of women in the sample; this is probably due to the fact that the survey was responded to by people in charge of household purchases and there are still a higher number of women in charge of this chore. Even though the sample could be considered biased in terms of its educational level, other elements, such as household composition, age and gender, these are similar to those found in the population of Navarre as a whole. The sample has representativeness problems in terms of the interviewees' education level. Furthermore, it was impossible to interview people over 65 years of age given that the survey was carried out in a working environment and the difficulty older people may have when it comes to answering laddering interviews. Interviewing was conducted in groups of approximately 10 subjects who were given an explanation of the questionnaire content, its component parts and instructions for completion and then they completed the survey in their homes. Special emphasis was placed on explaining the laddering technique and an example was given of the MEC relationship to ensure a fuller understanding of the process. The duration of the interview ranged between 40 and 60 min. Mecanalyst Plus 1.0.8. software was used to construct ladders for all the sample respondents. The main findings from the data analysis are presented below.

Results

Segment Characterization

In order to find out whether consumers' decision structures with regard to food innovation vary according to age, the sample was segmented based on this variable. Two age groups were established: 18-35 year old interviewees (the "young" group) and 36-65 year old interviewees (the "adult" group).

Table 3 shows the socio-demographic characteristics and lifestyles of the two groups determined a priori as well as the corresponding statistics in order to determine significant differences between these two segments. The young group constitutes almost 39% of the sample, the adult group being the biggest segment (61%). In terms of socio-demographic characteristics, differences can be seen in family size; the adult group has bigger family sizes (a logical result given the family life cycle stage each of the groups is going through). Differences are also observed in terms of lifestyles; the adult group tends to be more participative in NGOs and more concerned about health related matters (medical check-ups, eating additive-free food and reducing stress), which is consistent with results found by other authors (Rimal 2001).

Table 4 shows consumption frequency for the products analyzed (traditional coffee and coffee capsules) for both age segments. Consumption levels for traditional coffee are very high; 80% of the population consumes this product regularly. In the case of coffee capsules, the consumption frequency is much lower, which is consistent with the literature related to the dissemination and adoption of innovations. In this case consumption frequency differences are significant and consumption levels are clearly higher in the young segment. This is consistent with the literature related to adoption of innovations, which holds that innovations have higher acceptance levels among young consumers (Leek et al. 2001, Tellis et al. 2009).

Table 3. Socio-Demographic Characteristics and Lifestyles by Respondents' Ages.

	Young	Adults	Snedecor's F	Sig.
	38.8%	**61.2%**	2.831	0.096
Household Size *	2.72	3.19		
Life Styles				
I reduce salt intake	3.18	3.11	0.066	0.798
I am a vegetarian	1.41	1.65	1.157	0.285
I exercise regularly	3.54	3.21	1.179	0.280
I try to avoid industrial products	2.87	3.28	1.954	0.165
I regularly eat fruit and vegetables	4.09	4.33	1.290	0.259
I eat red meat in moderation	3.39	3.46	0.063	0.802
I am member of a wildlife conservation association	1.06	1.20	0.968	0.328
I try to eat additive-free food	2.40	2.89	2.839	0.095*
I have regular health check-ups	2.46	3.27	5.963	0.016**
I try to reduce stress	2.62	3.19	5.122	0.026**
I participate in NGOs	1.68	2.50	6.076	0.016**
I see a dentist regularly	3.28	3.71	2.135	0.147
I try to lead an organized, methodical life	3.43	3.49	0.054	0.817
I try to balance work and private life	3.75	3.99	1.120	0.293
I read food products' labels	3.54	3.95	2.653	0.107
	Young	**Adults**	**Chi-square test**	**Sig.**
Gender			0.123	0.726
Male	25.8%	29.3%		
Female	74.2%	70.7%		
Level of Education			0.020	0.808
Secondary	23.2%	25.9%		
Higher	76.8%	74.1%		

***, **, * show the existence of significant differences between groups for 1%, 5%, 10% maximum error level respectively.

Table 4. Coffee Consumption by Respondents' Age.

		Young 38.8%	Adults 61.2%	Chi-square	Sig.
Coffee	Do not consume	—	6.3%	2.322	0.313
	Occasional consumption	18.2%	14.3%		
	Regular consumption	81.8%	79.4%		
Coffee capsules	Do not consume	37.6%	58.7%	5.730	0.038**
	Occasional consumption	37.3%	19.0%		
	Regular consumption	25.2%	22.3%		

***, **, * show the existence of significant differences between groups for 1%, 5%, 10% maximum error level respectively.

Cut-Off Point of Hierarchical Value Maps (HVM)

Having obtained the socio-demographic profile of each group and following the construction of the hierarchical value maps, it was necessary to determine the cut-off point of the HVMs. All the maps constructed were level 6 maps; that is, they show all the attribute-consequence and consequence-value linkages at and above the frequency of the one ranked sixth in importance. The cut-off point obtained following the methodology proposed by Leppard et al. (2004) is different for each level of abstraction and group of respondents, as shown in Table 5, while allowing for comparison between maps. Almost all of these linkages are made by over 50.0% of the group in each case, thus satisfying the minimum requirement suggested by the majority of authors.

Table 5. Cut-Off Points for the 6 Levels of Abstraction and Total Percentage of Cases.

	Coffee				Coffee Capsules			
	Young		Adults		Young		Adults	
	CP	%	CP	%	CP	%	CP	%
Level 1 AC	37	97.3	60	100	31	81.5	54	86.6
CV	34	89.5	56	93.3	30	78.9	54	86.6
Level 2 AC	33	86.8	51	85.0	27	71.0	50	83.3
CV	32	84.2	41	68.3	26	68.4	49	81.7
Level 3 AC	31	81.5	49	81.7	25	65.8	48	80.0
CV	31	81.6	38	63.3	25	65.8	46	76.6
Level 4 AC	29	76.3	47	78.3	24	63.2	45	75.0
CV	30	78.9	37	61.6	23	60.5	42	70.0
Level 5 AC	28	73.7	44	73.3	22	57.9	43	71.6
CV	28	73.7	35	58.3	21	55.2	39	65.0
Level 6 AC	27	71.0	42	70.0	21	55.2	40	66.7
CV	26	68.4	34	56.6	19	50.0	36	60.0

Effect of Exposure to Innovation by Consumers' Ages

This section presents the HVM results for traditional coffee and coffee capsules both for the young and the adult groups. This will allow us to determine whether or not consumers' cognitive structures vary when exposed to a novel food product (coffee capsules). Figures 1 and 2 show the hierarchical value maps for both segments in relation to traditional coffee. Figures 3 and 4 show the results for coffee capsules. Each element (attribute, consequence or value) in the chain appears on the maps alongside the percentage of respondents who mentioned that linkage.
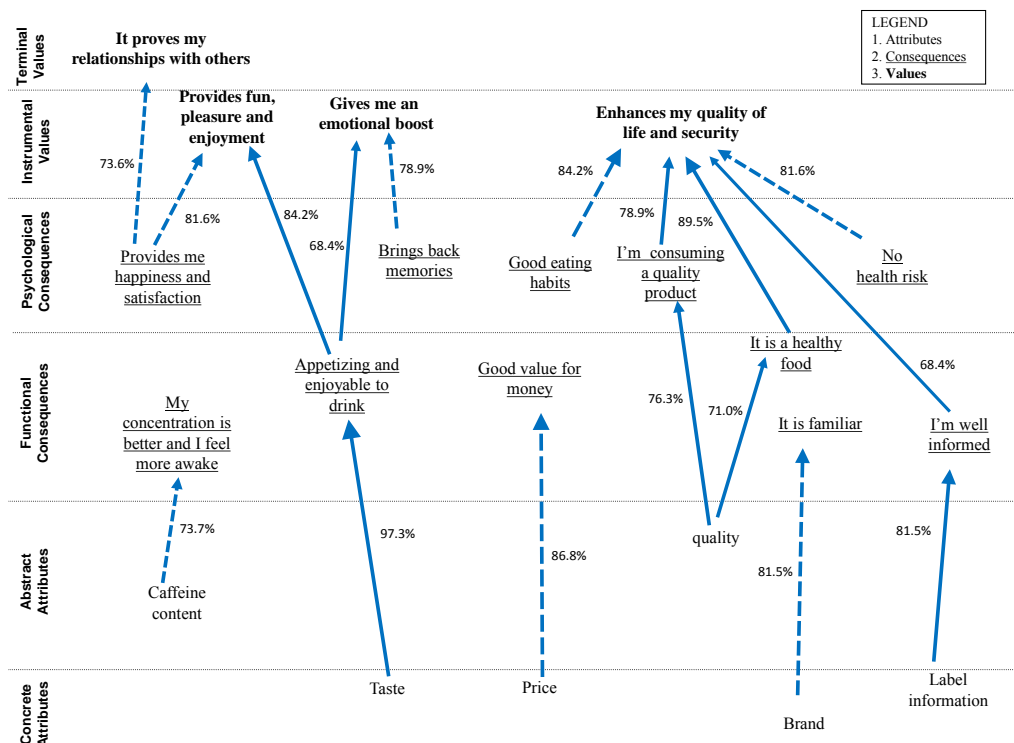
Figure 1. Level 6 Hierarchical Value Map for the Young Group and Traditional Coffee

Figures 1 and 2 show that the HVMs for the young and adult segments in the case of traditional coffee are quite similar in terms of attributes, consequences and values considered. The most significant differences are related to the "caffeine content" attribute in the case of the young group and the "aroma" attribute for adults. With regard to consequences, only one difference was observed, "being more concentrated and awake", which was valued by the young group; the same happened with the terminal value "improves my relationship with others".
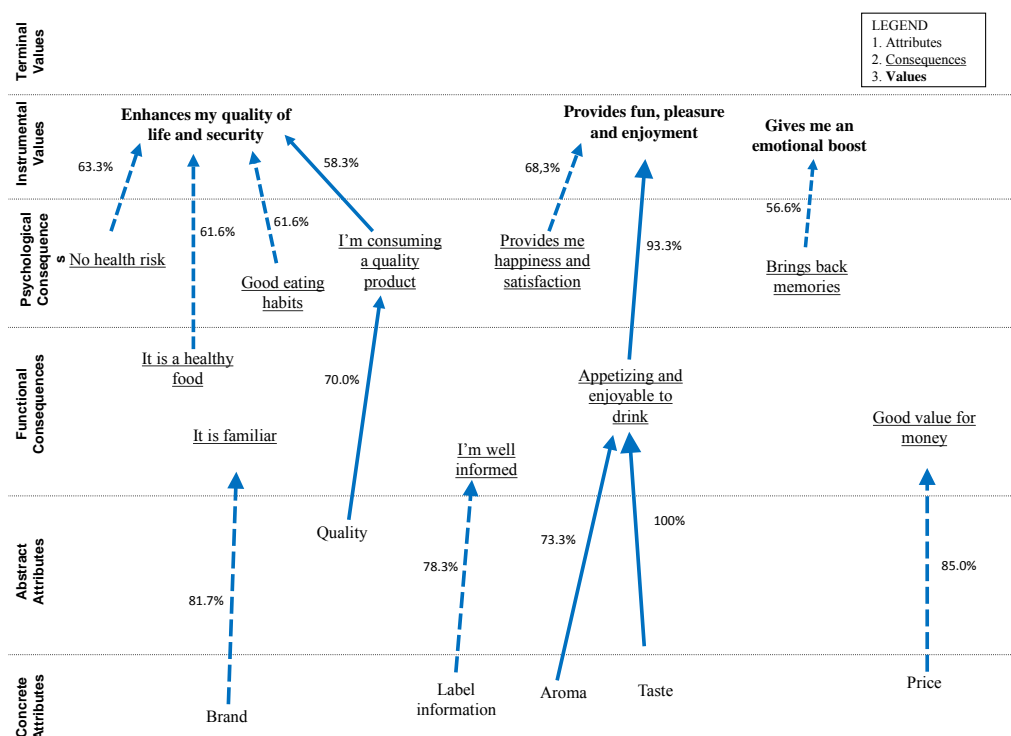
Figure 2. Level 6 Hierarchical Value Map for the Adult Group and Traditional Coffee

Figures 3 and 4, which show coffee capsules HVMs for the young and the adult segments respectively, indicate at a glance more complexity in the novel food product maps than in the traditional coffee ones for each of the two segments considered. A more detailed analysis of the HVMs for the young segment shows differences in the additional consideration of the concrete attributes "price" and "packaging" and the abstract attributes "familiarity" and " product preparation" in the case of coffee capsules. In terms of consequences, those related to the convenience and user-friendliness of coffee capsules ("make my life easier", "they save me time) are noteworthy as well as those which give consumers a sense of being "more cosmopolitan" and "having higher status". It is worth mentioning that "no risk perception" does not appear on the coffee capsules map, which implies that consumers somehow perceive that they are riskier than traditional coffee. In terms of values, a higher number of values for the novel food product are observed in the young segment, values related to "being more successful", "a sense of social belonging" and "having peace of mind, dignity and self-respect".

Figure 3. Level 6 Hierarchical Value Map for the Young Group and Coffee Capsules

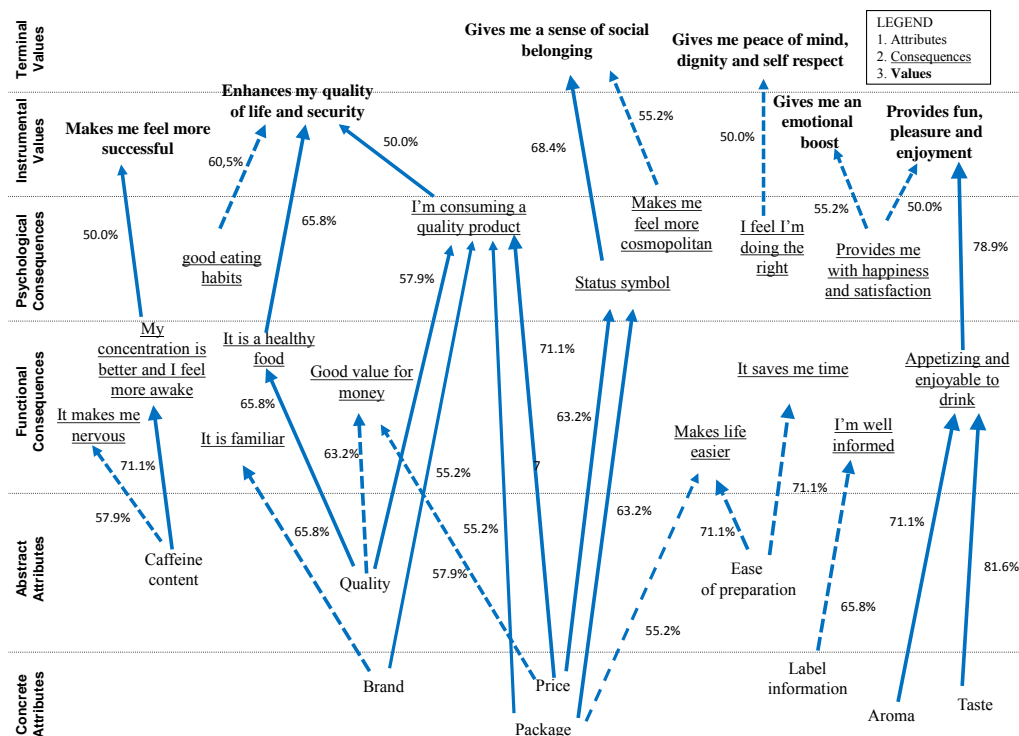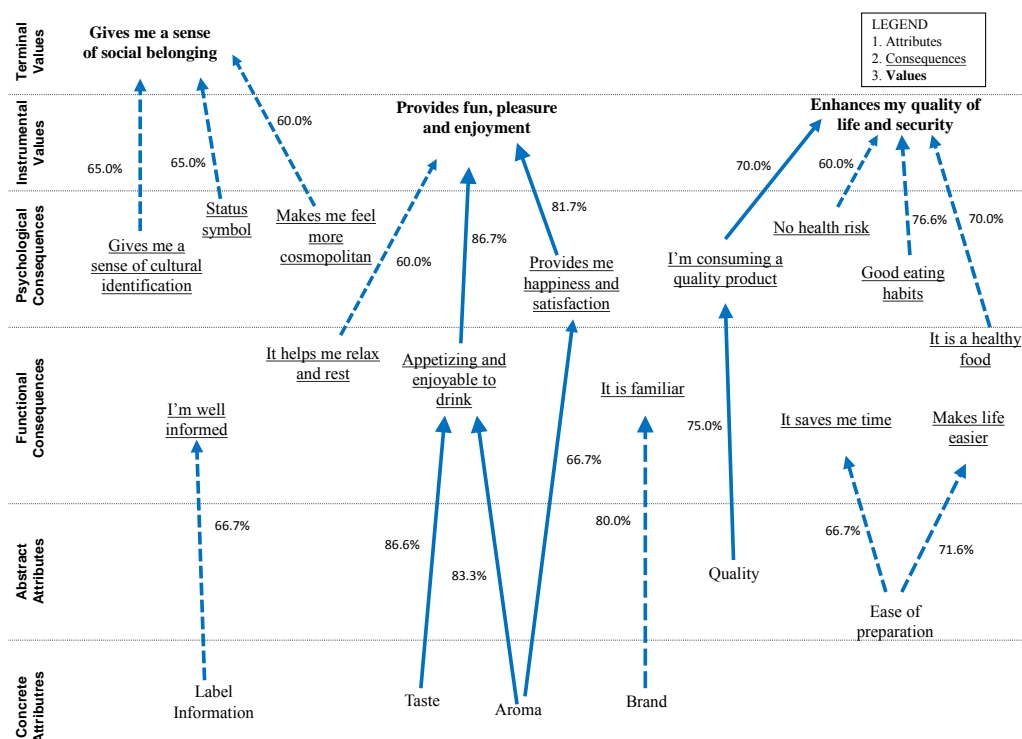**Figure 4.** Level 6 Hierarchical Value Map for the Adult Group and Coffee Capsules.

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In the case of adult consumers, the maps differ in one specific attribute, "price" which only appears in the traditional coffee HVM, and in "ease of preparation" as an abstract attribute in the case of coffee capsules. With regard to benefits or consequences, perceptions of regular coffee as a "good value for money" product and as a product that "brings back memories" are noteworthy. In the case of capsules, consumers identify a higher number of consequences, some of them related to the fact that this innovation "makes consumers' lives' easier" and to the fact that they perceive themselves as more cosmopolitan people when they consume it.

These results seem to indicate that in the case of a regularly consumed product consumers' cognitive structures are similar regardless of their age. When presented with a novel food product, consumers' cognitive structure becomes more complex. These differences are more patent in the young group.

Effect of Age on Decision Structure in Food Innovation

Once the fact that there actually exist differences in the cognitive structure when consumers are exposed to food innovation has been determined, we need to find out whether or not the decision structure related to the novel product differs according to the age of the consumers. To this end the HVM for young and adult consumers in coffee capsules are compared (Figures 3 and 4).

The initial analysis of the results obtained in relation to attributes reveals some interesting similarities between the two groups studied. Both segments are interested in concrete attributes such as "taste", "brand", "aroma" and "label information" i.e. mostly product organoleptic aspects, brand and information. As authors such as Grunert et al. (2003) have pointed out, sensory attributes, especially appearance and taste, have always been among the key factors influencing consumers when rating food products. In the case of abstract attributes, both groups perceive coffee capsules as a "quality" and "easy to prepare" product. In terms of differences in attributes, two concrete attributes are mentioned only by the young group: "price" and "packaging". The same happens with two abstract attributes: "caffeine content" and "product familiarity". These results show higher interest in packaging and caffeine content on the part of young consumers.

When the consequences or benefits mentioned by both groups are analyzed in more depth, functional consequences related to pleasure ("it's appetizing and enjoyable to drink") as well as those related to convenience ("it makes my life easier", "it saves me time") and being informed ("I'm well informed") are the ones which stand out. Similarities also emerge in terms of psychological consequences, specifically in those referring to consuming a quality product and having good eating habits as well as perception of higher status and cosmopolitanism when consuming coffee capsules. It should be noted that adults consume this product when they consider "it does not pose a risk to human health" while young consumers "feel they do the right thing", which shows that consumption of a novel food product is associated with the perception of being presented with a risk-free product. Differences were found in the usefulness interviewees attribute to this novel product; the young segment use coffee to improve their concentration and feel more awake while the adult segment consumes it to relax and rest. Besides, the young segment mentions "good value for money". The young group also mentions a higher number of values. Both segments agree on instrumental values such as "I have good

quality of life and safety, "it provides fun, pleasure and enjoyment" and the terminal value "gives me a sense of social belonging". The young segment, however, is able to convey a higher number of values in the map and they indicate that coffee capsules consumption gives them an emotional boost, makes them more successful and feel they have "peace of mind, dignity and self-respect".

These initial findings could be analysed in more detail in a second stage of the analysis in order to gain a deeper understanding of how purchasers' means-end chains are formed. The ladders observed show three relationships common to both segments. The first two refer to the "taste" and "aroma" of coffee capsules which are related to the consequence "it's appetizing and enjoyable to drink" and the value "it provides fun, pleasure and enjoyment".

This suggests that one of the values that all groups pursue through the consumption of foods is the enjoyment of eating them, an association that it is hardly surprising to observe in food consumption research. Another common pattern in the groups is the chain linking the abstract attributes "quality" with the consequence "I am consuming a quality product" and the instrumental value "enhances my quality of life and security", all of these concepts being related to the quality of the product.

Certain differences in terms of consumers' age are observable given that the young segment is able to convey many more complete ladders. For instance, three ladders associating "brand", "packaging" and "price" of the product with consumption of a quality product that provides them with good quality of life and safety are observed. Besides, the young group associates "price" and "packaging" with a "status symbol" and this in turns makes them perceive a sense of social belonging. Finally, the caffeine content of the novel food product is associated with better concentration and being more awake, which leads to being more successful.

From the analysis of the various elements and ladders shown on the hierarchical value maps of these consumer segments, it appears that the more complex cognitive structure underlying the decision making process with respect to innovations is that of the young group, the one which shows higher consumption of the new product.

Given that young and adult consumers presented consumption frequencies significantly different in relation to coffee capsules (Table 4), frequent coffee capsules consumers' HVMs for both age ranges were analyzed in order to find out whether these results were derived from age or from consumption frequency. Figures 5 and 6 show the HVMs obtained for young and adult regular coffee capsules consumers. The results show that even though there are some minor differences, the map structures remains similar to the one obtained for the groups in general when consumption frequency is not taken into account. The HVM for the young group is still considerably more complex than that of adults consuming this innovation, regardless of consumption frequency. These results seem to indicate that differences derive from age and not from consumption frequency.
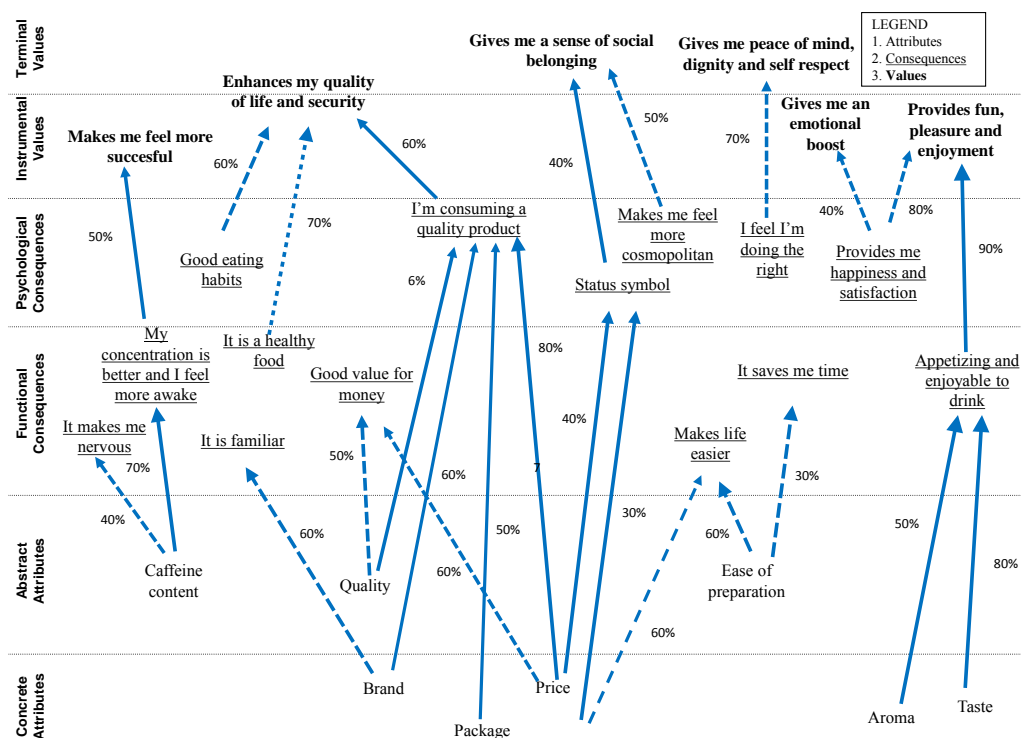
Figure 5. Level 6 Hierarchical Value Map for the Young Group and Coffee Capsules (Regular consumption).
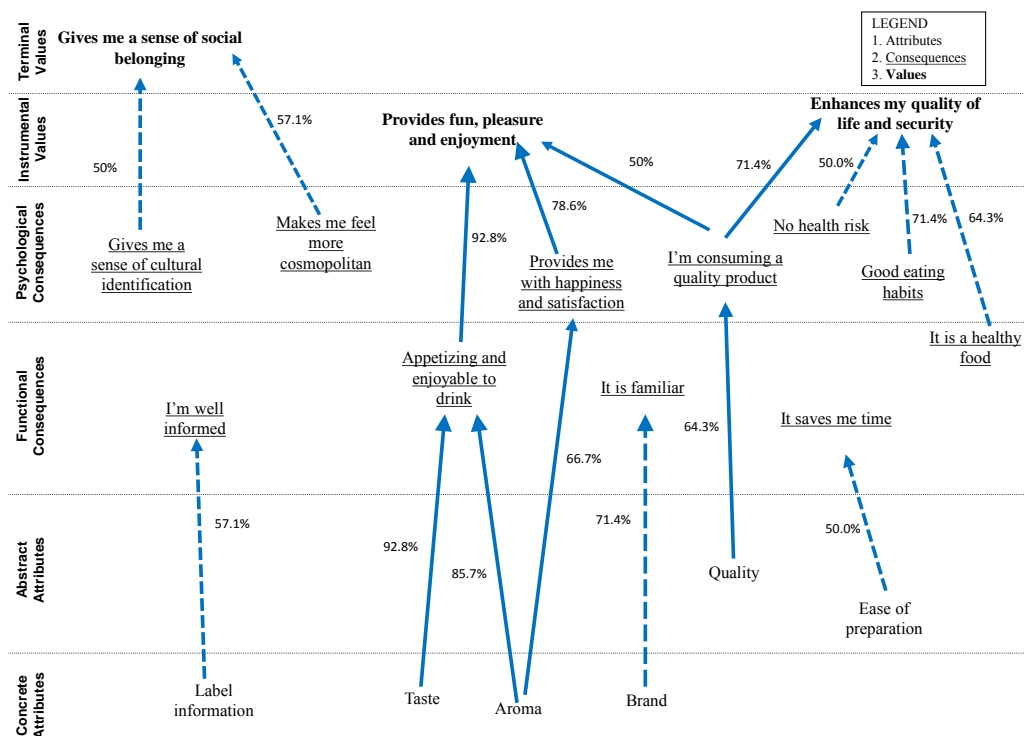
Figure 6. Level 6 Hierarchical Value Map for the Adult Group and Coffee Capsules (Regular consumption).

Degree of Abstraction Comparison

Results seem to suggest variations in the respondents' cognitive structure as a function of exposure to innovations and according to their age. Table 6 summarizes the complete ladders formed by each group in terms of the attributes, consequences and values involved. In general, the innovative product shows a higher degree of abstraction and more complex maps. Besides, this complexity becomes more patent with the young segment. Assuming that the degree of abstraction increases as the cognitive structure is more heavily dominated by abstract attributes, psychological consequences and terminal values than by concrete attributes, functional consequences and instrumental values, this higher degree of abstraction indicates that young consumers include more personal associations in the purchase process than adult consumers.

Table 6. Complete Ladders for Each Group and Product Analyzed.

			Coffee		Coffee Capsules	
Attributes	**Consequences**	**Values**	**Young**	**Adult**	**Young**	**Adults**
Concrete	Functional	Instrumental	3	2	2	2
		Terminal	—	—	—	—
	Psychological	Instrumental	—	—	3	1
		Terminal	—	—	2	—
Abstract	Functional	Instrumental	1	—	2	—
		Terminal	—	—	—	—
	Psychological	Instrumental	1	—	1	1
		Terminal	—	—	—	—

Conclusions

In recent years, market globalization and higher levels of competition have placed the food industry under ever greater pressure. Added to this, consumers are becoming more and more demanding and are more aware of what to look for in food products: quality, food safety, healthier products, etc. This reality has forced producers and processors to develop new products to meet these new demands in order to achieve a competitive market position. Despite the efforts on the part of the agro-food industry, the failure rate for novel food products is very high. This is due to various reasons, but it is mainly connected to a lack of understanding of consumers. In societies where nutritional needs are covered, the success of a given product in the market is related to acquiring knowledge about consumers, finding out what they look for in a product and what personality traits they project through the food products they purchase and consume. Consumers tend to put up barriers to novel products when they fail to find clear benefits in them or when they do no match their self-image.

Traditionally, consumer behavior oriented research on innovations has focused on demographic traits associated with willingness to adopt novel products. One of the variables generally considered is consumers' age, given that studies show that young consumers tend to be the more innovative ones. Our study attempted to analyze decision structures in consumers within different age ranges in relation to novel food products in order to determine potential differences. This knowledge will help identify the key elements for each age range to try and improve novel food adoption rates. These issues were explored in an application based on means-end chain theory, enabling us to map attribute-consequence-value linkages obtained through laddering

interviews with two consumer segments (young and adult consumers) and two products, traditional coffee (control product) and coffee capsules (food innovation).

The results show in the first place that young consumers have higher food innovation consumption levels, which is consistent with the results in most of the literature, which show that young consumers rank higher when it comes to adopting novel products.

Moreover, the hierarchical value maps allow us to conclude that consumers' cognitive structures are similar regardless of age when they are presented with a traditional product. However, this structure becomes more complex when they are presented with a novel food product in both age ranges. In other words, the decision structure related to novel food products projects a higher number of aspects connected to consumers' personalities through the products' attributes. Likewise, when adult and young consumers' decision structures for novel food products are compared, we find that complexity is much more patent for young consumers. In brief, young consumers of the novel product analyzed perceive more benefits in the novel food through its attributes and that said attributes reflect to a greater extent their personality.

Regardless of age, consumers adopt the novel product for hedonic reasons (taste, aroma and pleasure), due to ease of use (a key aspect for the market success of this product) and also because it makes them feel more trendy (more cosmopolitan) and gives them certain social status. Product search and experience attributes such as label information, brand, taste and ease of use are key factors. However, product belief attributes such as product quality are also noteworthy. This indicates that choice is not completely based on tangible product aspects; intangible or belief elements also play a role, which become more relevant when consumers are faced with the novel food product. The results in the study provide knowledge on the tangible and intangible elements which define the choice structures of the different consumer groups, which is knowledge of the consumer that goes beyond sociodemographic characteristics. And this knowledge facilitates the design of promotion strategies, which can be based on the links between product attributes and the values mentioned by consumers. Furthermore, the age of consumers is determinant in terms of certain benefits pursued in the novel food product analyzed; young consumers look for success through caffeine content, which allows them to improve their concentration while adult consumers aim at relaxation and rest. Finally, a further differentiating element is that young consumers attribute more importance to the products' image and packaging, brand and price, all of them perceived as quality and social status symbols. These factors are worth taking into consideration when it comes to designing marketing strategies aimed at boosting consumption among consumers of different ages.

Finally, we should mention some limitations of this study. In the first place, the sample used has representativeness problems in relation to the education level of interviewees (higher than that of the population of Navarra) and to the impossibility of interviewing people over 65 years of age. Second, it would have been interesting to introduce more variables in the preferences analysis, such as psychometric variables, which have not been taken into account in this study. Third, the study is focused on one product and we were unable to generalize the findings to other novel foods or the food market in general. A further limitation is that the level of involvement with the product is likely to be different according to different age groups and therefore behavior in relation to the product may vary. It would be therefore useful to corroborate the results by extending the scope of the research to other geographical areas, other food innovations or larger consumer samples.

Acknowledgements

References

Arnett, Jeffrey Jensen. 2000. Emerging adulthood: a theory of development from the late teens through the twenties. *American Psychology* 55: 469-480.

Assael, Henry. 1987. *Consumer Behavior and Marketing Action.* 3rd Edition. Kent Publishing Company: Boston.

Audenaert, Anke; Steenkamp, Jan-Benedict E.M. 1997. A Consumer-oriented Approach to the marketing of Food Products: Application of Means-end Chain Theory to the Consumption of Beef. In. *Agricultural Marketing and Consumer Behaviour in a Changing World.* Wierenga B.; Van Tilburg A.; Grunert, K.; Steenkamp JB. E.M. & Wedel M Kluwer Academic Publishers.

Baregheh, Anahita; Rowley, Jennifer; Sambrook, Sally. 2009. Towards a multidisciplinery definition of innovation. *Journal of Management Decision* 47(8): 1323-1339.

Bartels, Jos; Reinders, Machiel J. 2010. Social identification, social representations, and consumer innovativeness in an organic food context: a cross-national comparison. *Food Quality and Preference* 21(4): 347-352.

Botschen, Gunther; Hemetsberger, Andrea. 1998. Diagnosing Means-End structures to determine the degree of potential marketing program standardization. *Journal of Business Research* 42(2): 151–159.

Botschen, G., and E. Thelen. 1998. Hard versus soft laddering: implications for appropriate use. In *New developments and approaches in consumer behaviour research.* 321–339, edited by I. Balderjahn, C. Mennicken, & E. Vernette. Stuttgart, Houndmill &London: Schaffer-Poeschel Verlag & Macmillan Press Ltd.

Capitanio, F.; A. Coppola, and S. Pascucci. 2009. Indications for drivers of innovation in the food sector. *British Food Journal* 111(8): 820-838.

Costa, A. I .A.; M. Dekker, and W.M.F. Jongen. 2004. An overview of means-end theory: potential application in consumer-oriented food product design. *Trends in Food Science & Technology* 15(7-8): 403-415.

Dickerson, M.D.; and J.W. Gentry, 1983. Characteristics of adopters and non-adopters of home computers. *Journal of Consumer Research* 10(2): 225-235.

Erikson, Erik H. 1980. Identity and the life cycle. Norton and co. New York.

Flight, Ingrid; C. G. Russell, I. Blossfeld, David N. Cox. 2003. From sensory attributes to marketing hooks: using laddering to understand consumer perceptions of red meat. *Food Australia* 55: 418-424.

Flight, Ingrid; Phillip; Leppard, David N. Cox. 2003. Food neophobia and associations with cultural diversity and socio-economic status amongst rural and urban Australian adolescents. *Appetit*e 41: 51-59.

Fortuin, Frances T. J. M.; S.W.F. Omta. 2009. Innovation drivers and barriers in food processing. *British Food Journal* 111(8):839-851.

Gatignon, Hubert; and Thomas S. Robertson. 1991. Innovative decision processes. *Consumer Behavior* (316–348). Englewood Cliffs, NJ: Prentice-Hall.

Gourville, John T. 2006. Eager Sellers and Stony Buyers: Understanding the Psychology of New-Product Adoption. *Harvard Business Review* 84: 98–106.

Grande, Ildefonso. 1993. El comportamiento de los consumidores por grupos de edad. Implicaciones sobre el diseño del marketing mix [The behavior of consumers by age groups . Implications for the design of the marketing mix]. *Distribución y Consumo* 12: 40-58.

Gresham, George; J. Hafer, and E. Markowski. 2006. Inter-functional market orientation between marketing departments and technical departments in the management of the new product development process. *Journal of Behavioral and Applied Management* 8(1): 53–65.

Grunert, Klaus G; Lone Bredahl; Joachim Scholderer. 2003. Four questions on European consumers' attitudes toward the use of genetic modification in food production. *Innovative Food Science and Emerging Technologies* 4(4): 435–445.

Gutman, Jonathan. 1982. A means-end chain model based on consumer categorization processes. *Journal of Marketing* 46(2): 60-72.

Heckhausen, Jutta; Carsten Wrosch and Richard Schulz. 2010. A motivational theory of life-span development. *Psychological Review* 117(1): 32-60.

Im, Subin, Barry L. Bayus, and Charlotte H. Mason, 2003. An empirical study of innate consumer innovativeness personal characteristics, and new-product adoption behavior. *Journal of the Academy of Marketing Science* 31(1):61-73.

Imram, Nazlin. 1999. The role of visual cues in consumer perception and acceptance of a new product. *Nutrition & Food Science* 99(5): 224-228.

    167

Kahle, Lynn R. 1985. The nine nations of North America and the value basis of geographic segmentation. *Journal of Marketing* 50(April): 37-47.

Krystallis, Athanasios; Michalis Linardakis and Spyridon Mamalis. 2010. Usefulness of the discrete choice methodology for marketing decision-making in new product development: an example from the European functional food market. *Agribusiness* 26(1): 100-121.

Kühne, Bianka; Filiep Vanhonacker, Xavier Gellynck, Wim Verbeke. 2010. Innovation in traditional food products in Europe: Do sector innovation activities match consumers' acceptance*? Food Quality and Preference* 21(6): 629-638.

Leek, Sheena; Isabelle Szmigin, and Marylyn Carrigan. 2001. Older consumers and food innovation. *Journal of International Food and Agribusiness Marketing* 12 (1): 71-89.

Leppard, P.; C.G. Russell, and D.N. Cox. 2004. Improving means-end-chain studies by using a ranking method to construct hierarchical value map. *Food Quality and Preference* 15(5): 489-497.

Lunsford, Dale A; Burnett, Melissa S. 1992. Marketing Product Innovations to the Elderly: Understanding the Barriers to Adoption. *Journal of Consumer Marketing* 9(4): 53-63.

MARM, Ministerio de Agricultura, Alimentación y Medio Ambiente de España. 2011. La alimentación en España[Food in Spain]. http://www.magrama.es.

Michon, Christelle; O'Sullivan, Maurice; Sheehan, Eliz; Delahunty, Conor; Kerry, Joe 2010. Study on the influence of age, gender and familiarity with the product on the acceptance of vegetal soups. *Food Quality and Preference* 21: 478-488

Naidoo, Vik. 2010. Firm survival through a crisis: The influence of market orientation, marketing innovation and business strategy. *Industrial Marketing Management* 39(8): 1311-1320.

Nielsen N.A., T Bech-Larsen and K.G. Grunert. 1998. Consumer purchase motives and product perceptions: a laddering study on vegetable oil in three countries. *Food Quality and Preference* 9(6):455-466.

Olson, James C.; and Thomas J. Reynolds. 1983. Understanding Consumers' Cognitive Structure: Implications for Advertising Strategy. In *Advertising and Consumer Psychology*. Lexington, MA. L. Percy & A. Woodside. Lexington Books.

Olson, Jerry C. and Thomas J. Reynolds. eds. 2001. The means-end approach to understanding consumer decision making*, in Understanding Consumer Decision Making: the Means-End Approach to Marketing and Advertising Strategy*, 3-20. Lawrence Erlbaum Associates. Mahwah, NJ.

Pelchat, Marcia L. and Patricia Pliner. 1995. Try it. You'll like it. Effects of information on willingness to try novel foods. *Appetite* 24(2): 153-165.

Pliner, Patricia. 1994. Development of measures of food neophobia in children. *Appetit*e 23(2): 147–163.

Resa, Sylvia. 2011. Los sectores de café y té persiguen el rango de la degustación [The coffee and tea sectors pursue the range of tasting]. *Distribución y consumo* 20: 70-74.

Reynolds, Thomas J., and Jonathan Gutman. 1984. Laddering: extending the repertory grid methodology to construct attribute-consequence-value hierarchies. In *Personal Values and Consumer Psychology*, *Vol. II.* 155-167. Edited by R. Pitts and A. Woodside. Ed. Lexington, MA: Lexington Books.

Reynolds, Thomas J. and Jonathan Gutman. 2001. Advancements in laddering. In *Understanding consumer decision making: the means-end approach to marketing and advertising strategy*, edited by Olson, J.C.; Reynolds, T.J. Mahwah, NJ: Erlbaum. 91-118

Rimal, Arbindra P. 2003. Who buys reduced fat? A case of reduced fat peanut butter. *Journal of International Food and Agribusiness Marketing* 13(1): 27–40.

Robinson, Oliver C. 2013. Values and adult ages: findings from two cohorts of the European Social Survey. *European Journal of Ageing* 10(1): 11-23.

Rogers, Everett M. 1995. *Diffusion of Innovations*. 4th edition, New York, The Free Press.

Rogers, Everett M. 2003. *Diffusion of Innovations*. 5th edition. New York: The Free Press.

Roininen, Katariina; Laurence Filion, David Kilcast, Liisa Lähteenmälii. 2004. Exploring difficult textural properties of fruit and vegetables for the elderly in Finland and the United Kingdom. *Food Quality and Preference* 15(6): 517-530.

Russell, G., A. Busson., I.H.K. Flight, J. Bryan, J.A.Van Lawick, D.N. Cox. 2004. A comparison of three laddering techniques applied to an example of a complex food choice. *Food Quality and Preference* 15: 569-583.

Tellis, Gerard J.; Eden Yin and Simon Bell. 2009. Global consumer innovativeness: cross-country differences and demographic commonalities. *Journal of International Marketing* 17(2):1-22.

Ter Hofstede, Frenkel; Audenaert, Ankel; Steenkamp, Jan-Benedict E.M; Wedel, Michel. 199). An investigation into the association pattern technique as a quantitative approach to measuring means-end chain. *International Journal of Research in Marketing* (15): 37-50.

Tsakiridou, Efthimia; Christina Boutsouki, Yorgos Zotos, Konstadinos Mattas. 2008. Attitudes and behaviour towards organic products: an exploratory study. *International Journal of Retail & Distribution Management* 26(2): 158-175.

Vannoppen, Jan, Verbeke, Win; Van Huylenbroeck, Guido; Viaene, Jacques, 1999. Consumer valuation of short market channels for fresh food through laddering. *Journal of International Food Agribusiness Marketing* 12: 41-69.

Walker, Beth A. and Jerry C. Olson. 1991. Means-end chains: connecting products with self. *Journal of Business Research* 22(2): 111-118.

Xu, Jing; Soyeon Shim, Sherry Lotz and David Almeida. 2004. Ethnic identity, socialization factors and culture-specific consumption behaviour. *Psychology and Marketing* 21(2): 93-112

Young, Shirley and Barbara Feigin. 1975. Using the benefit chain for improved strategy formulation. *Journal of* Marketing 39(3): 72-74.

Farmers' Preferences for Management Options as Payment for Environmental Services Scheme

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Abstract

In developing countries opportunity exists for the application of policy instruments like Payment for Environmental Services (PES) to address the challenges of poverty and environmental degradation. Assessing the preferences of farmers for management scenarios provides an inroad into the application of this tool and should be considered by policy makers and practitioners. Using conjoint analysis this study found that farmers' ranking of management scenarios is affected by the commitment period and land sizes exceeding 40% of their total land size and that their decision to participate was affected by gender, age, household size, awareness, land tenure and annual income.

Keywords: payment for environmental services, farmers' preferences, conjoint analysis, management scenarios

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Introduction

Desertification, biodiversity loss, reduced forest cover, water scarcity, increased soil erosion, and climate change contribute to the complex environmental challenges the world faces today. These are complicated by their linkages to other global challenges, like fast growing population, increasing inequality and the global financial crises. Together these challenges leave an estimated one billion people in the world without enough food, water and other basic needs. Recognizing the gravity of these global challenges, the United Nations through its agencies United Nations Environment Program (UNEP 2008); the Food and Agricultural Organization (FAO 2011); and the International Fund for Agricultural Development (IFAD 2013), have endeavored to focus the World's attention on the questions about how we manage natural resource production systems, what value we assign to them, how we distribute these resources, and how we conserve them for future generations. However, poverty has been identified as one of the obstacles to the conservation and sustainability agenda. The Millennium Ecosystem Assessment (2005) defines poverty as the pronounced deprivation of well-being, which often arises from a broken link between human well-being and environmental services. Further poverty is directly linked to food security, which refers to the supply and access to provisioning environmental services, such as food, fibers, water, wood and fuel (MA 2005). One of the greatest challenges to addressing the problem of food insecurity in Africa, is how best to formulate development strategies that integrate environmental resource conservation into food security goals.

These strategies need to reconcile the environmental debt of tomorrow with the food deficit of today, calling for a trade-off between food security and environmental quality. There is need therefore for affordable policy approaches that will meet these two goals simultaneously.

Since the release of the Millennium Ecosystem Assessment (MA 2005), ecosystems have become widely recognized as natural capital assets supporting and supplying services which are highly valuable to humans. Agricultural ecosystems are by far the largest managed ecosystems in the world (FAO 2007) and the largest sector of rural economies in Africa, engaging majority of the rural population (Nkonya et al. 2011). The productivity of smallholder agriculture and its contribution to poverty reduction and food security depend on the services provided by well-functioning ecosystems, and in turn, affect the condition of ecosystems (IFAD 2013). In the face of the current global challenges, the agricultural sector is expected to provide an ever-growing supply of ecosystem-based goods and services. About 80 percent of the anticipated increase in land-based agricultural production is expected to derive from increased input use and improved technology on existing agricultural land (FAO 2007). This in turn could exacerbate damage to land-based ecosystems through expansion into environmentally fragile areas, soil erosion, pressure on water supplies, rising nitrate levels in ground and surface water, salinization, and growing air and water pollution from livestock wastes. Farmers can provide a better mix of ecosystem services through changes in land-use and production systems, and in so doing expand the share of environmental services characterized by positive externalities.

There are some land use practices based on sustainable agricultural principles which produce multiple outputs and thus offer potential opportunity to achieving the two mutually exclusive objectives and minimize the tradeoffs (Ajayi et al. 2008). There is a consensus in the literature

that most of the practices are feasible and technically sound (Ajayi et al. 2008; Sileshi et al. 2008), but the level of uptake of the practices by farmers has been low particularly in low income regions of the world, or attained only a modest success in other regions (Antle and Diagana 2003; Mercer 2004).

Environmental services are public goods, a special class of externalities, that are non-excludable and non-rivalry, therefore there is generally very little incentive to preserve them. As a result, there are no direct market mechanisms to signal the scarcity or degradation of a service until it fails. A key question, therefore, concerns how society can motivate farmers to reduce negative side-effects while continuing to meet the increasing demand for agricultural produce.

Payment for environmental services (PES) has emerged as an important tool that can motivate farmers to provide environmental services through land use changes and adoption of best land management practices, and in so doing, ensure the productive basis of long-term food security for local communities. PES is premised on the concept that to maintain the flow of environmental goods and services for society, incentives are needed to induce local people to forego more disruptive land and resource use practices. It is defined as a voluntary transaction in which a well-defined environmental service (or land use likely to secure that service) is being bought by a minimum of one environmental services buyer from a minimum of one environmental services provider if and only if the provider continues to supply that service (Wunder 2005). Proponents of PES argue that compensating land user for ecosystem services would make markets consider such services in decision making processes, thereby increasing chances of arresting land degradation and other environmental problem such as erosion and floods (Pagiola et al. 2005).

The concept of PES is premised on a theoretical background that stems from neoclassical environmental economics (Pearce and Turner 1990; Perman et al.2003), where environmental dilapidation is attributed to the constant inability of markets to internalize environmental externalities, and to free-riding brought on by the public-good nature of ecosystem services. A Coasian solution to land use externalities has gained popularity and proposes to align private and social costs through conditional payments from those affected by the externality to the landholder (Engel et al. 2008). Hence, the PES philosophy argues for the internalization of environmental externalities through the creation of ES markets or quasi-markets. The explicit focus on positive externalities results in a shift from the 'Polluter Pays Principle' (PPP) to a 'Beneficiary Pays Principle' (BPP) (Pagiola et al.2002, Pearce et al. 2004) or 'Provider Gets Principle' (PGP) (Hubermann and Leipprand 2006). The land user is now seen not as a polluter, but as a service provider who is presented with an opportunity to add an environmental service to their production portfolio, either as a joint product of other goods or as a service that is independently generated (Heckens and Bastiaensen 2010). Watershed contexts are believed to tie in better with the Coasean upstream–downstream externalities framework, as they can capitalize on the production of straightforward externalities (water services) and the generation of relatively low transaction costs by adding environmental services payments to financing structures already established by local water utilities (Kosoy et al. 2007). This prompted research exploring the potential of local payments for watershed services and the prospects it offers for securing long-term ecosystem protection (Ortega-Pacheco et al. 2009; Porras et al. 2008; Southgate and Wunder 2009) and financing for improved agricultural productivity.

In developing countries opportunity exists for emerging markets in PES to help address the challenges of poverty and natural resource degradation. The study, whose findings are presented in this paper, was motivated by that opportunity and building on existing knowledge of PES, endeavored to understand how farmers can participate effectively in PES schemes to meet the intertwined goals of increased food production and reduced ecological footprint. The study was conducted in the western part of Kenya, in the Mt. Elgon ecosystem, one of the five water towers in the country. River Kuywa the watershed used in this study is one of the tributaries of the River Nzoia that drains into the Lake Victoria an important shared resource of the East African Community Partner States. To facilitate planning for sustainable land management, it is vital that there is an understanding of farmers' preferences for the different attributes that make up the management options for intended PES Schemes. However, there is little information on farmers' preferences as they relate to PES management options in Kenya and specifically in the Mt Elgon ecosystem. This study examined the preferred management options that farmers would be willing to adopt to support provision of environment services in a Payment for Environmental Services (PES) approach within the Mt. Elgon ecosystem, Kenya. Specifically the study:

i.   determined combinations of attributes that comprise a suitable management scenario.
ii.   evaluated farmers preferences for these attributes with a view to select the best combination of attributes to form the most preferred management option for a PES scheme.
iii. examined which factors affect the selection of attributes that constitute the management options.

The results of this study will directly inform the development of PES schemes and lay the foundation for negotiations with potential buyers of the environmental services, while also contributing to a broader understanding of investment in PES programs which continue to expand globally, by providing critical information to policy makers and development practitioners.

Environmental Services

In recent decades, the interdisciplinary field of ecosystem management focused on human-nature dependence has emerged and represents a major area of inquiry into understanding the current state of earth's ecosystems and their ability to support human wellbeing (MA 2005). Natural or human- managed ecosystems provide positive environmental externalities, normally not taken into account in individual economic decisions (Pagiola et al. 2002a). This, economists such as Suhdev (2010), claim is the underlying cause for the observed degradation of ecosystems and the loss of biodiversity. The notion of environmental services was therefore, introduced and promoted as an alternative way of thinking about conserving biodiversity threatened by habitat destruction; one in which human well- being is considered more explicitly. In so doing environmental economists postulate that this would lead to economic valuation of ecosystems and their integration into decision making (Wunder et al.

2008; Stiglitz and Walsh 2002; Pagiolo 2005; Spangenberg and Settele 2010) providing a comprehensive and compelling economic case for conservation. According to Goldman et al. (2008), "Where traditional approaches focused on setting land aside by purchasing property

rights, ecosystem service approaches aim to engage a much wider range of places, people, policies and financial resources in conservation." With this new environmental services approach has come new strategies and tools to support conservation efforts worldwide.

The term *environmental services* has been defined in a variety of ways by scholars. According to Kosoy et al. (2007) environmental services refers to the provision of positive environmental externalities. Spangenberg et al.(2010) defined environmental goods (such as food) and services (such as waste assimilation) as representing the benefits human population derive, directly or indirectly, from ecosystem functions. Daily (1997) noted that environmental services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life, while Boyd and Banzhaf (2007) define environmental services as "components of nature, directly enjoyed, consumed, or used to yield human well-being". Rosegrant (2002) and Johnson and Baltodano (2004) also defined environmental services as "the conditions and processes through which ecosystems sustain and fulfil human life, including the provision of food and other goods". This paper adopts the definition by the MEA (2005) which defined environmental services (ES) as benefits received from healthy ecosystems, satisfying human needs without neglecting other species requirements that are usually not internalized in economic decisions. A critical factor is the maintenance of adequate stocks of ecosystem resources to ensure an adequate flow of environmental services (Batabyal et al. 2003) and hence the need to understand ecological resilience. Human decisions lead to actions that have impacts on ecosystems, causing changes in ecosystem structure and function. These changes in turn lead to changes in the provision of environmental services, which have impacts on human welfare. A clear understanding of these links provides information that can lead to the reform of institutions and better decisions that ultimately improve the state of ecosystems and the services they provide to society.

The Millennium Ecosystem Assessment report (2005) classified environmental services into four categories; (i) provisioning services, which are the products obtained directly from the environment like food or water; (ii) regulating services, which are the benefits obtained from the regulation of environmental processes such as control of floods, erosion regulation, water purification and waste treatment; (iii) supporting services which are needed to maintain the functioning of other ecosystem processes, including nutrient cycling; soil creation; and photosynthesis; and (iv) Cultural services which are the non-material benefits that people obtain the environment such as aesthetic pleasure, recreational opportunities, and spiritual and cultural sustenance.

Payment for Environmental Services

Natural resources are the basis of subsistence in many rural communities and the livelihoods of developing country populations are directly dependent on healthy ecosystems. There is a recognized link between poverty alleviation and the benefits that people derive from ecosystem services. Payment for Environmental Services (PES) has been presented as contributing towards sustainable development—a positive incentive to combine nature conservation and livelihood development (Gross-Camp et al. 2012). The PES approach strives to attain both goals of economic gain and environmental nourishment. PES is a policy instrument that combines the transfer of monetary resources directly to farmers or other rural actors in exchange of a land-use

or management practice that increases or secures the provision of an environmental service. The most widely applied definition of PES given by Wunder (2005) refers to PES as *"a voluntary transaction in which a well-defined environmental service (ES), or a land-use likely to secure that service, is being bought by at least one well defined ES buyer from a defined ES provider, if, and only if, the ES provider secures ES provision"*. While there is no consensus on this definition of PES schemes, it introduces basic principles that differentiate PES schemes from other market-based policy instruments.

While the definition of Wunder (2005) is acknowledged and widely applied, it is increasingly considered to be too narrow in some aspects and thereby excluding PES-like incentive and effective rewarding schemes that do not adhere strictly to these principles (Sommerville et al. 2009; Swallow et al. 2007; Pagiola et al. 2005). Since 2005, efforts have been undertaken to refine and improve the concepts (Karousakis 2010; Swallow et al. 2007; Wunder et al. 2008; Sommerville et al. 2009). This has resulted in the development of a number of alternative and extended concepts such as: Markets for Ecosystem Services (MES) (Pagiola and Platais 2007), Compensation for Ecosystem Services (CES) (Van Noordwijk and Leimona 2010), International Payments for Environmental Services (IPES) (UNEP et al. 2006) or Compensation and Rewards for Ecosystem Services (CRES).

Compensation and Rewards for Ecosystem Services (CRES) are defined as negotiated and contractual agreements between ES stewards, ES beneficiaries and/or intermediaries aimed at maintaining, enhancing, reallocation or offsetting of damage to ES (Swallow et al. 2007).

Pagiola (2010) provided three reasons that make PES particularly attractive namely: i) it can be implemented as a development program that has the ability of generating its own finance; ii) it can be economically efficient, since efforts can be focused where benefits of conservation are highest and costs are lower; and iii) it can be more sustainable in the long-term, since it relies more on self- interested users than on external supporters such as governments, NGOs or donors. It follows from this that in a situation of high environmental concerns and limited financial resources, PES can generate additional alternative resources, allocate funds to environmentally friendly management practices and sustainable production patterns (WWF 2012). Payments for Environmental Services (PES) schemes require clear and enforceable rules and transaction mechanisms to foster trust and confidence among stakeholders (Robertson and Wunder 2005). Identification of farmers' preferences for management options provides information to support the development of acceptable management contracts for PES schemes.

Methodology

Sampling Procedures

To generate the sampling frame GIS was used to delineate the watershed area for the Kuywa River and the sampling frame was the list of households living within the delineated watershed based on the Kenya National population Census 2009. Using catchment maps provided by the Lake Victoria North Water Resources Management Authority (LVNWRMA), overlaid on a GIS map with administrative boundaries; the researcher listed all sub-locations (smallest Administrative unit) that fell within the watershed. Using a random sampling technique, six sub-

locations were selected for inclusion in the study. Since the sub-locations vary in size and population, selection of sample households was based on a spatial sampling technique; systematic unaligned pattern (McCoy 2005). Accordingly for each sub-location random sampling points (RSP) were calculated in each cell using ArcGIS tools. This guaranteed a good spatial representation of the sample set. Each RSP represented a survey respondent. For each RSP the GIS coordinates were provided and used to identify the respondents on the ground. Some RSP fell at a spot with no household like churches or market places. To take care of this, some reserve RSP were generated to replace possible ineligible ones. The sample size was determined by the experimental design as outlined in the next section.

Experimental Design

To determine which management scenario would be ranked by the respondents, and therefore the experimental foundation for the design of the conjoint analysis, attributes and attribute levels were selected based on information collected from a review of literature, focus group discussions and key informant interviews. The study selected six attributes with various levels namely: (i) Land area to be committed (ii) Length of commitment period; (iii) Right to harvest products from committed land; (iv) Incentive Scheme; (v) Local scheme administering Agent; (vi) Required free labor contribution. The design of the hypothetical scenarios (Product) was then created by combinations of different attribute levels using a factorial design method on the selected attributes previously employed by Arifin et al. (2009). Of the six attributes, four attributes had three levels and two had four levels therefore $(3^4 * 4^2)$ generated a total of 1,296 management scenarios. Based on a pre-test of the questionnaire, it was determined that each respondent could comfortably rank a maximum of 9 management scenarios, therefore the full set of scenarios could be handled by 144 respondents. The 1,296 management scenarios were divided among the 144 respondents in a manner that achieved a near orthogonal design using AlgDesign package from R statistical system (Wheeler 2008). The respondents were asked to rank the scenarios on a scale of 1-5 for each hypothetical scenario in terms of the likelihood that s/he would participate.

Model Specification

The study applied conjoint analysis to evaluate farmers' preferences towards various unique hypothetical management scenarios that could be applied to a proposed Payment for Environmental Services (PES) scheme. A fundamental characteristic of this approach is that the utility derived from a product can be decomposed into part-worths[1] relating to the different attributes of that product. To ensure accuracy and reliability of the results for the conjoint analysis, the data collected was analyzed using three models; (i) the traditional conjoint rating model; (ii) the Binary Logistic regression; and (iii) the ordered logit model. The traditional conjoint rating model was used to analyze rating data assuming intervals are equal. A binary logistic regression was used to assess the effect of the levels of the attributes on farmer's preference to definitely undertake a specific scenario. While the Ordered logit model was used to analyze the rating data assuming intervals are not equal.

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[1] Part-worths

The statistical method primarily used in Traditional conjoint analysis is Ordinary Least Squares regression. The underlying assumption of this method is that the rating scale responses satisfy the numerical properties associated with interval scales i.e. that individuals can use rating scales to provide meaningful differences between scenario profiles and that the units of the rating scale represent equal differences. The landholders' rating for each management scenario is assumed to be proxies for individual utility. And assuming (a) rating scale intervals are equal; (b) the individual's utility function is strictly additive and linear in the model parameters; (c) The errors are distributed normally and independently with constant variance; the unobserved latent utility of individual n when he selects management scenario j will be expressed as:

(1) $U_{nj} = \beta_o + \beta_1 R_{nj} + \varepsilon_{nj}$

Where:

β are unobserved true parameters that linearly relate the observed ratings to the unobserved latent utility

R are the rating given by respondent n to management scenario j

ε is an error term

The ratings provide information about the true utilities, and thus allow one to specify the rating data as a linear regression of attribute levels as follows:

(2) $R_{nj} = \alpha_o + \beta_1 X_{1,1} + \beta_2 X_{1,2} + \ldots + \beta_{m-1} X_{1,m-1} + \ldots + \beta_{k(m-1)} X_{k(m-1)} + \varepsilon_{nj}$

Where:

β's are utility or preference estimates (part-worth) associated with each attribute level, and ε_{nj} is an error term that must satisfy the usual OLS assumptions of mean zero, constant variance and independence.

If the assumptions are satisfied, the estimated β's can be interpreted as part-worth utilities, representing the conditional response means associated with each attribute level.

A binary logit model was used to assess the effects of the levels of attributes on farmers' preferences to definitely undertake a specific scenario among the different options presented during the conjoint experiment. For purposes of logit modeling a binary dependent variable Y is created; Where:

Y = 1 when the individual would definitely undertake a given scenario; and
Y=0 otherwise.

In this approach only those individuals who said they would definitely undertake a given scenario were counted as participating. Further it is assumed that individual's decisions to participate depend upon program attributes. The rational farmer will prefer to undertake the

i^{th} management scenario if the utility he expects to derive from i is greater than or equal to the utility he would expect to derive from other alternative contract scenarios. In other words:

$$Y_i = 1 \; if \, U_{ni} \geq U_{nj} \; , \; \forall_{j \neq i} and$$
$$Y_i = 0 \; if \, U_{ni} \leq U_{nj} \; , \; \forall_{j \neq i}$$

It follows that the utility that farmer n derives from the observed attributes of the ith land management scenarios can be represented as:

(3) $V_{ni} = \beta_i X_{1i} + ...+ \beta_k X_{ki} + \alpha_i H_i +.....+ \alpha_R H_R$

$X_{1i} .... X_{ki}$ are levels of the identified attributes
$H_1 ..... H_s$ are respondent's individual socio-economic characteristics
$B_1 ...... \beta_k$ and $\alpha_1 ...\alpha_s$ are unknown parameters

An ordered Logit model was used in the analysis of the respondents rating for alternative management scenarios. Suppose a rating scale of $1 - 5$; it follows that the dependent variable is the rating between **1** (a respondent preferred that he would definitely not undertake) and; **5** (a respondent preferred that he would definitely undertake). The independent variables are the levels of the attributes and the specific characteristics of the respondents. We assume that any contract that the farmer rates with a higher number is preferred over any contract that he/she rates with a lower number. But unlike in the traditional conjoint model, we do not assume that the intervals between ratings are equal. The ratings are characterized as discrete and ordered, but not ordered by equal intervals and again assuming the error terms are distributed over the logistic function.

It follows then that the utility that farmer n derives from the observed attributes of the ith land management scenarios can be represented as

(4) $V_{ni} = \beta_i X_{1i} + ...+ \beta_k X_{ki} + \alpha_i H_i +.....+ \alpha_R H_R$

Where:
$X_{1i} .... X_{ki}$ are levels of the identified attributes
$H_1 ..... H_s$ are respondent's individual socio-economic characteristics

$B_1 ...... \beta_k$ and $\alpha_1 ...\alpha_s$ are unknown parameters

Though V_{ni}, the indirect utility derived from a particular contract cannot be observed, the conjoint rating experiment provides information about farmer's ratings of alternative scenarios. We observe the rating 1 through 5 where:

Rating = 1 *if* $V_i \leq \mu_1$
Rating = 2 *if* $\mu_1 \leq V_i \leq \mu_2$
Rating = 3 *if* $\mu_2 \leq V_i \leq \mu_3$
Rating = 4 *if* $\mu_3 \leq V_i \leq \mu_4$
Rating = 5 *if* $V_i \geq \mu_4$ and

μ_1 ....μ_4 are estimated cut off points

The probability that the farmer will give a rating of j to the ith contract scenario is given as:

(5) $\Pr(Rating = j) = \Pr[\mu_{j-1} < (\beta_1 X_{1j} + ... \beta_K X_{kj} + \alpha_{1j} H_1 + ... + \alpha_{RJ} H_R) < \mu_4]$

Results and Discussion

Socio-Economic and Demographic Characteristics of Respondent

Of the 144 respondents, 42.1% were male and 57.9% were female. Demographic characteristics of respondents are said to affect their responses. An examination of these showed that the respondents ranged from age 18 years to 86 years, with an average age of 41 years. Respondents had an average household size of 6 persons and ranging from one person per household to 13 people per household. This indicates that in the study area majority of the people are middle aged and they have relatively large families compared to the county average of 5.31persons per household (KNBS 2010). Majority of the respondents had some years of formal education, with those with primary education making up 51% of the respondents and those with secondary education 37.2%; technical and university levels 1.4% and 4.8% respectively. Those with no formal schooling made up only 5.5% of the respondents. The main occupation and therefore main source of income for the respondents is farming comprising over 80% of the respondents. Income level has been predicted to affect farmer's land use choices; Farmers in the study area have a mean income of approximately USD 149 per month. The average income from farming activities was approximately USD 102 per month and that from off-farm activities was approximately USD 46 per month. This is consistent with reports that the area suffers high unemployment (KNBS 2010) and the low farm income could indicate poor farming methods and/or poor soils, which are all indicators of land degradation. The low mean income indicates high level of poverty which, when converted to income per person per day, translates to less than a dollar a day at approximately USD 0.8 per person per day, based on the assumption of a 30-day month and household size of six.

Land is an important factor of production in rural economies and therefore land size, tenure and other variables affecting land are critical to any scheme. The study examined the land use characteristics of the respondents and found that they have an average land size of 3.4 acres ranging from land as small as 0.25 acres to a maximum of 24 acres. The respondents have lived on these farms for periods ranging from 1 year to 62 years with an average length of stay being approximately 17years. Land tenure is an important factor that has been found to affect the decision to participate in land management schemes (Kosoy 2007). The land tenure upstream differed among respondents with individual tenure accounting for 52.8%; family land 33.3%; community land 3.5% and squatters accounted for 10.4% of the respondents. These findings indicate that slightly over half of the participants have secure rights to the land they live on. This is expected to affect the decision they make to participate in the hypothetical scheme, since one need to be able to guarantee their ability to provide the environmental service to be able to participate in a PES scheme.

State of the Environment in the River Kuywa Watershed

For PES to be viable there must be a valuable environmental service that is actually being degraded or whose degradation is imminent, and key stakeholders who perceive, or can be made aware of, both the value of the environmental service and the threat. It must also be possible for actions by defined individuals or groups to mitigate these threats or prevent degradation. The study examined the state of the environment within the study area and found that 82.8% of the respondents perceived the catchment as degraded while another 6.9% thought it was very degraded. Further, since the study area was in the River Kuywa catchment, the state of the water in the river was seen as an indicator for the state of the environment. In this regard the study found that 81.25% and 9.03% of the respondents reported that the quality of water in the river was poor and very poor respectively. On the other hand, 74.3% of the respondents said the quantity of water was reliable against those who felt it was unreliable of 25.7%. To find out which were the most prevalent environmental challenges in the watershed respondents were asked to rank environmental problems according to how severely they affect them, with 1 being the most prevalent problem and 6 the least prevalent. Respondents felt that poor water quality was their biggest environmental problem, followed by deforestation, wetland degradation, loss of biodiversity, poor agricultural yield and the problem of least concern was inadequate water. These challenges were blamed on increased human activities and the magnitude of these problems has led to increasing poverty and food insecurity among the communities, deteriorating environmental conditions and continued depletion of natural resources.

The design and implementation of watershed PES scheme is premised on stakeholders recognizing the relationship between the condition of the ecosystem and its capacity to provide environmental services for instance suitable land use activities like agro-forestry practices, organic agriculture are expected to enhance provision of environmental services such as provision of clean water, increased ability of the soil to absorb water, vegetation filtration potential, water flow rates and weather buffering of the wetland and thus the water quality and flow seen as the most valuable of hydrological services. Recognizing this relationship establishes a basis for connecting the needs and wellbeing of downstream users of water to the actions of upstream land managers. This knowledge is expected to help influence upstream land use and management practices. Based on this the study sought to find out the level of awareness of the respondents, whether they were already carrying out environmental conservation activities, what kind of environmental activities the respondents are already carrying out, and if they are not practicing any conservation initiatives why they choose not to. Majority of the respondents, (89.4%) are aware that the activities farmers carry out on their farms upstream affects the quality and quantity of water received by downstream and urban users. However, only about 56 % are carrying out conservations activities on their farms. Despite the high awareness on environmental conservation within the watershed only 4% of the respondents had heard of trade in environmental services in any of its forms. The study results show that the respondents are aware of the interrelatedness of the upstream activities to the downstream benefits. However, this was not matched one-to-one with those who are implementing conservation measures to reduce their impact. The reasons given for not engaging in environmental conservation included a lack of awareness, inadequate labor, lack of money and too little land.

Results from the Conjoint Analysis

Each respondent was asked to rank a set of nine unique management scenarios. The ranking thus obtained was subjected to analysis using the respondents' ranking for the alternative management scenario as the dependent variable while the attributes were included as explanatory variables. The results of a traditional conjoint analysis generated by running an ordinary least square regression of ranking on attributes of management scenarios are presented in Table 1.

Table 1. Results of the Traditional Conjoint Analysis

Attributes	Estimate (Log Odds)	Std. Error	z value	Pr(>|z|)	Odds	marginal. effects	Change Δp
Land area 20%	0.06	0.48	0.13	0.89	1.06	0.011	0.049
Land area 40%	-1.13	0.52	-2.18	0.03*	0.32	-0.212	-0.916
Commitment period 15yrs	-1.49	0.55	-2.72	0.006**	0.22	-0.282	-0.96
Commitment Period 30yrs	-1.19	0.46	-2.58	0.009**	0.31	-0.223	-1.215
Harvest partially permitted	0.15	0.49	0.31	0.76	1.16	0.029	0.123
Harvest not permitted	-0.29	0.48	-0.59	0.55	0.75	-0.0541	-0.233
Incentive agric. extension	0.13	0.63	0.20	0.84	1.14	0.024	0.103
Incentive Microcredit	0.26	0.53	0.49	0.62	1.30	0.049	0.212
Incentive Cash Ksh.5,000	0.38	0.63	0.59	0.55	1.46	0.071	0.305
Administrator local NGO	0.27	0.56	0.47	0.64	1.30	0.050	0.216
Administrator WRMA	-0.30	0.52	-0.59	0.55	0.74	-0.057	-0.247
Admin. rural water supply	-0.74	0.58	-1.26	0.21	0.48	-0.138	-0.597
Free labor 2 days/mth	0.19	0.49	0.39	0.69	1.21	0.037	0.158
Free labor 3 days/mth	-0.02	0.50	-0.05	0.96	0.9	-0.005	-0.020

Significant at 0.005 ** ; Significant at 0.05 * ;
Source. Field Survey (2013).

The binary logit analysis estimated the probability that farmers would definitely undertake any of the management scenarios. The dependent variable Y=1 for management scenarios which received a conjoint ranking of 5 (individual would definitely undertake that scenario) and Y= 0 otherwise. The results of the binary logit analysis are presented in Table 2.

Analysis using the ordered logit, in which the dependent variable, the ratings were characterized as ordered but not by equal intervals, and those of the traditional conjoint, in which the intervals between the dependent variable, ratings, were assumed to be equal, returned the same results. The results from the binary logit analysis, in which the dependent variable was not continuous, showed slight differences. Despite the variations made to the dependent variable, results from all three models used, indicated that commitment period and percentage land area to be committed were significant factor affecting the respondents' decision to select a management scenario. The binary logit analysis also returned a significant result for the right to harvest products from the committed land. The rest of the factors do not significantly affect the preference of farmers for a given management scenario. Commitment period (15years and 30years) is highly significant at p<0.005 and is negatively related to the respondents ranking. This means management scenarios

with longer commitment periods were rated lower. Land area to be committed becomes significant at p<0.05 after the area exceeds 40% of the total farmers land area and is also negatively related to respondents ranking. Therefore farmers' ranking is indifferent to land area below 40%; however after land area committed approaches 40% any further increase will lower the ranking for that scenario. Land area of 20% is not statistically significant. Other than the two variables above which are also statistically significant with the Binary Logit, this analysis also found that the right to harvest was highly significant and is negatively related to the respondents ranking of a management scenario, for the option where land owners are not permitted to harvest from the committed land area. This means that a management scenario that denies landowners 'rights to harvest' will most likely not be selected by the respondents.

Table 2. Results from a Binary Logit Model

Attributes	B	Std. Error	Wald Stat.	P-Value	Exp (B)
Land area 20%	-0.576	0.147	15.376	0.000 ***	0.562
Land area 40%	-3.177	0.246	167.095	0.000***	0.042
Commitment period 15yrs	-0.416	0.164	6.427	0.011***	0.660
Commitment Period 30yrs	-1.201	0.175	46.879	0.000***	0.301
Harvest partially permitted	-0.120	0.166	0.524	0.469	0.887
Harvest not permitted	-0.625	0.172	13.190	0.000***	0.535
Incentive agric. extension	0.231	0.199	1.341	0.247	1.260
Incentive Microcredit	0.179	0.194	0.846	0.358	1.196
Incentive Cash Ksh.5,000	0.254	0.199	1.632	0.201	1.289
Administrator local NGO	0.012	0.199	0.004	0.951	1.012
Administrator WRMA	0.001	0.198	0.000	0.996	1.001
Admin. rural water supply	0.205	0.199	1.056	0.304	1.227
Free labor 2 days/mth	-0.024	0.170	0.020	0.887	0.976
Free labor 3 days/mth	0.067	0.170	0.156	0.693	1.070
Constant	0.609	0.264	5.309	0.021***	1.838
Observations	N=1296				
Correct Prediction	69.40%				
Cox and Snell R Square	0.240				
Nagelkerker R Square Hosmer and Lemeshow test Chi-Square	0.339				

Significant at 1%, ** Significant at 5%, * Significant at 10%
Source. Field Survey (2013).

The study calculated Δ**p** parameter which shows the marginal effect of a change from the baseline case situation. Base on the Traditional conjoint analysis presented in Table 1 above, everything else being equal, increasing the land area committed to 20 percent is a preferred option to that of 10% by nearly 5%. This changes drastically when land area committed increases to 40% then the likelihood to be selected decreases by 90%. Going through all the attribute levels and comparing them to the baseline, the study was able to rank the attributes and found that a management scenario that includes commitment of 20% of land area for a period of five years would have the highest likelihood of being selected. This can be combined with other likely first choices which include harvesting partially permitted, a cash incentive of USD 59 per acre per annum; administered by a local NGO and requiring contribution of free labor for two days. The socio-economic and demographic characteristics of the respondents were entered as

dependent variables and the decision to participate or not in the schemes was the independent variable. Table 3 shows these results.

Table 3. Factors Affecting Decision to Participate in the Land Management Scheme

Socio-Econ Characteristic	Estimate (Log Odd)	Std. Error	Z-value	Pr(.|z|)
Gender	2.804000	1.199000	2.338	0.019*
Age	0.120300	0.045810	2.626	0.0086**
Education	0.469600	0.622300	0.755	0.45
Household Size	-0.775800	0.210400	-3.688	0.0002**
Awareness of environmental benefits from their farming activities	6.130000	2.213000	2.77	0.0056**
Currently carrying out environmental conservation activities	7.123000	1.647000	4.324	0.000**
Member of water resource users Associations	-16.90000	2597.0000	-0.007	0.99
Association access to financial services	-21.950000	2046.0000	-0.011	0.99
Land Tenure Systems	6.004000	1.843000	3.258	0.001**
Land size	-0.253900	0.198100	-1.282	0.199
Farm income	0.000018	0.000012	1.46	0.144
Annual income Ksh.	-0.000011	0.000002	-4.783	0.000**

Significant at 0.01 **; Significant at 0.05 *
Source. Field Survey (2013)

Twelve socio-economic, demographic characteristics and perceptions were run and show that Gender, age, household size, environmental benefit awareness; carrying out environmental conservation on farm, land tenure and annual income are statistically significant, and therefore the factors that influence the decision to participate in the scheme. Gender and Age have a positive relationship with the decision to participate as has land tenure meaning that females are more likely to participate in the scheme than male respondents while as age increases and as tenure becomes more secure it is more likely that they will participate in the management scheme. Further as expected respondents with awareness, knowledge and prior experience in environmental conservation are also more likely to participate in the management scheme. Household size has a negative relationship indicating that as household size increases the farmers are less likely to participate. Since the scheme will require the commitment of a portion of the land, it is likely that a person with a large family feels they are not able to forego use of any piece of their land for fear of being unable to provide food for their family using the remaining piece. Total annual income is statistically significant and has a negative relationship with the decision to participate meaning as income increases it is unlikely that the person will participate. This is expected since the total income comprises farm and non-farm income. It is expected that non-farm income will increase by larger proportions than the farm income therefore it may be correct to assume that increase in non-farm income is the cause of the

negative sign. And increase in Non-farm income is usually associated with stay away from home since most jobs are in urban areas.

The study found that level of education, and land size were not statistically significant and are therefore unlikely to affect the decision to participate in the management scheme. The insignificance of level of education is an unexpected result since previous studies show that education plays a significant role in environmental management programs in developing countries (Balana et al. 2008). This contrary finding could mean that the respondent have sufficient environmental awareness, knowledge and hands on experience. Another unexpected result was the insignificant and negative relationship of land size and the decision to participate. It had been anticipated that given the value attached to land and the generally small land size (average land size of 3.4 acres), the decision to participate would be related positively to land size. This finding could mean that with other appropriate measures in place, land size is not a major constraint in implementing improved land management practices.

Conclusion and Recommendations

Environmental services provided by watersheds are scarce due to destruction and unsustainable use of watershed resources. Land degradation, poor water quality and the associated stress on human populations continues to be a major challenge to policy makers as demand for water increases and the human population continues its exponential growth path. The sustainable development thinking highlighted the economic angle of the problem of environmental management and made interdependence central to the policy formulation process. This led to governance approaches that incorporate economic consideration into environmental management. Work therefore increased to making environmental goods and services marketable, through valuation and using this information to inform policymaking. It is from this that the concept of Payment for Environmental services grew. Payment for Environmental Services (PES) is an economic instrument designed to provide positive incentives to natural resource users that are expected to result in continued or improved provision of environmental services. In watershed land use decisions by farmers upstream affect the provision of water quality and quantity downstream providing a setting in which PES can be applied. PES has emerged as an important tool that can motivate farmers to provide environmental services through land use changes and adoption of best land management practices. It is premised on the concept that to maintain the flow of environmental goods and services for society, incentives are needed to induce local people to forego more disruptive land and resource use practices. It is also presented as a sustainable, economically efficient and self – financing development program that could go a long way to support the goals of increased production at farm level while reducing the ecological footprint. The study finds that information on the preferences of farmers to aspects of a possible management contract for a PES are a key to setting up a sustainable PES scheme.

Using locally identified sets of management attributes and their levels and applying conjoint analysis, this study assessed farmers' preferences for alternative management options for a PES scheme aimed at enhancing watershed service in River Kuywa catchment. This conjoint analysis study of farmers' preferences for the attributes of management scenarios for PES was analyzed using three methods that gave similar results indicating high confidence in the validity of the

results. The results indicate that in Mt Elgon Ecosystem and probably elsewhere in Kenya, conjoint analysis can be effective in eliciting farmers' preferences over the attributes for management options for PES. The results found that the length of time the management intervention will commit the farmers land significantly affected their ranking of the management scenarios presented. Land size to be committed also significantly affected the ranking of the management scenario, but only after it reached land area of 40% and above of the total land area. This is an indication that farmers are willing to set aside a portion of their land for the conservation intervention. This leads the study to conclude that preparation of any management contract should take these two factors into consideration to encourage farmers to accept the contract. Based on the ranking of the farmers for the various management scenarios presented to them lead to the conclusion that a management contracts that includes commitment of 20% of land area for a period of five years, a cash incentive of USD 59 per acre per annum; administered by a local NGO and requiring contribution of free labor for two days would have the highest likelihood of being selected. It is therefore recommended that these attributes are incorporated in management contracts for a PES scheme for the Kuywa River watershed. The study found that gender, age, household size, awareness of upstream effect on downstream benefits; carrying out environmental conservation on farm, land tenure and annual income are the main factors that affected the decision of the farmer to participate in the scheme. These characteristics should therefore be taken into consideration when designing a PES scheme.

PES implemented elsewhere in the world have been found to support both development and environmental goals, therefore developing countries faced with the problems of land degradation, food insecurity and water scarcity should consider the use of this policy instrument. Assessing the preferences of farmers for management options provides an inroad into the application of this tool and should be considered by policy makers and practitioners who intend to use PES. The findings of this study that land size did not significantly affect the farmers' decision to participate in the scheme implies to policy makers and practitioners that environmental goals could be realized despite the size of the land held by the farmers.

The practical value of the findings in this study have been demonstrated, however the study focused on only one aspect of an entire toolbox required for the design and implementation of a Payment for Environmental Services Scheme. Further research is recommended to fill the gap. Specifically for PES to meet the goal for reduced land degradation, research is needed to find out which agricultural practice could be promoted in such a scheme to ensure this is met alongside the goal of increased food production.

References

Ajayi, O, F. Akinnifesi, J. Mullila-Mitti, J. Dewolf, P. Matakala and F. Kwesiga. 2008. Adoption, profitability, impacts and scaling-up of agroforestry technologies in southern African countries, edited by D. Batish, R. Kohli, S. Jose and H. Singh, 'Ecological basis of agroforestry', Taylor and Francis Group, Boca Raton, Florida.

Alriksson, S., and T. Oberg. 2008. Conjoint analysis for environmental evaluation: a review of methods and applications. *Environmental Science and Pollution Research* 15 (3): 244-257.

Angelsen, A. 2010. Policies for reduced deforestation and their impact on agricultural production. *Proceedings of the National Academy of Sciences* 107(46): 19639–19644.

Arifin, B., B.M. Swallow, S. Suyanto, and R.D. Coe. 2009. A conjoint analysis of farmer preferences for community forestry contracts in the Sumber Jaya Watershed, Indonesia. *Ecological Economics* 68(7): 2040-2050.

Batabyal, A.A., J.R. Kahn, and R.V. O'Neill. 2003. On the scarcity value of ecosystem services. *Journal of Environmental Economics and Management* 46(2): 334–352,

Balana, B., B. Muys, F. Nega, E. Tollens, J. Nyssen, J. Deckers, and E. Mathijs. 2008. Household livelihood strategies and forest dependence in the highlands of Tigray, Northern Ethiopia. *Agricultural Systems* 98(2): 147–155.

Balana, B., B. Muys, F. Nega, E. Tollens, J. Nyssen, J. Deckers, and E. Mathijs. 2008. The Economic Contribution of Forest Resource use to rural livelihoods in Tigray Northern Ethiopia. *Forest Policy and Economics.* 11(2): 109 – 117.

Boyd, J. and S. Banzhaf. 2007. What are ecosystem services? The need for standardized environmental accounting units. *Ecological Economics* 63(2–3): 616–626.

Cary J, and A. J. Roberts. 2011. The limitations of environmental management systems in Australian agriculture. *Environment Management.* 92(3):878-85.

Coase R. 1960. The problem of social cost. *Journal of Law and Economics.* 3: 1-44.

Comprehensive Assessment of Water Management in Agriculture. 2007. *Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture.* London: Earthscan, and Colombo: International Water Management Institute.

Daily G. C, ed. 1997. *Nature's services: societal dependence on natural ecosystems.* Island Press, Washington, D.C., USA.

Engel, S., S. Pagiola and S. Wunder. 2008. Designing payments for environmental services in theory and practice: an overview of the issues. *Ecological Economics* 65:663-674.

Food and Agriculture Organization of the United Nations. 2011. *Payments for ecosystem services and food security.* Rome, Italy: The Food and Agriculture Organization of the United Nations.

Gómez-Baggethun, E. 2011. Economic valuation and the commodification of ecosystem services. *Progress in Physical Geography* 35(5): 613-628.

Gross-Camp Nicole D., A. Martin, S. McGuire, B. Kebede and J. Munyarukaza. 2012. Payments for ecosystem services in an African protected area: exploring issues of legitimacy, fairness, equity and effectiveness. *Oryx* 46(1):24-33.

Hardin, G. 1968. The tragedy of the commons. *Science* 162(3859): 1243-8.

Hubermann, D. and T. Leipprand. 2006. *Developing International Payments for Ecosystem Services: A Technical Discussion. Background Paper.* UNEP-Economic and Trade Branch, Geneva.

International Fund for Agricultural Development. 2013. *Smallholders, food security, and the environment.* Rome, Italy: International Fund for Agricultural Development.

Jack B., C. Kousky and K. Sims. 2008. Designing payments for ecosystem services: lessons from previous experience with incentive-based mechanisms. *Proceedings of the National Academy of Science* 105(28): 9465.

Johnson N., and M. E. Baltodano. 2004. The economics of community watershed management: Some evidence from Nicaragua. *Ecological Economics* 49(1): 57 – 71.

Johnson F.R., E. Lancsar and D. Marshall. 2013. Constructing experimental designs for discrete-choice experiments: report of the ISPOR Conjoint Analysis Experimental Design Good Research Practices Task Force. *Value Health* 16(1):3–13.

Kenya National Bureau of Statistics. 2010. Kenya population and Housing Census Volume 1a: Population distribution by administrative units. 217p. Kenya: Kenya National Bureau of Statistics, Nairobi (KNBS).

Kothari C. R. 2004. *Research Methodology: Methods and Techniques.* New Age International Publishers.

Kosoy, N., M. Martinez-Tuna, R. Muradian, and J. Martinez-Alier. 2007. Payments for environmental services in watersheds: insights from a comparative study of three cases in Central America. *Ecological Economics* 61 (2-3): 446–455.

Marshall D, J.F.P. Bridges, and B. Hauber. 2010. Conjoint analysis applications in health—How are studies being designed and reported? *Patient* 3(4):249–256.

McCoy, R. M. 2005. *Field Methods in Remote Sensing.* The Guilford Press, New York. Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Wellbeing: Synthesis.* Island Press, Washington DC. 319.

Moon K, and C. Cocklin. 2011. A landholder-based approach to the design of private-land conservation programs. *Conservation Biology* 25(3):493-503.

Nkonya E., F. Place, J. Pender, M. Mwanjololo, A. Okhimamhe, E. Kato, S. Crespo, J. Ndjeunga and S. Traore. 2011. Climate Risk management through Sustainable Land management in Sub-Saharan Africa. *IFPRI Discussion paper 01126*. Washington DC: International Food Policy Research Institute.

Ortega-Pacheco, D. V., F. Lupi, and M. D. Kaplowitz. 2009. Payment for Environmental Services: Estimating demand within a Tropical Wetland. *Journal of Natural Resources Policy Research* 1(2): 189 – 202.

Ostrom, E. 1990. *Governing the Commons: The evolution of Institutions for Collective Action.* Cambridge University Press, Cambridge.

Pagiola, S., N Landell-Mills, and J. Bishop. 2002. Making market-based mechanisms work for forests and people. In *selling forest environmental services: Market-based mechanisms for conservation and development,* edited by S. Pagiola, j. Bishop, and N. Landell-Mills, Earthscan, London. 261-289.

Pagiola S., A. Arcenas, and G. Platais. 2005. Can Payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date from Latin America. *World Development* 33(2): 237 - 253

Pagiola, S. and G. Platais. 2007. *Payment for Environmental services: From theory to Practice.* World Bank, Washington.

Pagiola, S. 2008. Payments for environmental services in Costa Rica. *Ecological Economics* 65 (4): 712-724.

Pagiola S. 2010. *Payment for Environmental Services in Saltillo*. World Bank, Washington.

Pearce D., C. Pearce and C. Palmer. 2004. *Valuing the Environment in Developing Countries.* Case Studies. Edward Elgar, Cheltenham.

Pearce D., and K. Turner K. 1990. *Economics of Natural Resources and the Environment*. Harvester, New York/London.

Perman, R., M. Yae, J. McGilvray, J. and M. Common. 2003. *Natural Resource and Environmental Economics, Third Edition*.

Porras, I., M. Grieg-Gran, and N. Neves. 2008. All that glitters. A review of payments for watershed services in developing countries. *Natural Resource Issues* No. 11. International Institute for Environment and Development, London, UK.

Putten V.I., S.M. Jennings, J.J. Louviere, and L.B. Burgess. 2011. Tasmanian landowner preferences for conservation incentive programs: a latent class approach. *Journal of Environmental Management*. 92(10):2647-56

Rafuse S. 2013. *Payment for Watershed Ecosystem Services: Explaining Landowner willingness to Participate in Watershed conservation.* University of Oregon, Oregon.

Reed Johnson F, E. Lancsar, D. Marshall, V. Kilambi, A. Mühlbacher, D.A. Regier, B.W. Bresnahan, B. Kanninen, and J.F. Bridges. 2013. Constructing experimental designs for discrete-choice experiments: report of the ISPOR Conjoint Analysis Experimental Design Good Research Practices Task Force. *Value Health.* 16(1):3-13.

Robertson N., and S. Wunder. 2005. *Fresh tracks in the Forest: Assessing incipient Payment for Environmental Services initiatives in Bolivia.* CIFOR, Bogor.

Rosegrant, Mark W., C. Ximing, and Sarah A. Cline. 2002. *World water and food to 2025: Dealing with scarcity.* IFPRI-2020 Vision/International Water Management Institute book. Washington, D.C. U.S.A.: International Food Policy Research Institute.

Sileshi, G, F. Akinnifesi, O. Ajayi and F. Place. 2008. 'Meta-analysis of maize yield response to woody and herbaceous legumes in sub-Saharan Africa', *Plant and Soil,* 307:1–19.

Sommerville, M. M., J. P.G. Jones, and E. J. Milner-Gulland. 2009. A revised conceptual framework for payments for environmental services. *Ecology and Society* 14(2): 34.

Sommerville, M., J.P.G. Jones, M. Rahajaharison, and E.J. Milner-Gulland. 2010b. The role of fairness and benefit distribution in community-based payment for environmental services interventions: a case study from Menabe, Madagascar. *Ecological Economics* 69(6): 1262–1271.

Southgate, D., and S. Wunder. 2009. Paying for watershed services in Latin America: A review of current initiatives. *Journal of Sustainable Forestry* 28 (3-5): 497 - 524

Spangenberg, J. H. and J. Settele. 2010. Precisely incorrect? Monetising the value of ecosystem services, *Ecological Complexity* 7 (2010) 327–337

Swallow B, M. van Noordwijk, S. Dewi, D. Murdiyarso, D. White, J. Gockowski, G. Hyman, S. Budidarsono, V. Robiglio, V. Meadu, A. Ekadinata, F. Agus, K. Hairiah, P.N. Mbile, D.J. Sonwa, and S. Weise. 2007. Opportunities for Avoided Deforestation with Sustainable Benefits. An Interim Report of the ASB Partnership for the Tropical Forest Margins, ASB Partnership for Tropical Forest Margins, Nairobi, Kenya.

United Nations Environment Program. 2012. *Global Environment Outlook 5: Summary for Africa.* UNEP

Van Hecken, G., and J. Bastiaensen. 2010. Payments for ecosystem services: justified or not? A political view. *Environment Science Policy* 13 (8):785-792.

Van Heckens G., J. Bastiaensen, W.F. Vásquez. 2010. Institutional embeddedness of local willingness to pay for environmental services: Evidence from Matiguás, Nicaragua. *Institute of Development Policy and Management* (IOB), University of Antwerp, Discussion Paper 2010-04.

Van Hecken G., and J. Bastiaensen. 2011. The viability of local payment for watershed services: empirical evidence from Matiguas, Nicaragua; *Ecological Economics* 74: 169 – 176.

Van Noordwijk, M., and B. Leimona. 2010. Principles for fairness and efficiency in enhancing environmental services in Asia: payments, compensation, or co-investment? *Ecology and Society* 15(4): 17.

Wheeler, B. 2008. *The AlgDesign Package*. Available from: http://cran.r-project.org/.

Wunder, S. 2005. Payment for environmental services: Some nuts and bolts. Occasional Paper No. 42. Bogor, CIFOR.

Wunder S., S. Engel, S. Pagiola. 2008. Taking Stock: A comparative analysis of payment for environmental services programs in developed and developing countries. *Ecological Economics* 65(4): 834 - 852

World Wildlife Fund. 2012. Living *Planet Report 2010: Biodiversity, biocapacity and better choices*. Gland: World Wildlife Fund.

Zhang, J., Z. Li, L. Zhu, F. Yang, and Q. Zhao. 2009. Advances of Research on Agricultural Non- point Source pollution and it's Control. *Agro-environment and Development (Chinese)* 26(3):1−5.

Assessing Environmental Management of Tomato Production under Protected Agriculture

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Abstract

This study examines the impact of environmental strategies on profitability of protected agriculture production systems in the state of Zacatecas, Mexico using the approach of Total Quality Environmental Management (TQEM) and Total Cost Assessment (TCA). We identified environmental management practices currently used by production units and analyzed the existing situation, plus two hypothetical scenarios. Profitability indicators show that adopting conservation production practices will not only improve the image of the organization but permit better access to markets, maintain positive profitability and contribute to the conservation of natural resources.

Keywords: environmental cost accounting, TCA, Mexico, TQEM, greenhouses.

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Introduction

Zacatecas, is a semi-arid state located in the north-central region of Mexico. The main source of water is 34 aquifers—44 % of which are over exploited (CNA 2011). Agriculture is the primary user of water in the region; 11.8 % of the arable land is irrigated. However, over-irrigation and obsolete irrigation systems (CNA 2007, Mojarro et al. 2010), contribute to water use that is unsustainably high.

Within the agricultural sector, protected agriculture has grown rapidly in recent years, with a mean annual growth rate of 25 % from the year 2000 to 2010 (Padilla-Bernal et al. 2010). The concept of protected agriculture refers to production under cover to protect the crop from adverse climate (García et al. 2011). The rapid growth of these systems is attributed, on the one hand, to technical production factors (higher yields, better quality produce, greater control in the use of inputs, better pest and disease control, and the possibility of cultivating more than one crop per year, or producing during the entire year). On the other are social factors; these systems generate more employment per hectare than conventional agriculture, contributing to regional development and the possibility of increasing social well-being (Padilla-Bernal et al. 2007, García et al. 2011).

Nevertheless, protected agriculture greatly affects the environment. In 2010, the Secretariat of Agricultural Development estimated that, of the 277 hectares under protected agriculture, 90 % is used to cultivate tomatoes (SEDAGRO 2010). Moreover, 70 % has been used for monocropping tomatoes in soil for 8 to 10 consecutive years, leading to progressive reduction of organic matter and loss of productivity. This, in turn, has caused excessive use of chemicals (herbicides, pesticides, fertilizers), and occasionally, the change from soil to inert substrates (Sánchez-del Castillo et al. 2014). In addition, protected agriculture produces large amounts of solid residues: plastics from renovating the structure covering, irrigation tubes and containers, among others, plant residues from the unused part of the crop, and substrates. Added to this, all protected agriculture systems use large quantities of groundwater.

Protected agriculture requires higher investment and production costs than field production. These costs vary in function of the level of technology. The variables structure type (macrotunnel, shade house, Almería-type greenhouse and multi-tunnel greenhouse, among others), climate control (active or passive), cultivation technique (soil or hydroponics) and size are determining. For the investment to be attractive, higher prices are needed. Furthermore, consumers increasingly demand environment-friendly products (Williams 2009). Thus, consistent quality and sustainable production practices must be permanent attributes of the produce.

Under these conditions, gaining a position in the market requires that production units attain sustainable competitive advantages while considering economic, social and environmental aspects. This will require changes in terms of technology, production and organization to achieve sustainable competitiveness, such as the adoption of production practices oriented toward protection of natural resources and public health. These changes involve investment to reduce soil degradation, air pollution and residues and to improve water quality and availability. It is

necessary, however, to determine its cost-effectiveness, while considering environmental costs, to support decision-making.

Total Quality Environmental Management (TQEM) and Total Cost Assessment (TCA) are administrative approaches that incorporate aspects of quality into environmental management. While environmental aspects in quality have been discussed by several authors since the early 1990s (Sarkis and Rasheed 1995; Chidiak and Murmis 2003), the agricultural sector has been slow in formally adopting programs and strategies relative to environmental protection. Programs such as environmental management systems (EMS) have been primarily adopted by large agribusinesses (Williams 2009: 59). Environmental management strategies are an essential factor in the competitiveness of the organizations, although introducing them will generate short- and medium-term costs (Puig and Freire 2007). Williams (2009) reported that, in the end, integrating the environmental aspect in total quality management will increase competitiveness.

One of the fundamental objectives of TQEM is that organizations recognize environmental costs and incorporate them into the capital budgeting process to improve decision-making. Curkovic and Sroufe (2007) suggest that by incorporating Total Cost Assessment (TCA) in each project, environmental proposals will compete successfully with non-environmental alternatives for capital resources in an organization. Since there is little information on the application of TCA in agriculture, a proposal for its use may serve as a useful tool in decision-making.

The objective of this study is to examine the impact of environmental strategies on profitability of protected agriculture production systems in the state of Zacatecas, Mexico using the structure of Total Cost Assessment (TCA). Existing environmental management practices of the production units are also identified, and given the importance of water for agriculture in the state of Zacatecas, emphasis is placed on investment and adoption of practices that contribute to its conservation. The research questions posed are the following. Can protected agriculture production systems maintain profitability with investment in and adoption of sustainable production practices? Are tomato growers aware of the environmental costs generated by their protected agriculture production process?

The results of the study will contribute to closing the information gap in terms of how environmental strategies impact Mexican agriculture. According to SEMARNAT (2006:255), most of the agricultural production units report a huge deficit of information on the topic. The results will be of use to administrators, owners of protected agriculture production units and researchers, as well as to agricultural policy designers.

This study comprises several sections. First, a brief review of literature on TQEM and TCA is presented. The following section describes the methodology of the study, which is a case study of four production units selected through the cluster technique and analysis of data provided by informants. Finally, the results are reported and suggestions are made in terms of environmental and quality management for both government authorities and growers.

Total Quality Environmental Management and Total Cost Assessment

Total Cost Assesment (TCA) was proposed by Curkovic and Sroufe (2007) to assess investment in Total Quality Environmental Management (TQEM) programs. TQEM includes concepts that are partial or totally omitted in a traditional analysis, such as water savings, associated water extraction and treatment costs, and energy savings, among others. TCA is an integral process aimed to identify, compile and analyze incurred, avoided and saved environmental and health costs, as well as to mitigate future risks and contingent costs of productive processes, products or places (Norris 2000).

The proponents of TCA classify environmental costs into four categories: direct costs, hidden costs, contingent liability costs and less tangible costs (Table 1). Direct costs are easily identified and quantified and can include recurrent and non-recurrent costs (Constable 1999, Laurin et al. 2013). These are found in the data sources used traditionally by most organizations and include concepts such as equipment installation, raw material, labor and residue handling (Table 1).

Table 1. Environmental Cost Categories Applied in Total Cost Assessment.

Category	Description	Cost Type
Direct Costs	Direct costs are directly linked with a project, product, or process.	Capital Expenditures/Depreciation -Buildings -Equipment -Utility connections -Equipment installation -Project engineering Operating and Maintenance Expenses -Materials -Labor -Waste management
Hidden Costs	Regulatory compliance or other costs that are "hidden" or lumped into a general account.	-Compliance reporting -Monitoring -Legal support -Sampling and testing -Education and training -Notification -Utilities
Contingent Liability Costs	Costs associated with liabilities that may result from waste and materials management.	-Costs associated with accidental releases -Lawsuits and settlements for remedial action, personal injury, or property damage.
Less Tangible Costs	Benefits that derive from improved corporate image, customer acceptance, and community goodwill.	-Organization and product image -Community goodwill -Customer acceptance

Source. GEMI 1994. Curkovic and Sroufe 2007.

Hidden costs are regularly found recorded in general overhead, the reason they are difficult to identify and quantify as environmental costs. Under this heading are recorded costs of complying

with environmental norms and regulations, such as monitoring, training, legal support, sampling and testing, among others (Constable 1999, Shapiro 2001). Contingent liability costs are those usually associated with liabilities that result from handling residues and materials, for example, costs associated with accidents or those resulting from personal injury or lawsuits (Constable 1999). Unlike other cost categories, contingent liability costs are not easily calculated and so are generally estimated. Many organizations base their estimates on past experience, while others rely on studies of similar production units of the same sector or industry (Curkovic and Sroufe 2007).

Of the cost categories, less tangible costs are the most subjective and controversial. Like contingent liability costs, less tangible costs are difficult to determine. To estimate these costs, some organizations consider the increase in incomes or decrease in expenditures attributed to improved corporate image. These costs can include the level of acceptance of the product on the part of their clients and the community, as well as the positive or negative image of the organization (EPA 1995, Constable 1999).

Research Methodology

To examine the impact of environmental strategies on profitability of protected agriculture systems and to determine what environmental management practices are being used by the production units, we used the method Total Cost Assessment (TCA) proposed by Curkovic and Sroufe (2007). Because of the type of information required and the difficulty in obtaining it through a representative sample of production units, the study developed as a case study. To obtain the information, following Eisenhardt (1989) for case studies, field data collection methods were used: questionnaires and interviews with owners or technicians of the production units. Information was also obtained from secondary sources.

The disadvantage of the case study research approach is that it is not easy to make inferences and external validity of the study is limited. However, because of the scarce theoretical construction of TQEM and TCA applied to agriculture (Williams 2009), it is important to use the case study approach to describe what is occurring in the area of environmental management in actual production units.

Selection of Production Systems

Selection of the production systems included in the study was based on a cluster analysis of 55 units that produced tomatoes. The clusters were determined using a procedure of hierarchical analysis with the group linking method. The database was constructed in 2010 with data collected through a survey of protected agriculture production units that were larger than or equal to 2,500 m^2 in area. The variables used in the cluster analysis were structure type, cultivation technique, climate control and size. Four groups were obtained (Table 2) and one representative system was selected from each group. The criteria for selecting the production units for the study were a) that they belonged to one of the four groups obtained, b) that they had grown tomatoes in the 2013 growing cycle, c) the market destination of their produce, and d) availability of technicians in the production unit to provide information. The main characteristics of the production systems analyzed are presented in Table 3.

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Table 2. Protected agriculture production units in Zacatecas, Mexico, classified by variables and groups obtained with a cluster analysis.

Variable	Type	Group 1	Group 2	Group 3	Group 4	Total
Structure type	Almería type greenhouse		15	15	2	32
	Multi-tunnel		10	3	5	18
	Shade house	2	1			3
	Macro-tunnel	2				2
	Total	**4**	**26**	**18**	**7**	**55**
Climate control	Active		7		7	14
	Passive	4	19	18		41
	Total	**4**	**26**	**18**	**7**	**55**
Type of cultivation	Hydroponics				6	6
	Soil	4	25	17	1	47
	Soil and hydroponics		1	1		2
	Total	**4**	**26**	**18**	**7**	**55**
Size[1]	Small		6			6
	Medium		19		1	20
	Large	4	1	18	6	29
	Total	**4**	**26**	**18**	**7**	**55**

Note. [1]Size was determined by area covered by the production modules, applying the criterion of the Technical Commission of the Greenhouse Program SEDAGRO-SAGARPA: a) small, up to 2,500 m^2; b) medium, 2,500 m^2 to 1.5 ha, and c) large, more than 1.5 ha.

Table 3. Principal Characteristics of the Production Systems.

Characteristics	Group 1	Group 2	Group 3	Group 4
Structure type	Shade house	Multi-tunnel	Almeria type greenhouse	Multi-tunnel
Tomato variety	Saladette	Saladette	Saladette	Round tomato
Cultivation technique	Soil	Soil	Soil	Hydroponics
Climate control	Passive	Passive	Passive	Active
Size	Large	Large	Large	Large
Production period	August-October	June-November	May-November	August-April
Market	Domestic	Domestic	Domestic	Domestic/International
Domestic market destination	Wholesale market Iztapalapa, D.F.	Wholesale market Iztapalapa, D.F.	Wholesale market Iztapalapa, D.F.	Wholesale market Aguascalientes
Days of growing cycle	155	249	275	332
Yield (t/ha)	130	230	310	637
Number of plants (ha)	20,250	30,000	40,500[1]	28,644
Daily liters water per plant	2	2.5	2	3

Note. [1]The technique of interplanting is used: 1st cycle February-September. 2nd cycle June-November.

Data Collection

Primary information was obtained with a questionnaire and structured interviews with technicians or owners of the production units selected during the period from February to April of 2014. The questionnaire was divided into two large sections: 1. Data on the production unit (identification of the production unit, structure type, safety practices, crop variety, planting date, harvest date and yield, type of climate control, type of irrigation system, work areas, machinery and auxiliary equipment, services related to development of crop quality, and employed personnel); 2. Data on crop development and commercialization (input technical coefficients-fertilizers and agrochemicals-and labor, irrigation depth, marketing and shipping). The unit of analysis for the second part of the questionnaire was one hectare cultivated in the 2013 agricultural year. Information on production and environmental production practices was collected through structured interviews, comprising the following sections: a) identification of the production unit, b) costing system, c) identification of activities and practices related to the categories considered in Total Cost Assessment (direct costs, hidden costs, contingent liability costs and less tangible costs), and d) open questions about practices aimed toward care and protection of the environment (water conservation, air quality and soil conservation).

Following suggestions by Eisenhardt (1989) for case studies, after the information was processed, it was checked by the surveyed technicians or owners of the production units and validated by specialists in the field, who had not provided information. Prices of inputs were obtained from suppliers. Information on investment in the structure, auxiliary machinery and equipment, heating system and irrigation equipment was determined with price quotes from manufacturers and suppliers. Investment in cisterns for rainwater harvesting was determined following indications of Anaya-Garduño (2010) and Brown et al. (2005), considering the mean rainfall recorded in the period from 2002-2013 in the regions where the production systems studied are located.

Tomato prices were determined at the farm level considering the months in which the produce was marketed during the year 2013 and the market destination: domestic or international. Reference prices for domestic and international markets were obtained from the Sistema Nacional *de Información e Integración de Mercados* (*SNIIM) and the United States International* Trade Commission (USITC), respectively. The information was applied in real terms considering a 10-year horizon. The number of years was based on recommendations of the Fideicomisos Instituidos en Relación a la Agricultura (FIRA 2014) for loans for this type of Project. The data considered in the analysis were kept constant during the 10 years, except when a change in the time variable is reported. The real interest rate was obtained in the following manner:

1) $r = \left(\dfrac{1+i}{1+\pi}\right) - 1,$

where i is the nominal interest rate of 15 %, and π is the annual inflation rate of 3.57 % (INEGI 2014). The nominal interest rate is that applied by Financiera Rural to direct preferential loans in the reference year.

Data Analysis

Because not all of the production units keep a formal systemized costing system, initial work centered on determining actual production, sales and administration costs, identifying and quantifying private and environmental costs under a variable costing system, which included direct inputs, labor and assignment for indirect production costs and administrative expenditures. Assignment for indirect production costs and administrative expenditures helped to determine the cost of production and administration of the product since some costs had been recorded in the general overhead categories. These costs are usually grouped into two categories: indirect production costs, which deal with product costs, and sales and general administrative overhead, which deals with costs of the period. The product costs are those incurred in its production, while the period costs are those that the management considers part of the operation of the agribusiness itself. Both types of costs may include items ranging from equipment to human resources, research and development.

To determine environmental costs, the cost headings used were TCA categories and the costs were expenditures of the production units in their current situation (Table 4). Following Curkovic and Sroufe (2007), once the processes carried out in the production unit were reviewed and the costs classified, processes to be improved were identified and strategies were designed to make the production unit more environment friendly. With this information, two alternative scenarios were constructed: one "unsustainable" and the other "sustainable". In these scenarios, water management was a basic element of analysis, given the critical situation of water for agriculture in the state of Zacatecas.

The scenario denominated "unsustainable" considered environmental degradation caused by over-exploitation of the aquifers, which affects productivity of the production systems. Budgets and multi-annual net cash flows were generated assuming a 2% reduction in yields (Castellanos and Ojodeagua, 2009; Macías-Duarte et al. 2010) due to poor water management. Adjustments for use of day labor in harvesting and packing and, based on information provided by CNA-GODEZAC-UAZ (2008), operation costs for pumping water from a well 14 m deeper were made.

In the "sustainable" scenario (alternative project), sustainable production practices and water use management are adopted. In this scenario, it was assumed that yields would no longer decrease, and therefore, they were maintained constant during the useful life of the Project (10 years). According to Kirda et al. (2004), Macías-Duarte et al. (2010) and Alaoui et al. (2014), efficient irrigation can sustain greenhouse tomato productivity with 2 L/plant/day in hydroponics and 1.5 L/plant/day in soil, and therefore, these amounts were used. In addition, rainwater harvesting and storage in cisterns, use of moisture sensors, and equipment for recycling water, as proposed by Alaoui et al. (2014) and Anaya-Garduño (2010), were part of this sustainable scenario.

To analyze the "unsustainable" and "sustainable" scenarios and consider all environmental costs included in the production and sales processes, as in the current situation, indirect costs were assigned so that some environmental costs would not be included in general overhead categories. According to Curkovic and Sroufe (2007), identification of all savings and costs associated with a TQEM program is the first and foremost step in TCA. It should be mentioned that TCA is

similar to traditional budgeting techniques, except that it includes all associated environmental benefits and costs, which are not frequently considered in a traditional analysis.

Table 4. Classification of Environmental Costs by Structure Type.

Category	Group 1	Group 2	Group3	Group 4
	Shade House (soil)	Multi-Tunnel (soil)	Almeria Type Greenhouse (soil)	Multi-Tunnel (Hydroponics)
Direct Costs	− Infrastructure for reducing risk from use of agrochemicals − Labor − Handling residues	− Infrastructure for reducing risk from use of agrochemicals − Labor − Handling green and solid residues	− Infrastructure for reducing risk from use of agrochemicals − Labor − Handling residues	− Infrastructure and equipment for reducing risk from use of agrochemicals − Labor − Handling green and solid residues
Hidden Costs	− Education and training − Chemical analysis of soil and water − Electricity − Guidelines of Good Agricultural Practices are followed.	− Education and training − Analysis of produce pollutants. − Chemical analysis of irrigation water and soil − Electricity − Certifications of the production unit	− Education and training − Chemical analysis of water and soil − Electricity − Guidelines of Good Agricultural Practices are followed	− Education and training − Analysis of produce pollutants − Chemical analysis of irrigation water and soil. − Electricity − Certifications of the production unit.
Contingent Liability Costs	Not considered	− Increase in job risk premium, IMSS	− Increase in job risk premium, IMSS	− Increase in job risk premium, IMSS
Less Tangible Costs	Not considered	They recognize that the application of environmental protection practices lead to better access to the market, but the effect has not been quantified.	Not considered	They recognize that environmental management practices allow better access to the market and improve the product's image, but the effect has not been quantified.

Once all costs and savings of each of the scenarios are identified, tools are applied for financial assessment of the investment in each project. According to GEMI (1994) and Curkovic and Sroufe (2007), when applying TCA, standard financial indicators can be used to compare investments. The financial assessment techniques applied were net present value (NPV), internal rate of return (IRR) and profitability index (PI), also known as the benefit-cost ratio (BCR).

Net present value is used to assess capital projects. This technique "discounts" to a present value the dollars received in future periods by the rate of return that a production unit could obtain on an investment with comparable risk. NPV was obtained with the following equation:

$$2) \ NPV = \sum_{J=0}^{J=n} \frac{NCF_j}{(1+r)_j} \ ,$$

where *NCF* is the annual net cash flow from *j = 0* to *j = 10; r* is the real interest rate and *n* is the useful life of the project. If *NPV* ≥ 0, the net cash flows cover the inversion; otherwise, the project does not provide sufficient retribution to obtain positive profitability. In the case of IRR, the discount rate that makes the project NPV null is calculated in the following way:

$$3) \ NPV = \sum_{j=0}^{j=n} \frac{NCF_j}{(1+r)^j} = 0 \ ,$$

where *r* is *IRR* in real terms. PI or *BCR* is determined as a relationship between incomes and costs at current values. It is calculated with the following equation:

$$4) \ BCR = \frac{\sum_{j=0}^{n} \frac{B_j}{(1+r)}}{\sum_{j=0}^{n} \frac{I_j}{(1+r)} + \sum_{j=0}^{n} \frac{OC_j}{(1+r)}}$$

where *B* is income or benefits, *OC* is operation costs, *I* is the investment, *r* is the real interest rate, and *n* is the useful life of the project. To be an acceptable investment, BCR must be greater than 1. Based on the proposal of Curkovic and Sroufe (2007), in TCA both normal savings and costs related to the project and environmental savings and costs associated with the project are incorporated.

Results

Environmental Management-Related Activities

The information obtained from the interviews enabled us to identify the activities related to environmental management in each of the production units analyzed. It should be mentioned that none of the production units has a formally established environmental management system, such as ISO 14001. Carruthers (2005) and Williams (2009) point out that adoption of a formal environmental management system has been slow in the agricultural sector. Nevertheless, the soil multi-tunnel and hydroponics multi-tunnel production systems (groups 2 and 4) carry out activities aimed at reducing residues, conserving water and detaining soil erosion. All of the production units declare that they have established an accounting system with which they can identify direct costs, which include management of some residues, such as plastic coverings, input containers and green residues. However, only the production systems of groups 2 and 4 had a formal system of costs, and only in group 4 did they declare having certificates of quality. This is the only production unit that exports. None of the production units has an accounting system that includes measurement of environmental costs.

Although the interviewees recognize that certification or recognition for having participated in environment-related programs facilitates access to markets and generates competitive advantages, in this sphere of action the production units have been driven basically by national and international norms and legislation (Table 5, see Appendix). As has been pointed out by Curkovic and Sroufe (2007), this is a reactive attitude in which growers deal with environmental problems only when they occur, rather than planning for their prevention. The interviewees from only two production units stated having plans or having begun other actions aimed at applying strategies of environmental quality management (Table 5, see Appendix), in addition to recycling structure covering, containers and green waste.

Environmental planning entails several possibilities. Bello et al. (2000) point out that there are biological alternatives for plant health management in a protected agriculture production system, implicating different ways of managing soil and crop health (Bello et al. 2003; Bautista-Calles et al. 2008). Moreover, several authors indicate sustainable practices for irrigation water management in protected agriculture that reduce its use and better care, as pointed out by Macías-Duarte et al. (2010) and Alaoui et al. (2014). They also suggest harvesting rainwater from the plastic coverings (Anaya-Garduño 2010) and storing it for use in crop irrigation, as well as water recycling systems and soil moisture sensors at different depths (Alaoui et al. 2014).

Impact of Environmental Strategies on Profitability

In their current situation, the four production systems studied register a positive net present value (NPV), an internal return rate (IRR) above the discount rate, and a benefit-cost ratio (BCR) above one, reflecting sufficient financial sustainability. The lowest NPV was obtained in the production system consisting of a shade house, largely due to the harvest and selling period (75 days during August and October). This contrasts with the system with a multi-tunnel structure and hydroponics (Table 6), which exports 88% of its production 270 days of the year, including the winter months when international tomato prices are higher.

Table 6. Current investment and profitability indicators of the protected agriculture production systems per hectare.

	Group 1	Group 2	Group3	Group 4
	Shade House (soil)	**Multi-Tunnel (soil)**	**Almeria Type Greenhouse (soil)**	**Multi-Tunnel (Hydroponics)**
Initial fixed investment [1]	103.48	239.05	233.41	748.45
Re-investment [1,2]	55.06	113.55	131.83	277.98
Working capital[1]	18.06	23.56	31.60	128.68
Total investment (000/USD)	176.61	376.16	396.84	1,155.12
Net present value[1] (NPV)	132.62	256.90	452.43	1,096.60
Internal return rate (IRR) (%)	29.98	29.25	42.42	35.77
Benefit-cost ratio	1.30	1.37	1.52	1.39

Note. [1] (000/USD) [2]Additional investment necessary for replacing the structure covering and equipment.

With the savings and costs assigned to the "sustainable" and "unsustainable" scenarios, the financial indicators of each scenario were determined. In the "sustainable" scenario (Table 7), NPV, IRR and BCR are higher than in the "unsustainable" scenario (Table 8) in all of the cases studied. This indicates that the net cash flow that the producer in the "sustainable" scenario would receive would cover the investment made in sustainable production practices, and the financial return would be higher than in the "unsustainable" scenario. In other words, in the "unsustainable" scenario the income not received due to loss of productivity, at present value, would be more than the investment needed for adoption of sustainable production practices. It should be mentioned that in the case of investment in equipment for water recycling in the multi-tunnel-hydroponics system, only the part proportional to one hectare was considered, even though the price quote obtained for the production unit referred to the entire cultivated area.

Table 7. Investment and profitability indicators of the protected agriculture production systems: "sustainable" scenario (one hectare).

	Shade House[1] (soil)	Multi-Tunnel[1] (soil)	Almeria Type Greenhouse[1] (soil)	Multi-Tunnel[2] (Hydroponics)
Initial fixed investment [4]	103.48	239.05	233.41	748.45
Re-investment[3,4]	55.06	113.55	131.83	277.98
Working capital[4]	18.54	23.99	32.06	131.70
Investment in cistern, moisture sensors & water recycling system [4]	16.44	16.44	16.44	103.26
Scenario total investment[4]	193.52	393.03	413.74	1,261.40
Net present value[4] (NPV)	117.47	242.61	437.61	1,001.34
Internal return rate (%)	26.19	27.38	39.83	31.53
Benefit cost ratio	1.26	1.35	1.50	1.35

Notes. [1] Includes geomembrane cistern. [2]Considers water recycling system. The amount allotted to investment for the recycling system was determined by prorating the total budget estimated for the production unit by number of hectares (9.12 hectares). [3] Additional investment necessary for replacing the structure covering and equipment. [4] (000/USD).

Table 8. Investment and profitability indicators of the protected agriculture production systems: "unsustainable" scenario (one hectare).

	Shade House (soil)	Multi-Tunnel (soil)	Almeria Type Greenhouse (soil)	Multi-Tunnel (Hydroponics)
Initial fixed investment[1]	103.48	239.05	233.41	748.45
Re-investment[2](000/USD)	55.06	113.55	131.83	277.98
Working capital [1]	18.05	23.54	31.58	128.65
Scenario total investment [1]	176.59	376.14	396.82	1,155.09
Net present value (NPV) [1]	87.02	182.98	350.12	787.24
Internal return rate (%)	24.75	25.10	37.69	30.79
Benefit cost ratio	1.20	1.28	1.42	1.37

Note. [1] (000/USD). [2]Additional investment necessary for replacing the structure covering and equipment.

Based on the structure developed by Curkovic and Sroufe (2007) for implementation of TCA, the results of this study provide the owners of the production units information on which to base their decisions regarding investment alternatives that contribute to their sustainability.

Conclusions

All of the production units have an accounting system that allows them to determine direct costs of handling plastic coverings, input packaging and green organic waste. However, on the part of technicians or owners of the production units, there is no clear understanding of what is involved in environmental accounting or in total cost assessment of the production process. They were nevertheless open to adopting techniques that would improve production processes and give them better access to information for their decision-making.

The technicians or owners of the production units also manifested that their actions relative to the adoption of environmental production practices are those required by environmental regulation. None of the production units has established a formal environmental management system even though they recognize that having been certified (México Calidad Suprema, Good Agricultural Practices, Good Handling of Fruit and Vegetables, and Good Use and Management of Agrochemicals) allows them to access markets, improve their image, and sell at higher prices.

TCA can give production units more precise information for decision-making in the administration of environmental projects. This information would include implementation of a water savings strategy: normal costs and those associated with loss of productivity due to environmental degradation, as well as savings and investment in rainwater harvesting or water recycling. Profitability indicators obtained in the "sustainable" and "unsustainable" scenarios illustrate how an enterprise, by adopting sustainable production practices, can not only have better access to markets, but also maintain positive profitability while helping to conserve the natural resources soil and water.

For implementation of environmental and quality management strategies in administrative systems of the agricultural sector, we recommend that the government: a) Hold workshops to inform growers of the critical situation of water in the region and of the importance of protecting the environment to make the production units sustainable. b) Design an environmental management framework for the agricultural sector aiming for ISO 14001 certification. c) Promote the adoption of TCA as a form of assessing production unit environmental projects.
At the level of the production unit, we suggest: a) Implementation of a costing system in which identifies product costs and period costs. b) Establishing strategies for addressing aspects of quality and environmental management in the administrative system, prioritizing environmental costs in decision-making.

References

Alaoui, S.M., R. Salghi, A. Abouatallah, N. Jaouhari and B. Hammouti. 2014. Impact of drip irrigation scheduling on vegetative parameters in tomato (*Lycopersicon esculentum* Mill.) under unheated greenhouse. *International Journal of Engineering Research and Applications* 4(1): 71-76.

Anaya-Garduño, M. 2010. Captación o cosecha de agua de lluvia diseño de sistemas de captación del agua de lluvia. In *Aumento de la oferta hídrica* [Increased Water Supply]*,* 9-68. Instituto Nacional de Recursos Hidráulicos, Dominican Republic: INDRHI-CEHICA.

Bautista-Calles, J., R. Garcia, J. Pérez, E. Zavaleta, R. Montes, and R. Ferrera. 2008. Inducción de supresividad a fitopatógenos del suelo. Un enfoque holístico al control biológico. [A holistic approach to biological control] *Interciencia* 33(2): 96-102.

Bello, A., J.A. López, R. Sanz, M. Escuer and J. Herrero. 2000. Biofumigation and organic amendants. In *Metyl Bromide Alternatives for North African and Southern European Countries,* 113-141. Aloise, J., R. Shenede, S. Gorman and C. Mercado (Eds.). Rome: UNEP.

Bello, A., J.A. López, A. García and L. Díaz. 2003. Biofumigación y control de los patógenos de las plantas. In *Biofumigación en agricultura extensiva de regadio.* [Biofumigation in extensive irrigated agriculture] Bello, A., J.A. López and A. García (Eds.). España: Fundación Rural Caja Alicante, Mundi-Prensa.

Brown, C., J. Gerston, and S. Colley. 2005. *The Texas manual on rainwather harvesting,* 3rd ed. Texas Water Development Board. Austin, Texas: TWDB.

Carruthers, G. 2005. *Adoption of environmental management systems in agriculture. An analysis of 40 case studies.* Publication No. 05/032. Canberra: RIRDC. Australian Gov.

Castellanos, J.Z. and J.L. Ojodeagua. 2009. Manejo de la fertirrigación del tomate en suelo. En *Manual de producción de tomate en invernadero*. [Fertigation management tomato in soil . In: *Manual greenhouse tomato production*] Castellanos, J. Z. (Ed.). México: Intagri.

Chidiak, M. and M.R. Murmis. 2003. Gestión ambiental en la agroindustria, competitividad y sustentabilidad. [Environmental management in agribusiness, competitiveness and sustainability] Estudio 1.EG.33.4; Préstamo BID 925/OC-AR. Pre II. CEPAL-ONU.

CNA (Comisión Nacional del Agua). 2007. *La gestión del agua en México avances y retos 2006.* [Water management progress and challenges in Mexico 2006] México: Comisión Nacional del Agua.

CNA (Comisión Nacional del Agua). 2011. *Estadísticas del agua en México. [Statistics of water in Mexico]*.México: Secretaría de Medio Ambiente y Recursos Naturales.

CNA (Comisión Nacional del Agua). GODEZAC 2004-2010. UAZ. 2008. *Plan hídrico de los acuíferos Aguanaval, Calera y Chupaderos en el estado de Zacatecas. [Water plan of Aguanaval , Calera and Chupaderos aquifers in the state of Zacatecas]*México: CNA-GODEZAC-UAZ.

Constable, D. 1999. *Total cost assessment methodology*. USA: American Institute of Chemical Engineers´ Center for Waste Reduction Technologies.

Curkovic, S. and R. Sroufe. 2007. Total quality environmental management and total cost assessment: An exploratory study. *International Journal of Production Economics* 105: 560-579.

Environmental Protection Agency (EPA). 1995. *An Introduction to Environmental Accounting As A Business Management Tool: Key Concepts and Terms*. Washington, DC. EPA. Office of Pollution Protection Prevention and Toxics.

Eisenhardt, K. M. 1989. Building theories from case study research, *Academy of Management Review* 14 (4): 532-550.

FIRA (Fideicomisos Instituidos en Relación con la Agricultura)-Banco de México. 2014. Créditos, garantías y apoyos. [2014 credits , guarantees and support] https://www.fira. gob.mx/Nd/FondeoFira.jsp [accessed May 2014].

García V., N, van der Valk, O., and A. Elings. 2011. *Mexican protected horticulture. Production and market of Mexican protected horticulture described and analysed*. Wageningen, Wageningen UR Greenhouse Horticulture. Rapport GTB-1126. Ministry of Economic Affairs. Agriculture and Innovation.

GEMI (Global Environmental Management Initiative). 1994. Finding cost-effective pollution prevention initiatives: Incorporating environmental costs into business decision making. GEMI: Washington, DC.

INEGI. Instituto Nacional de Estadística y Geografía. 2014. Calculadora de inflación. [Inflation calculator] http://www.inegi.org.mx/sistemas/indiceprecios/CalculadoraInflacion.aspx [accessed May 2014].

Kirda, C., M. Cetin, Y. Dasgan, S. Topcu, H. Kaman, B. Ekici, M.R. Derici, and A.I. Ozguven (2004). Yield response of greenhouse grown tomato to partial root drying and conventional deficit irrigation. *Agricultural Water Management* 69(3): 191-201.

Laurin, L., K. Hayashi and S. Uchida. 2013. The environmental and social impacts of biofuels production: Total Cost Assessment of biomass utilization trials in Japan. *Earthshift.* http://www.earthshift.com/software/3Pillars [accessed October 2013].

Macías-Duarte, R., R.L. Grijalva-Contreras and F. Robles-Contreras. 2010. Efecto de tres volúmenes de agua en la productividad y calidad de tomate bola [Effect of three volumes of water in the productivity and quality of ball tomato]. *Lycopersicon esculentum*, Mill. bajo condiciones de invernadero. *Biotecnia* XII: 11-9.

Mojarro, F., C.F. Bautista, H. Santana, A. Medina and J.J. Martínez. 2010. *Diagnóstico y políticas de manejo para la sostenibilidad de 6 acuíferos en el estado.[Diagnosis and management policies for sustainability 6 aquifers in the state.]* Informe de Investigación. Zacatecas: SAGARPA-SEDAGRO-UAZ.

Norris, G.A. 2000. Integrating Economic Analysis into LCA. Sylvatica, Harvard University. North Berwick, ME, USA.

Padilla-Bernal, L.E., A. F. Rumayor-Rodríguez, O. Pérez-Veyna and E. Reyes-Rivas. 2010. Competitiveness of Zacatecas (Mexico) Protected Agriculture: The Fresh Tomato Industry. *International Food and Agribusiness Management Review* 13: 55-4.

Padilla-Bernal, L.E., A.F. Rumayor-Rodríguez and O. Pérez-Veyna, O. 2007. La competitividad de los invernaderos de tomate del estado de Zacatecas [The competitiveness of tomato greenhouses in the state of Zacatecas]. In *Agricultura protegida,* 239-277. Lara H., A., R. Valdez and J.A. Zegbe D. (Ed.). Zacatecas, México: UAZ.

Puig Ventosa, I. and J. Freire González. 2007. Efectos de las políticas ambientales sobre la competitividad [Effects of environmental policies on competitiveness]. *Revista Iberoamericana de Economía Ecológica* 6: 52-61.

Sánchez-Del Castillo, F., E.C. Moreno-Pérez, J. Pineda-Pineda, J.M. Osuna, J.E. Rodríguez-Pérez, T. Osuna-Encino. 2014. Producción hidropónica de jitomate (*Solanum licopersicum* L.) con y sin recirculación de la solución nutritiva [Hydroponic production of tomato with and without recirculation of the nutrient solution]. *Agrociencia* 48:185-197.

Sarkis, J. and A. Rasheed. 1995. Greening the manufacturing function. *Business Horizons* 38(5): 17-27.

Secretaría de Desarrollo Agropecuario. 2010. *Apoyo a construcción y equipamiento de invernaderos, con el Programa de Alianza para el Campo del 2000 al 2007[Support for construction and equipping of greenhouses, with the Program for the Countryside Alliance from 2000 to 2007].* Subsecretaría de Agricultura. Zacatecas: SEDAGRO.

SEMARNAT. Secretaría de Medio Ambiente y Recursos Naturales. 2006. La gestión ambiental en México [Environmental management in Mexico]. México: SEMARNAT.

Shapiro, K.G. 2001. Incorporating costs in LCA. *International Journal of Life Cycle Assessment* 6(2): 121 – 123.

Williams, T. 2009. *Environmental management in agriculture and the rural industries: voluntary approaches to sustainability and globalization imperatives.* RIRDC. Publication No. 09/023. Australian Government. Canberra: Union Offset Printing.

Appendix

Table 5. Production Unit Practices Oriented Toward Establishing an Environmental Management System.

Concept	Group 1 Shade House (soil)	Group 2 Multi-Tunnel (soil)	Group3 Almería-Type Greenhouse (soil)	Group 4 Multi-Tunnel (Hydroponics)
Good agricultural practices and adequate use and management of inputs for pest control	Yes, those indicated by government programs	Yes, those indicated by government programs	Yes, those indicated by government programs	Yes, those indicated by government programs
Recognitions or certification for participating in environmental management programs	No	Good use and management of agrochemicals (BUMA) in tomato production and packing	No	▪ Primus GFS Global Food Safety Initiative ▪ SENASICA (BPA and BPM) ▪ Mexico Supreme Quality ▪ Global G.A.P. ▪ Ministry of Labor and Welfare. Agricultural Enterprise Free of Child Labor ▪ Good use and management of agrochemicals (BUMA)
Destination of plastic residues from renovation of coverings	They have been dumped in the garbage, but in the last change of covering, the old plastic was sold to a recycling company	It is sold to a recycling company	They have been dumped in the garbage, but in the last change of covering, the old plastic was sold to a recycling company	It is sold to a recycling company
Has personnel or consultants specialized in the area of food safety	No	Training courses given by the state Committees for Plant Health	Training courses given by the state Committees for Plant Health	Yes, a trained technician
Accidents in the production unit caused by misuse of agrochemicals	No	No	One worker affected	No
Fines for misuse of inputs, or product contamination	No	No	No	No
Benefits for the production unit from having recognition for participating in environmental management programs	Not applicable	Access to markets, increased competitiveness	Not applicable	Better access to markets and government subsidies
Actions directed toward establishing a Total Quality Environmental Management system (TQEM) to reduce environmental impact of residues or agrochemicals on water, soil, air and health.	Guidelines of Good Agricultural Practices manuals are followed.	▪ Contamination Risk Reduction Program of SENASICA and Good Agricultural Practices manuals are followed. ▪ Integral management of pests and diseases initiated.	Guidelines of Good Agricultural Practices manuals are followed.	▪ Good agricultural practices and vegetable handling are applied. ▪ Recognition and certifications indicated. ▪ A system for recycling water is planned.

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Farmers' Choice of Marketing Strategy:
A Study of New Zealand Lamb Producers

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Abstract

The red meat industry is of utmost importance to New Zealand's economy, generating $2.8 billion in export earnings, accounting for 6.5% of the total merchandise export value in 2010 - 2011. However, sheep numbers fell substantially from 70 million in 1982 to 31 million in 2012. This has led to large-scale rationalization within the processing industry, causing major processing companies to now focus on in-house performance, including external relationships with suppliers and downstream customers. Yet, there are still openly adversarial relationships between processing companies and farmer suppliers with a prevalence of spot market relationships between many producers and processors. As the industry attempts to determine how to improve performance, a clearer understanding of producers' selling behaviors and the drivers behind such behaviors is needed in New Zealand to effectively move towards a more comprehensive and sustainable procurement strategy for the industry. This research provides insights into why, and what influences why individual farmers chose various selling channels within the lamb meat supply chain.

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Introduction

New Zealand has a long history in meat production with mature supply chain industries built around it. The lamb sector continues to play a dominant role in the economic well-being of the New Zealand economy. Exports of sheepmeat contributed NZD$2.7 billion, representing 6.3% of New Zealand's merchandise exports in 2010 (Beef and Lamb New Zealand 2012). Recent years of low profits, volatile prices, and declining production have hampered opportunities for growth. The industry is now under threat from competing land use from dairying, dairy support, and forestry (MacLeod 2011).

Currently, a clear conflict faces sector participants at different points across the value chain. While processors benefit from being able to elicit longer-term supply commitments from farmers to ensure supply certainty, they face short-term financial incentives to procure on the spot market to both maximize capital utilization and gain additional quota markets (Ministry of Agriculture and Forestry 2009).

Over the last two decades New Zealand's red meat industry has undergone significant change with large-scale rationalization of processing capacity from the peaks of the early 1980's created by Government subsidy payments (Clare, Shadbolt, & Reid 2005). Now major processing companies focus on in-house performance including external relationships between suppliers (farmers), and downstream customers (distributors, retailers and consumers).

New Zealand lamb production is based on a seasonal pasture-based system. Lamb production closely follows New Zealand's pasture growth curve, where the bulk of lamb is supplied over the summer and autumn months (Beef and Lamb New Zealand 2012). On one hand, these systems provide a comparative advantage of relatively low-cost production that yield a natural product. On the other, the highly seasonal nature of this supply results in excess processing at certain times of the year and tight capacity during others when exacerbated by drought conditions that push slaughter dates forward by farmers. Furthermore, due to the decline of sheep numbers from 70 million in 1982 to 31 million in 2012, there is an excess processing capacity within the industry. This excess capacity combined with the seasonality and uncertainty of the lamb supply, drives processors to offer or remove procurement premiums throughout the season and engage in intense competition with one another (McDermott et al. 2008.

Supply and price uncertainty has led to an openly adversarial relationship between processing companies and farmer suppliers (Clare, Shadbolt, & Reid 2005, McDermott et al. 2008), not dissimilar to that found in red meat supply chains elsewhere (Fearne 1998). Behaviors of farmers said to drive the shape of the industry are the spot market relationships, yet there are farmers who have adopted contracts with processors to supply lambs at specific times and for specific customer requirements. However, McDermott, Saunders, Zellman et al. (2008) note that both farmers and processors often treat contracts with a cavalier attitude, depending on market and climatic conditions. Farmers can feel constrained by contracts as they try to match lamb production with pasture growth—which varies from year-to-year. Spreading the season beyond its natural pasture-based bounds is not always an option and can add both cost and risk to farmers (Ministry of Agriculture and Forestry 2009).

Achieving higher levels of supply certainty is often cited as a key value driver for the sector (MacLeod 2011; McDermott 2012) and agribusiness in general (Matopoulos et al. 2007). With certainty of supply the sector's processors and marketers will be able to better manage key risks and volatility in the market through increased use of contracts. With a fixed price contract, exporters can use financial instruments to manage their exposure to currency fluctuations, thereby reducing their price volatility and that of their suppliers. Key benefits identified for the processor include certainty of supply (procurement), inventory management (not having to freeze excess lamb supply, therefore lowering its value), cost efficiency and asset utilization (removing the peaks of supply, therefore, having less excess capacity during the winter months), customer service improvements, marketing effectiveness and sales growth (Zanquetto-Filho, Fearne, & Pizzolato 2003, Matopoulos et al. 2007). Other advantages include plants becoming more capital intensive and the ability to enter into new markets that require year-round supply of chilled cuts (McDermott, Saunders, Zellman et al. 2008, MacLeod 2011). The advantages for producers is not frequently mentioned in the literature.

It is unlikely that the benefits will be the same for both parties (processor and producer), but they need to be strong for both. In addition, the drivers must be strong enough to provide each party with a realistic expectation of significant benefits through a strengthening of the relationship (Lambert, Emmelhainz, & Gardner 1996).

It is not fully understood why some producers commit supply through contracts and others do not. A clearer understanding of producers' selling behavior and the drivers behind such behavior is needed in New Zealand to effectively move towards a more comprehensive and sustainable procurement strategy for the industry. The objective of this research is to provide insights into why, and what influences individual farmers choices in selecting various selling channels within the lamb meat supply chain.

In order to best examine these selling decisions an initial review of literature on the marketing strategies of producers, their choice of selling channel, and the nature of their supply chain relationships was carried out. This, combined with a selection of interviews with lamb producers and industry experts, was used to formulate a survey of the marketing strategies of a targeted random sample of New Zealand lamb producers. Principal component analysis and regression partitioning modelling identified factors that explain both the variance between the sample producers overall and then of each marketing strategy. Key drivers of the different marketing strategies were examined and discussed to best determine the factors that most influence selling decisions and behavior amongst NZ lamb producers.

New Zealand Lamb Industry

The efficiency of the New Zealand lamb industry is largely based on climatic conditions that allow for year-round pasture production. This enables the production of a low cost, natural product, providing the foundation of New Zealand's reputation as a global meat producer. However extensive free-range production also brings challenges with large variations due to climatic conditions between years.

Timing and spread of lamb supply varies by season and throughout the country depending on climatic conditions and pasture growth rates. The uncertainty surrounding the timing of lamb supply, and therefore prices, is a key predictor of the balance of power and economic fortune of producers and processors for the season. The entire lamb supply chain is at risk of disruption each year due to weather patterns.

Generally producers have at least two to three different marketing options in which to sell their finished lambs. This can include directly to a meat processing company or through an independent agent. Each company will have a range of procurement or supply options available to farmers which differ in the level of "contractual" risk and flexibility. This can include the determination of prices paid (fixed or spot market, per head or per kilogram weight); whether or not a producer must commit their lambs to the company; and any premiums available for meeting certain weights or supply of lamb target numbers.

In most cases, producers have an option to commit to a particular company by giving estimated numbers and dates of their predicted lamb supply in advance. This decision must normally be made at the start of the lambing season (August/September) and an agreement will be made with one company for the forecast number of lambs to be sold in that year. Although committed to one company, often the price received will be determined on the day as the "spot price". Farmers generally have the option to meet more stringent requirements such as monthly delivery of a pre-determined number of lambs to a specified weight range. In some cases, this will generate a fixed price and or a premium for the supply to meet these specifications.

Spot prices usually begin to decrease in early summer, November, when the pasture growth rates are at their peak and lambs are starting to be weaned for sale (Figure 1), and lift again as pasture growth rate and lamb supply dwindles in the winter. In some seasons the lift has been sooner (08/09 and 10/11) or not at all (11/12).
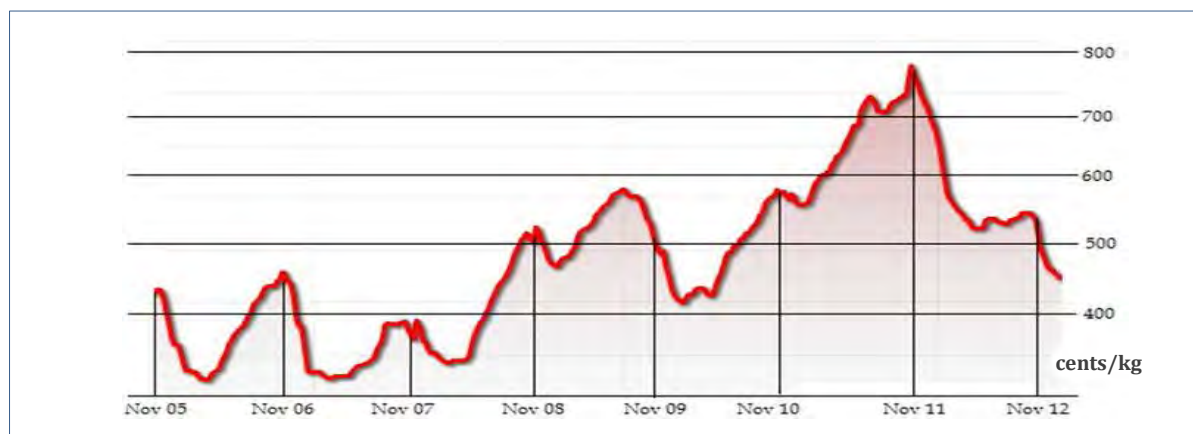
Figure 1. Seasonal New Zealand Lamb Schedule Prices (Polson 2012).

When growing conditions are favorable to producers (e.g. in 10/11), they often hold on to stock longer, reducing supply, resulting in companies paying premiums to source stock. (McDermott, Saunders, Zellman et al. 2008). Conflict arises as processors are seen to pay premiums to procure stock for plant utilization in the short term, whilst calling for long term commitment from

producers (Ministry of Agriculture and Forestry 2009; MacLeod 2011). However in the case of a drought season the converse occurs; supply increases and prices decrease. Processing space can also be extremely limited and producers must rely on a good relationship with their company or agent to get access to available space.

The behavior of producers that "shop around" for the best price is seen to be detrimental to the industry. Closer collaboration through increased certainty of commitment, long-term relationships and contracts between producers and processors is deemed necessary to increase the competitiveness of the lamb supply chain (McDermott, Saunders, Sinclair et al. 2008, McDermott, Saunders, Zellman et al. 2008, Ministry of Agriculture and Forestry 2009, MacLeod 2011).

There are two similar schools of thought in the industry related to the need for increased collaboration and commitment amongst producers and processors.

- The need for greater plant efficiency achieved through committed supply arrangements between producers and processors. This would involve producers committing a large proportion of their stock to one company.
- Adding increased value along the supply chain by better meeting consumer requirements such as greater traceability and a link to the origin of their food products.

Both of the above suggest it is the producers' behavior that needs to change. Yet little research has evaluated why producers carry out the selling behavior that they do, what drives their behavior, and what is important to them when making selling decisions.

Literature Review

A review of the literature on producers' marketing strategies, their choice of supply chain channel, and the nature of supply chain relationships was carried out to develop a framework to examine New Zealand lamb producers' selling decisions.

Producers' Marketing Strategies

Food retailing is increasingly more customer responsive, more service focused, and more global in ownership. The input supply and product processing sectors are becoming more consolidated, more concentrated, and more integrated (Fearne 1998, Boehlje 1999, Hobbs & Young 2000). Vertical coordination refers to the means by which business arrangements move through the supply chain from production to consumption. It encompasses a continuum of possibilities from open market spot transactions at one extreme, through to full vertical integration at the other, and includes intermediate forms such as strategic alliances, joint ventures and contracting (Frank & Henderson 1992).

Several authors have identified a variety of hybrid coordination strategies between spot markets and vertical integration, such as contracts, and equity arrangements (Joskow 1987; Osborn & Baughn 1990), to more informal strategies, such as, information sharing and joint planning (Palay 1984, Noordeweir, John, & Nevin 1990). The uniqueness and inter-connectedness

between individual strategies and the continuum of vertical strategies are discussed by Peterson, Wysocki, and Harsh (2001), and Wysocki, Peterson and Harsh (2006). Figure 2 is a hypothesized continuum, with five major categories of vertical coordination strategies that have been identified, ranging from spot markets to vertical integration.

Spot Market	Specification Contract	Relationship Based Alliance	Equity Based Alliance	Vertical Integration

Characteristics of "Invisible Hand" Coordination
- Self-interest
- Short-term relationship
- Opportunism
- Limited information sharing
- Flexibility
- Independence

Characteristics of "Managed" Coordination
- Mutual interest
- Long-term relationship
- Shared benefits
- Open information sharing
- Stability
- Interdependence

Figure 2. Strategic Options for Vertical Coordination
Source. Peterson et al.(2001)

At the ends of the continuum, the characteristics of "invisible-hand" coordination and "managed" coordination are, respectively listed. At the spot market end participants follow their self-interest and pursue exchange relationships that are short term, opportunistic, limited as to information sharing, flexible, and preserving of their independence (Hobbs & Young 2000; Peterson et al. 2001, Matopoulos et al. 2007). At the other extreme, managed coordination is built upon the mutual interests of the exchange participants who pursue relationships that are long-term, benefit sharing, open as to information flow, stable, and supportive of interdependence (Peterson et al. 2001). As the continuum moves from left to right, coordination moves from being dominated by invisible-hand characteristics through a changing mix of invisible-hand/managed characteristics to coordination being dominated by managed characteristics.

In order to understand the concept of collaboration in the context of the agri-food industry there is a need to better analyze the sector by identifying its particularities and the changes that have occurred lately (Matopoulos et al. 2007). Global retailers are building partnerships and support close collaboration practices with many of their suppliers in an effort to achieve performance improvements across many business levels (Kaufman 1999). Also, consumers are more than ever interested in having healthy food and are characterized by higher levels of food safety concerns. This has increased public pressure for transparency, traceability and "due diligence" throughout the agri-food supply chain (Hughes 1994; Boehlje & Hofing 1999; Fearne, Hughes, & Duffy 2004).

Existing empirical studies clustering producers based on their business and marketing strategic orientation were reviewed. These types of studies emulate previous business management strategy theory that attempt to classify and identify firms that follow similar strategies. A gap in the literature was identified by McLeay, Martin, and Zwart (1996) in relation to describing the marketing activities of individual producers, they analyzed farm business marketing and strategic management processes and found that differences exist amongst groups of producers. Since then several other studies have analyzed producers' strategic orientation in several industries and locations (Davies et al. 1999; Poole 2000; Isengildina and Hudson 2001; Tsourgiannis, Eddison, and Warren 2008). The importance of marketing within a producer's strategy differs depending on the overall business strategy of the producer and their orientation towards production, the consumer and livestock market, risk, and flexibility.

Choice of Supply Chain Channel

Given the existence of differences in marketing strategies, the next area of investigation was to explore in more detail the reasons behind the producers' choice of selling channel.

The transaction cost economics approach has traditionally been the most common method to determine the drivers of different types of transactional exchanges. Theory suggests that increased integration through contracts and more formal relationships will occur to safeguard investments and reduce uncertainty. The theory is driven by assumptions about the nature of human behavior and how this will impact exchanges between two parties. This is founded in static economic theory whereby the most efficient outcome which minimizes the costs of transaction will prevail. However from the empirical studies it would seem that the level of transaction costs is not sufficient in determining the extent of coordination in a dynamic supply chain (Boger 2001, Hobbs 1997, Ferto and Szabo 2002, Gong et al. 2006, Woldie and Nuppenau 2009).

The relationship between a producer's strategic orientation and choice of channel was explored (McLeay and Zwart 1998, Wachenheim, deHillerin, and Dumler 2001, Gillespie, Basarir, and Schupp 2004, Tsourgiannis et al.2008). These scholars identified that a producer is more or less likely to contract depending on their strategic orientation towards entrepreneurship and differentiation compared to the desire for stability, and how important the role of marketing is to the business. This introduces the idea that the choice of channel relates to the type of person rather than pure economic efficiency grounds. The studies illustrate that marketing strategies make up an important component of farm business strategies, and that producers carry out heterogeneous strategies (McLeay et al. 1996, Davies et al. 1999, Poole 2000; Isengildina and Hudson 2001; Tsourgiannis et al. 2008).

The concept of supply chain participants picking between channels based on the features of the 'solution' was explored through conjoint analysis by a number of scholars (Hobbs 1996, Stanford et al. 1999, McDermott, Lovatt, and Koslow 2004). In these studies producers (and processors) are asked to rate what they preferred and disliked about different marketing channel options. This implies that there are potentially many different reasons related to the actual features of the channel that result in a producer choosing a certain channel. Conjoint analysis enables an analysis of individual's decisions based on a bundle of attributes. This method

expands on the theory of transaction costs in that producers make inherent trade-offs between channels based on the individual's perceptions of the costs of transaction. Individuals with different perceptions of transaction costs can then be grouped together and accounts for differences in personal characteristics such as age, location, and farm size. Therefore, this method combines elements of multinomial regression analysis of transaction cost economics and personal characteristics.

Conjoint analysis limits the number of variables that can be analyzed as well as the need to specify a limited number of variable levels. Results to date are rudimentary, they can only conclude the order that producers judged a limited number of variables and that they would generally prefer to choose the level that seemed to be obvious as preferential e.g. higher prices over lower prices and easier access over tighter access to processing space. This method limits the research insights to a study of a producer's decision between hypothetical situations at a static point in time. However this method adds value to the research beyond purely grouping producers based on personal characteristics and demographics.

A more dynamic method adopted by Fairweather (1999); among others (Darnhofer, Schneeberger, and Freyer 2005, Sahin 2006 and James; Klein and Sykuta 2011) is the application of innovation diffusion and complementarities theory to analyze a producer's uptake of more integrated supply channel options. This aligns with analyzing the attributes of a "solution", but takes a more holistic approach assessing which attributes encourage or dissuade a producer from adopting a more formal, contractual supply channel. Decisions trees can then be used to group producers by their behavior as well as the different motivators and constraints that compel behavior.

Overall, it appears from the literature that some producers prefer a certain supply channel because it makes selling decisions such as fixed price, increased flexibility, or low requirements, easier. Other producers seem to need a channel to be more beneficial for them to join such as higher than average prices or lower costs, or increased information. This difference seems to relate to the producers ability to deal with uncertainty. A producer's selling decision is dynamic and complex with many factors of possible consideration.

Supply Chain Relationships

The quality of supply chain relationships plays an important part in all business transactions and will be affected by several factors that can include wider macro factors, sector specific and personal factors. Various scholars concluded that the status of relationships is merely a consequence of the type of exchange transaction along a continuum of levels of integration between supply chain participants (Williamson 1998, Ferto and Szabo 2002, Young and Hobbs 2002; Peterson et al. 2001, Wysocki et al. 2006, Schulze and Spiller 2006; and Fischer et al. 2008). These scholars suggest that high quality, long-term, collaborative relationships increase the more integrated the supply chain transaction. Spot market transactions are considered to have a low level of relationship quality due to the arm's length, adversarial nature of the transaction. Other scholars view the transaction between producers and processors as similar to other business-to-business relationships, whereby industry and environment specific factors will influence the benefits, risks, enablers and barriers to increased integration (Zanquetto-Filho et al.,

2003, Ivens 2004, Gray, Boehlje, and Preckel 2006; and Matopoulos et al. 2007). Collaboration is driven by the recognition by both parties that collaboration makes sound business sense such as reducing costs or attempting to increase value. Only Matopoulos et al. (2007) highlighted that there were also risks involved in increased collaboration.

Further studies have examined the factors of quality of relationships rather than factors influenced, or those influenced by the nature of transactions and integration levels (Ivens 2004, Clare, Shadbolt, & Reid 2005, Theuvsen and Franz 2007, Fischer et al. 2008; and Schulze and Schlecht 2009). These studies attempt to empirically measure the quality of different relationships and factors that have played the largest role in relationship quality (Schulze and Schlecht 2009; Ivens 2004). The importance of dyadic variables such as trust and commitment on relationship quality led to investigating the antecedents for these factors (Kwon and Suh 2004, Schulze and Spiller 2006, Fischer et al. 2007). Relationships are important in supply chain transactions, yet how these relationships impact producers' marketing strategy or channel choices does not seem well defined.

Summary

From the literature it was concluded that producers differ in:

- strategic orientation based on attitudes towards the importance of marketing as a function of their business, and the degree of stability versus flexibility they desire.
- human characteristics as they impact how producers' perceive features of different available marketing channel options including the perceived costs of transaction.
- relationships and collaboration that can play a role in reducing transaction costs.
- perceptions of the different transaction costs for each option. These perceptions may be influenced by the individuals own ability and resources, including their own human characteristics being their desire for opportunistic behavior, their ability to search for and process information, and their differing levels of bounded rationality.

These factors may have just as large an impact on the choice of channel as the transactional characteristics of uncertainty, asset specific investments and frequency, yet this has not been explicitly explored in the literature. In addition there is little analysis combining a wide range of factors in decision making such as strategic orientation, producer attitudes, demographics and relationship variables.

In the New Zealand lamb industry context there are no stark differences in the transaction characteristics between marketing solutions. Transaction costs are said to be impacted by transaction characteristics of uncertainty, frequency of transaction and level of asset specific investments made. Price uncertainty can be reduced by entering into fixed price contracts; however this creates price risk from upward movements in the schedule. Processing space uncertainty is reduced under committed supply arrangements. Frequency of transactions should remain the same regardless of supply option, as generally lambs will be sent off the farm at regular intervals in line with available pasture and lamb growth rates. While some asset specific investments may be made for some supply options, there is generally little restriction between

entering and exiting committed supply options. This illustrates that there is likely to be different reasons for supply channel options.

Method

The literature review, initial interviews with producers and industry experts and pilot survey testing, determined the following topics to be included in the survey:

1) Producers' decision-making process and selling behavior.
2) Producers focus on market, production, flexibility, stability and cost orientation.
3) Producers values in relation to certain supply plan and company specific factors.
4) Factors that may cause producers to change between companies or between supply plans.
5) The quality of producers' relationships with their buying agent or meat company.
6) Farm and producer characteristics.

A range of variables including the producer's strategic orientation, values, relationships, and demographics formed the basis of the survey designed to investigate the characteristics of the producers carrying out different marketing strategies and the level of importance placed on different variables when making selling decisions.

A survey allows the investigation of the importance of the particular variable and the development of generalizable relationships between variables (Philliber, Schwab, and Sloss 1980). Interviews with 14 lamb producers throughout New Zealand were used to test the main concepts developed from the literature. Procurement managers for eight different meat companies were interviewed to discuss the different supply plan options available to producers, and to identify any differences in requirements or benefits to producers from selling to each company. The survey was tested for questionnaire design and ease of completion with seven producers. The initial design was adjusted based on feedback from producers.

A purposive random sampling procedure was used. Differences in selling decisions may be influenced by the number of selling options available and agro-climatic conditions. To limit the impact of these factors on the results, the two regions of New Zealand, the East Coast of the North Island and Otago-Southland in the South Island, were targeted for the study sample. Both regions have several different meat processing companies operating to which producers could choose to sell their lambs. The sampled regions represent several different land use classes within New Zealand from extensive high country farms in the South Island, to steep hill country, and more intensive finishing country. Surveys were sent either electronically or by post. From the sampled 2,621 producers, 883 (34%) responses were received, with 734 usable responses (28%) analyzed. Due to the high response rate, no further surveys were sent out and so there is no analysis of non-response bias.

Principal component analysis (PCA) was carried out on survey sections relating to strategic orientation, selling behavior, values, and relationship status to determine the main factors that differentiate producers. This grouped a range of questions in the survey into key variables which were then used to define key differences between producers based on their overall weighted scores of answers to each group of questions. Data was collected through Likert Scales ranging

from 1 (Strongly Disagree; or No extent) to 5 (Strongly agree; or High Extent). The principal component scores were obtained for each individual by multiplying the weightings and standardized original scores. To allow analysis with missing data, multiple imputations using the nearest neighbor method was carried out.

PCA was carried out to investigate which types of constructs could explain the most variance in the data. PCA was used rather than factor analysis, as factor analysis only improves the interpretability of the loadings by removing variables with low loadings. The final principal components that demonstrated the largest difference between producers were combined with demographic variables in logistic regression partition models to demonstrate the factors of greatest variance between producers carrying out different marketing strategies.

These different marketing strategies were the dependent variables used for the analysis. They were based on level of vertical coordination. For the case of the New Zealand sheepmeat industry, five marketing strategies were defined as illustrated in Figure 3.
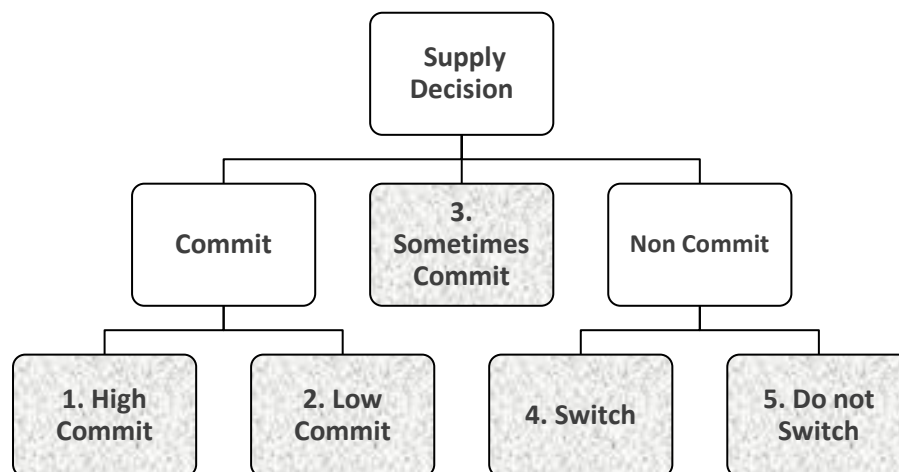
Figure 3. Marketing Strategies: The Dependent Variables

Strategies are categorized firstly based on how often the producer has committed their lambs to one company in the last five years. Secondly the producers are split based on the level of buy in they have to the initial split. Those that always commit are split into high or low committers based on the specifications of their commitment arrangement. High Committers are subject to greater specifications in delivery and price by meeting monthly or weekly delivery of specified lamb numbers, aiming for targeted weight and fat grades, have breeding or feeding requirements, or delivering under a contracted fixed price. Low committers are subject to less stringent specifications, but still provide an annual commitment of lambs to one company, and meet weight targets. These producers are seen as having a low level of buy in to a committed program.

Sometimes Committers have committed once or twice in the last five years, and are either new to committing, or have tried to commit but then for some reason have stopped. These producers were found to be more likely to commit to a fixed price contract arrangement than those that always commit.

Producers that have not committed in the last five years were split into those producers that have switched companies and those that have not switched companies in the last five years. Those that switch were considered to be more active in searching out the highest price on the day, or are active in their consideration of which meat company to sell too. This implies that Switchers carry out a certain amount of searching for information and evaluation of alternative companies and selling options. This can either be carried out by the producer, or they may use a third party agent. This implies a high level of buy in to the Non Commit option. Non Switchers are considered more complacent in their selling decisions, as while they have not actively looked to switch companies in the last five years, they are not compelled to commit to their current company. This option has a very low level of searching and evaluation and represents a low level of buy in to the Non Commit option.

The package Recursive partitioning and regression trees (Rpart), from R was used to model the data. Rpart uses recursive partitioning to create a decision tree which firstly classified a producer as a Committer or Non Committer. All principal components and demographic variables were initially included as independent variables in each model and the package Rpart selected the significant variables in terms of binary classification. Once analysis had been done to compare producers that do and do not commit, a similar process was carried out to compare producers within each group based on whether they had a high or low level of buy in to the channel. Refer to Appendix C to for a full list of independent variables used in the analysis.

Regression partitioning with a binary response allows the creation of groups based on the variables that are most important in defining the groups, rather than using all available variables as is the case in traditional hierarchical clustering techniques. Regression partitioning allows the interpretation of different groups based on the most important variables, rather than clustering on certain variables and then having to interpret the clusters through a second regression analysis of variables of difference. The models were created using Rpart programming and allocated producers to an end node based on the greatest differentiation between producers at each point of the regression-based partitioning trees. The models split producers based on the factors that cause the most differentiation between producers of each binary group at each branch for each model. Producers continue to be split until they cannot be significantly differentiated based on the producers' constructs scores or until they reach the limit of final node numbers. The partitioning was based on a specified minimum split size of 60 and end node size of 30 for model one, and 40 and 20 for models two and three.

In the commentary for each model, producers are partitioned based on whether they have a 'high' or 'low' (and in some cases a 'medium') score for the components. These terms have not been defined based on the level of the score, but are rather used for simplicity when describing one group of producers that have been partitioned to one side of a tree-branch relative to the other. Due to the standardization of the PCA scores, each component will have an average score of around zero, with half of the producers having positive scores, and half having negative scores. So while the value that partitions producers may be higher or lower than the average (at zero), producers with scores greater than the value of the partition are deemed to have 'high' scores and those that have scores less than the drafting value are deemed to have 'low' scores.

Generalization of the research may be limited by several factors. Overall this study was of an exploratory nature rather than a strict test of pre-specified relationships between variables. Little

research has previously examined the selling decisions of New Zealand lamb producers and the literature identified a wide range of factors that could impact selling decisions.

There may be an over representation of producers that are more interested in selling decisions for their lambs as these producers would seem to be more likely to reply to a survey on this topic. The survey was conducted in a season of higher lamb prices following a period of several consecutive years of declining producer profitability. If this survey was conducted in the period of declining profitability results may differ. Producers were asked to describe their behavior over the last five years in an attempt to counter this issue. Exploratory factor analysis was used in this research and the constructs developed may need testing in future research to be further validated.

Results

Description of Sample

From the 734 responses used in all the analysis, 330 (45%) committed their lambs to one company over the previous five years (Committers). These were made up of 18% (Figure 4) that committed (40% of the committers) had a high level of buy-in to the channel either through a fixed price contract or meeting tighter delivery specifications such as weekly or monthly delivery and weight and fat specifications (High Commit). A small number of these producers also adhered to breeding and feeding specifications. The other 27% (60% of the committers) that committed delivered an annual commitment without the tighter specifications (Low Commit). There were also 125 (17%) that had committed once or twice (Sometimes Committers). Of the 279 (38%) that never had (Non-Committers), this was further divided equally into the 19% that had switched the company they sell to more than once (Switchers), and 19% that had not changed companies over the last five years (Non Switchers). The resultant breakdown into the five marketing strategies is shown in Figure 4.
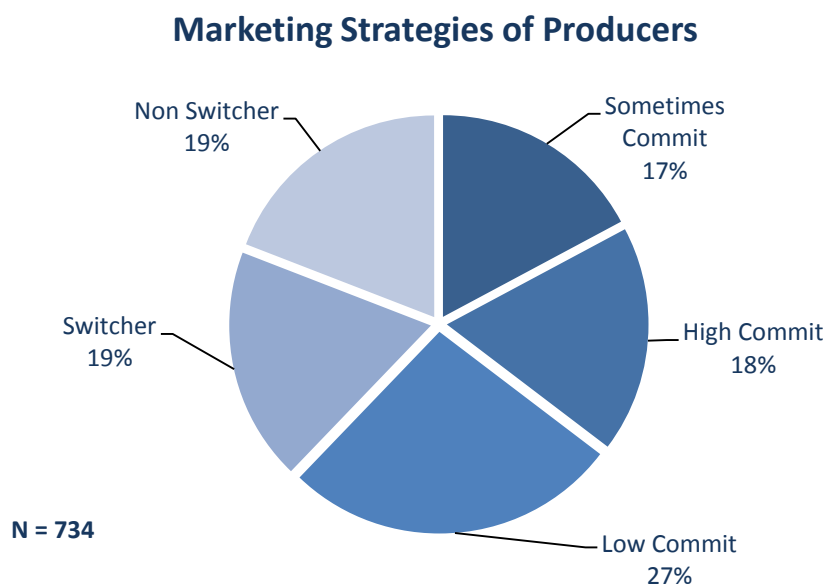
Figure 4. Marketing Strategies by Proportion

Overall respondents were evenly split between the two regions; however there were differences in locations based on the selling behavior of producers. For example, of those producers who are in the low commit group 80% were in the Otago/Southland regions, 20% in the East Coast. Conversely those who do not commit and actively switched, 76% were in the East Coast and 24% in Otago/Southland. Respondents were asked who they considered their main relationship when selling lambs; a third party agent, the meat company, or a meat company representative. While there was a relatively even split overall between the three types, some groups of producers were much more likely to use a certain type of relationship. The low commit group is unlikely (9%) to use an agent to sell through whilst the switchers would (55%), and the high commit group are more likely (59%) to relate directly with the meat company

Table 1. Location of Sampled Producers

	Location of Farm		**Main Relationship**		
Marketing Strategy	*East Coast*	*Otago-Southland*	*Agent*	*Meat Company*	*Company Rep*
High Commit	42%	58%	14%	59%	27%
Low Commit	20%	80%	9%	50%	41%
Sometimes Commit	58%	42%	34%	26%	40%
Switcher	76%	24%	53%	16%	31%
Non Switcher	58%	42%	27%	39%	35%
Total	48%	52%	26%	39%	35%

Principal Component Analysis (PCA)

Producer responses were examined for variance under four groups - strategic orientation, selling behavior, values and overall relationship status. These four groups were selected based on the literature and the hypotheses generated from initial discussions with producers. The PCA creates a loading for each variable from which differences between producers can be determined. These differences form the basis of the components described in Table 2 and the percentage of variance in producer scores explained by component by group. Further details on the PCA as well as the survey questions that make up the different components for each group are provided in Appendix A.

Table 2. Principal Component Analysis (percentage of variance in producer scores explained by component by group

Components	**Strategic Orientation**	**Selling Behavior**	**Values**	**Relationship Status**
One	Market Focus (18%)	Active (24%)	Conscientiousness (20%)	Trusting (36%)
Two	Trader (9%)	Influencer (20%)	Convenience (16%)	Adversarial (12%)
Three			Autonomy (11%)	

Strategic Orientation

Principal component analysis demonstrated that overall producers are quite similar in their strategic orientation towards production and cost factors as no large variance in responses were received. However producers did differ in their orientation towards the consumer market (Market Focus), and whether or not they like the risk that comes from trading (Trader). This indicates that while production activities are generally important for all producers, it is the extent that producers consider the importance of marketing and trading that differentiates them the most.

Selling Behavior

Two components are found to explain the most significant amount of variance in responses for the selling behavior group. The first relates to how active a producer is in supporting and recommending their preferred meat processing company (Active). The second component measures how the producer perceives their level of bargaining power, leadership, and openness to new marketing plans (Influencer).

Values

Three components are found to explain the most significant amount of variance in responses for the values group. The first explains the majority of the variance and measured how conscientious (Conscientious) a producer is in relation to how much thought and effort goes in to making marketing decisions for their lamb, and how much the producer tries to produce lambs to preferred specifications. Producers with high Conscientiousness scores are much more likely to be willing to make changes to their business to improve the marketing of their lamb, and consider that differences exist between meat companies and the prices offered by companies.

The next component was Convenience. Producers with high scores for this factor prefer to use a third party agent to take care of the marketing arrangements, are not overly concerned with the quality of their lambs, and do not see value in spending time on marketing activities. The third component of Autonomy differed from the second primarily on the variables that they prefer to make their own decisions rather than use a third party agent, and more concern is placed on lamb quality. Both components had positive loadings for importance of being committed to a company, and selling to a cooperative. They both had negative loadings for perceived differences between companies and prices offered, which means if a producer believed differences exist, they would have a lower Convenience and Autonomy scores.

Relationship Status

Two components are found to explain the most significant amount of variance in responses for the relationship group. The responses for this group of questions are a combination of responses to questions based on the producer's main relationship for selling lambs (the meat company, a meat company representative, or a third party agent). The first component measured the quality of the relationship a producer had with their main sales relationship based on high levels of integrity, competence, honesty, and trust (Trusting). The second component measures how adversarial the relationship is (Adversarial). A high loading for this factor is put on seeing the relationship as a necessity due only to the level of dependency the producer has on the other party.

Regression Partitioning Models

Three regression partitioning models were created based on differences in producers' marketing strategies (refer to Appendix B for copies of the models).

The first binary model (Figure 6) examined differences between producers that always commit (Committers) and those that do not always commit (Non Committers and Sometimes Committers). A producer's score for Conscientiousness (end node D) and their location (end node C) were the factors that caused the most variance between producers that do and do not commit. To explain in more detail, at the top branch out of the 734 producers 45 per cent are Committers. The largest cause of differentiation between the two groups (Committers and Non Committers) is the producers' scores for Conscientiousness. Three-hundred and thirty three have low Conscientiousness scores of which 23 per cent commit, while of the 401 that have high Conscientiousness scores 63 per cent commit. At the left branch (Low Conscientiousness scores), Location is the only factor that can further differentiate Committers from Non Committers out of those with Low Conscientiousness. Out of the 333 that have a Low Conscientiousness score, 196 are in the East Coast, and 137 in Otago-Southland. Out of both of those groups, 13 per cent of the 196 in the East Coast are Committers, and 38 per cent of the 137 in Otago-Southland are Committers.

Caution in interpretation is needed however as it could be that producers that commit need to be more conscientious to fulfil their commitments, rather than the conscientiousness tendencies leading to a desire to commit. Nevertheless the model is designed to be exploratory in nature rather than predictive and therefore it is useful to understand the strength of the relationship between Conscientiousness and commitment.

The second model (Figure 7) analyzed different behavior of producers that always commit, by comparing those that make a high commitment (High Committers) with those that make a low commitment (Low Committers). High Committers are more likely to have a high Market Focus, and low Convenience and Autonomy scores. Convenience and Autonomy components were orthogonal in the PCA and it could be that producers with low scores for both do not value the use of a buyer to organize sales, but do not have a strong desire to have full control of decisions themselves either. This is illustrated through their higher level of commitment which places increased restrictions on their selling activities and reduced their control relative to Low Committers. Negative variable loadings for Convenience and Autonomy include the perception that prices are different between companies and that there are differences between companies. These beliefs are therefore important in differentiating High Committers from Low Committers.

The third model (Figure 8) analyzed behavior of Non Committers, by comparing the producers that switch companies (Switchers) and those that do not switch (Non Switchers). Switchers are more likely to have lower scores for Convenience and Conscientiousness, and higher scores for Trader.

Discussion

From a range of constructs and demographic variables, a limited number of strategic orientation and values constructs have the majority of influence in determining the difference between different types of marketing strategies. The profile of characteristics identified from this analysis of producers within each type of marketing strategy, are as follows:

High Committers are conscientious, and are the marketing strategy most interested in what is going on in the consumer market. This combination of traits means that they are willing and able to meet tighter specifications in terms of price and delivery. They see selling decisions as playing an important part of their overall business strategy, and will make changes to production activities that are tied in to marketing decisions. While these producers like to have involvement in the selling process, they do not require full control of the process and are willing to lose some control to be part of the bigger picture of delivering the required product to the market. Some control is given to processors in more coordinated and committed supply channels through commitment to dates and numbers of livestock delivered. High Committers place higher value on the services processors provide such as market information, producer groups and technology for feedback. These producers do not value the provision of a livestock drafter. They prefer to use the information available to make their own decisions.

The High Committers strategy is the most company focused marketing strategy. These producers are influenced by the provision of targets and rewards for meeting targets, partnership with the company, and any potential area for closer collaboration. These producers value a high level relationship with a meat company, and the drivers of this relationship are different than those producers who have dependent relationship with their buyer. There is potential to bind these producers in closer to the company by rewarding them for meeting more stringent delivery specifications, provision of more in-depth information above what regular suppliers get, and an increased level of services. This collaboration incentive needs to come from the meat company executive to be effective. There is potential to increase asset specific investments for these suppliers combined with more formal contractual arrangements that appeals to their higher level of conscientiousness. These producers had the lowest propensity to switch companies once they had committed at any price level examined illustrating their loyalty to a company and its strategy.

Low Committers have less desire than High Committers to be involved in market oriented activities but commit to decrease uncertainty and standardize selling decisions. Low Committers are more likely to commit for low or zero financial incentive, due to the non-pecuniary benefits commitment provides to them. Trusting relationships are important to Low Committers, primarily with a meat company representative. Low Committers had the highest scores for relationship quality and this in part reflects the dependence that these producers have with their buyer. Therefore the buyer may have a higher degree of influence over these producers than the High Committers. However the preference for autonomy and lack of market focus prohibits greater integration with the company.

Sometimes Committers were more likely to commit under a fixed price system than other committers. Price certainty is the main reason this marketing strategy committed rather than guaranteed processing space which was the main reason for High and Low Committers. Sometimes Committers have the lowest ranking for guaranteed processing space as a necessary service. This illustrates that these producers most likely operate farming systems that are not pressured to gain access to processing space. While these producers were drawn to committing for price certainty, potentially following a season of volatile or low prices, a proportion of these producers decided to stop committing. Reasons centered on an adverse weather event which resulted in producers deciding that committing did not suit their farming operation. Those

producers that entered fixed price contracts may have also experienced a year where the schedule price went above the fixed price, and felt that contracts were not worthwhile. Therefore these producers are particularly sensitive to committing and may illustrate the issue of compatibility of commitment programs to different farming systems, the need for flexibility and tailoring of programs to suit individual farm needs.

Switchers are characterized by their focus on trading. The Trader construct relates to attempting to maximize returns by buying and selling at certain times based on market conditions. This desire for flexibility in sales channels is an inherent difference from other marketing strategies. The ability to have full control and evaluation of a number of different selling channels is a pivotal part of this marketing strategy. These producers also have a higher level of bargaining power and influence in selling decisions. Switchers prefer to internalize uncertainty and feel that they are better equipped to deal with the potential for opportunistic behavior, and have greater information than other parties. The desire to retain control means these producers require the highest financial incentive to commit, and the preference for trading means these producers are most likely to switch companies for smaller financial incentives. Switchers place the most value on achieving the highest price, and are willing to trade this off against convenience, security and service. They feel little connection to any one company, and have little requirement for services provided by a company.

Non Switchers are characterized by not committing to one company yet having passive involvement in their selling decisions. The producers seem to be complacent in their selling decisions and prefer another party to take care of selling arrangements for them. This is related to their high score for convenience, and lower concern for trading than their Switcher counterparts. These producers are satisfied with their current selling plan, and have little desire to change. The provision of a livestock drafter is considered a very important service to be provided by a meat company as these producers prefer not to have to make these decisions themselves. Non Switchers generally do not like to be involved in selling decisions and commitment would increase the burden of selling decisions and potentially impact on their production activities.

So, with the exception of the sometime committers, while producers can make the same selling channel decision (commit or not commit), they carry out quite separate marketing strategies based on their level of buy-in to the channel, whether they are active or passive in their selling behavior (Figure 5).

	Commit	Non Commit
Active	High Committer	Switcher
Passive	Low Committer	Non Switcher

Figure 5. Marketing Strategy Matrix

This concept is inherently different to that of other vertical coordination theories (Schulze and Spiller 2006, Ferto and Szabo 2002, Wysocki et al. 2006) which consider the level of integration to be a linear progression from spot market to full integration between companies. The decision by producers whether or not to commit seems to be linked to their preference for dealing with uncertainty, while the level of buy in to a channel is determined by how active or passive the producer is in making selling decisions. Demographic variables such as age, education and size of farm were found have little effect differentiating marketing strategies.

The free range and seasonal nature of New Zealand lamb production leads to several uncertainties producers must deal with. These include access to processing space at peak supply periods and during drought conditions; uncertainties around how favorable production conditions will be from year to year; and market prices within and between seasons. Committers seem to externalize this uncertainty through secured processing space and fixed contract prices. They do this by transferring the production and market uncertainty to the processing company as a type of insurance. By removing this realm of uncertainty from their business, they can focus on controlling on-farm production factors. Non Committers seem to prefer to internalize uncertainty through maintaining control of selling decisions, or "self-insuring". These producers dislike the lack of control that comes with committing and prefer to keep this production and market uncertainty within the realm of their overall farm business. For Switchers, this allows them to make the most of uncertainty through trading. Non Switchers are already satisfied with their current arrangement and prefer the convenience that comes from not having to meet commitments. To these producers, commitment would potentially create increased uncertainty.

Producers also seem to differ in their desire and ability for involvement in selling decisions. An active involvement in selling decisions includes searching for market information, attempting to meet market specifications (either timing or specification of supply), and generally taking an active interest in where and how the lambs will be sold. This comes down to the selling decision playing an important overall role in the producers' farming business. Previous studies found that producers with more independence and market knowledge were more likely to use spot market transactions (McLeay and Zwart 1998; Fischer et al. 2007). The appeal of contractual certainty is seen to be reduced if a producer has the ability or desire to undertake other management strategies that increase market knowledge (Isengildina and Hudson 2001; Blandon, Henson, and Islam 2009; McLeay and Zwart 1998) and this is reinforced in this study through the Switchers marketing strategy.

In contrast a passive involvement attempts to minimize the amount of time and energy spent on selling decisions. This can be through a combination of outsourcing this task to a third party or company livestock representative and by keeping these decisions and activities as simple and standardized as possible. This reinforces previous studies findings that producers differed in their level of desire and ability for involvement in decision process for buying goods (Kool, Meulenberg, and Broens 1997; Feeney, Berardi, and Steiger 2011; Gunderson, Boehlje, and Gray 2005; Gloy and Akridge 1999; Bunn 1993; Diekmann, Loibl, and Batte 2009).

In terms of the nature of relationships it seems the level of dependence and collaboration relates more to the producer's active or passive involvement than the level of supply chain integration. It would seem that producers with passive involvement, the Low Committers and Non Switchers,

have more dependence on the other party. Close and trusting relationships play an important part of their marketing strategies due to this dependence. There seems to still be a level of collaboration between those with an active strategy and their buyer, yet the relationship does not play as large a role in the selling decisions. This is most likely at a company level in the case of High Committers, and with an independent agent in the case of Switchers. These result differ somewhat from previous theory that suggest relationship quality is determined by the level of integration (Ferto and Szabo 2002; Cox 2004; Fischer et al. 2007; Fischer et al. 2008; Gray, Boehlje, and Preckel 2006; Ivens 2004; Matopoulos et al. 2007; Peterson et al. 2001; Schulze and Spiller 2006; Trienekens and Beulens 2001; Wysocki et al. 2006; Young and Hobbs 2002; Zanquetto-Filho et al. 2003).

Seasonal grass-based production systems are the foundation of the cost efficiency of New Zealand's lamb industry. However the link between climatic conditions and lamb production creates uncertainty in the timing and quality of lamb production, processing plant efficiency and market prices. This uncertainty has been found to have a strong relationship with the nature of producers' selling decisions. Therefore it can be concluded that the seasonal nature of production and the uncertainty of climatic conditions does create unique factors that influence producers' selling decisions in comparison to other industries and countries. Furthermore a producer's marketing strategy is also influenced by their ability and willingness to be actively or passively involved in selling decisions and activities.

Implications

It is useful for policy makers, industry stakeholders, and processing companies to understand the differences in producers' marketing strategies. Producers differ in their choice of whether to commit to one company or not, and also in their desire for active or passive involvement in selling decisions. These preferences for involvement have a fundamental influence on a producers' selling behavior and will heavily affect the success of any efforts by parties to try to change producers' behavior. In particular, for some producers such as Switchers, committing to one company goes against core aspects of the strategic orientation of their business. For these producers the ability to remain flexible and have autonomy of selling decisions to be able to respond to changing climatic and market conditions is fundamental to their business strategy. Commitment can require more from producers than deciding to only sell to one company. Commitment can impose new requirements on producers such as needing to meet production targets. For some producers, particularly Non Switchers, this will create extra uncertainty.

Creating marketing strategy profiles and providing choice of company procurement programs may provide producers with options that better suit their strategic orientation and values. This research has identified the key factors of strategic orientation, values, selling behavior and buyer relationships and how they influence producers in each marketing strategy group. These factors influence how price sensitive producers are, how they are influenced by their main relationships, and potential drivers of behavioral change. Procurement programs could be designed to vary in the level of commitment necessary, which would relate to the level of risk and reward.

Conclusions

The research has identified why, and what influences why, producers in the New Zealand lamb supply chain commit their lambs to processors or not. It has shown that producers do not act in a homogenous manner. Interestingly only 19% of this sample of producers 'shop around', the rest either actively or passively commit their lambs through contracts or don't commit but don't change which company they sell to either, and are quite passive in their marketing activity. Importantly, for these producers it provides a better understanding of what drives the differences in producers' marketing strategies. The decision by a producer of whether or not to commit cannot be considered in isolation. This decision is interwoven within many other farm management decisions and therefore a holistic approach is needed to unravel the many elements that factor in to the individual producer's decision.

Producers carry out a range of marketing strategies defined by whether or not they commit to one company and secondly whether the producer is active or passive in their involvement in selling decisions. Producers' values and strategic orientation in their selling decisions were found to cause the most differentiation between marketing strategies. An association between the producers' marketing strategy and their desire to internalize or externalize the uncertainty associated with selling decisions was found. Furthermore, differences in the drivers of the marketing strategies present challenges and opportunities to influence producers' selling behavior. This is critical to the development of more collaborative transactions between producers and processors through improved relationships and more integrated and coordinated supply chains.

Acknowledgement

References

Beef & Lamb New Zealand Economic Service, Statistics New Zealand. 2011.

Beef and Lamb New Zealand. 2012. *Sheep and Beef Mid Season Update*. Wellington.

Blandon, J., S. Henson, and T. Islam. 2009. Marketing preferences of small-scale farmers in the context of new agrifood systems: a stated choice model. *Agribusiness* 25(2):251-267.

Boehlje, M. 1999. Structural changes in the agricultural industries: How do we measure, analyse and understand them? *American Journal of Agricultural Economics* 81(5):1028-1041.

Boehlje, M., & S.L. Hofing. 1999. *Value chains in the agricultural industries*. Department of Agricultural Economics Purdue University.

Boger, S. 2001. Quality and contractual choice: a transaction cost approach to the Polish hog market. *European Review of Agricultural Economics* 28(3):241.

Bunn, M. D. 1993. Taxonomy of Buying Decision Approaches. *The Journal of Marketing* 57 (1):38-56.

Clare, B., N. Shadbolt, and J. Reid. 2005. Supply base relationships in the New Zealand red meat industry: A case study. Paper read at 5th annual world forum, symposium and case conference of the International Food and Agribusiness Management Association, at Chicago.

Cox, A. 2004. The art of the possible: relationship management in power regimes and supply chains. *Supply Chain Management: An International Journal* 9(5):346-356.

Darnhofer, I., W. Schneeberger, and B. Freyer. 2005. Converting or not converting to organic farming in Austria: Farmer types and their rationale. *Agriculture and Human Values* 22 (1):39-52.

Davies, D., J. Eddison, S. Cullinane, and J. Kirk. 1999. Is livestock marketing channel utilisation influenced by marketing orientations of beef farmers? Paper read at Roots '99: The proceedings of the RICS Rural Research Conference held at Harper Adams University College, 20-21 April, 1999.

Diekmann, F., C. Loibl, and M.T. Batte. 2009. The Economics of Agricultural Information: Factors Affecting Commercial Farmers' Information Strategies in Ohio. *Applied Economic Perspectives and Policy* 31(4):853.

Fairweather, J. R. 1999. Understanding how farmers choose between organic and conventional production: Results from New Zealand and policy implications. *Agriculture and Human Values* 16(1):51-63.

Fearne, A. 1998. Building Effective Partnerships in the Meat Supply Chain: Lessons from the UK. *Supply Chain Management* 3(4):214-231.

Fearne, A., Hughes, D., & Duffy, R. 2004. Concepts of collaboration-supply chain management in a global food industry. *Supply Chain Management* 55-89.

Feeney, R., V. Berardi, and C. Steiger. 2011. Agricultural Input Market Segmentation in Argentina: How do Argentine farmers buy their expendable inputs? The Case of the Seed Industry. Paper presented at International Food & Agribusiness Management Association World Symposium, Frankfurt, Germany, June.

Ferto, I., and G.G. Szabo. 2002. The choice of supply channels in Hungarian fruit and vegetable sector. Paper presented at American Agricultural Economics Association Annual Conference, Long Beach, CA., USA, July.

Fischer, C., M.A. Gonzalez, M. Henchion, and P. Leat. 2007. Trust and economic relationships in selected European agrifood chains. *Food Economics-Acta Agriculturae Scandinavica, Section C* 4(1):40-48.

Fischer, C., M. Hartmann, N. Reynolds, P. Leat, C. Revoredo-Giha, M. Henchion, and A. Gracia. 2008. Agri-food chain relationships in Europe-Empirical evidence and implications for sector competiveness. Paper presented at 12th Congress of the European Association of Agricultural Economists – EAAE 2008.

Frank, S., & Henderson, D. 1992. Transaction costs as determinants of vertical coordination in the US food industries. *American Journal of Agricultural Economics* 74(2):41-50.

Gillespie, J., A. Basarir, and A. Schupp. 2004. Beef producer choice in cattle marketing. *Journal of Agribusiness* 22(2):149–61.

Gloy, B.A., and J.T. Akridge. 1999. Segmenting the commercial producer marketplace for agricultural inputs. *International Food and Agribusiness Management Review* 2(2):145-163.

Gong, W., K. Parton, R.J. Cox, and Z. Zhou. 2006. Transaction costs and cattle farmers' choice of marketing channels in China: A Tobit analysis. *Management Research News* 30 (1):47-56.

Gray, AW, MD Boehlje, and PV Preckel. 2006. Value chain risk and reward sharing and governance structures: Implications for industry strategy and structure. *Journal on Chain and Network Science* 6(1):45-54.

Gunderson, M., M. Boehlje, and A. Gray. 2005. Segmenting Agribusiness Customers on Their Capital Expenditures. Paper to be presented at the International Food & Agribusiness Management Association World Food and Agribusiness Symposium. June.

Hobbs, J. 1997. Measuring the Importance of Transaction Costs in Cattle Marketing. *American Journal of Agricultural Economics* 79(4):1083-1095.

Hobbs, J. 1996. Transaction costs and slaughter cattle procurement: processors' selection of supply channels. *Agribusiness* 12(6):509-523.

Hobbs, J. E., & Young, L. M. 2000. Closer vertical co-ordination in agri-food supply chains: a conceptual framework and some preliminary evidence. *Supply Chain Management: An International Journal* 5(3): 131-142.

Hughes, D. 1994. *Breaking with Tradition: Building Partnerships and Alliances in the European Food Industry*. Wye: Wye College Press.

Isengildina, O, and D Hudson. 2001. Cotton producers' use of selected marketing strategies. *J. Cotton Sci* 5:206–217.

Ivens, B.S. 2004. How relevant are different forms of relational behavior? An empirical test based on Macneil's exchange framework. *Journal of Business & Industrial Marketing* 19 (5):300-309.

James, H., P. Klein, and M. Sykuta. 2011. The adoption, diffusion, and evolution of organizational form: insights from the agrifood sector. *Managerial and Decision Economics* 32(4):243-259.

Joskow, P. 1987. Contract duration and relationship-specific investments: empirical evidence from coal markets. *American Economic Review* 77:168-185.

Kaufman, P. 1999. Food retailing consolidation: implications for supply chain management practices. *Journal of Food Distribution Research* 6-11.

Kool, M., M.T.G. Meulenberg, and D.F. Broens. 1997. Extensiveness of farmers' buying processes. *Agribusiness* 13(3):301-318.

Kwon, I.W.G., and T. Suh. 2004. Factors affecting the level of trust and commitment in supply chain relationships. *Journal of Supply Chain Management* 40(2):4-14.

Lambert, D., Emmelhainz, M., & Gardner, J. 1996. Development and implementing supply chain partnerships. *International Journal of Logistics Management* 7(2):1-16.

MacLeod, A., 2011. Red Meat Sector Strategy Report. Deloitte.

Matopoulos, A., M. Vlachopoulou, V. Manthou, and B. Manos. 2007. A conceptual framework for supply chain collaboration: empirical evidence from the agri-food industry. *Supply Chain Management: An International Journal* 12(3):177-186.

McDermott, A. 2012. Livestock procurement in New Zealand: Current challenges. *Journal of the New Zealand Institute of Primary Industry Management Incorporated* 21-25.

McDermott, A., S.J. Lovatt, and S. Koslow. 2004. Supply chain performance measures for producers and processors of premium beef cuts: A conjoint approach. *Journal on Chain and Network Science* 4(1):33-43.

McDermott, A., C. Saunders, S. Sinclair, M. Pereira, and S. Dowling. 2008. *Meat Sector Literature Review: Report for MAF*. edited by M. o. A. a. Forestry. Wellington: AgResearch.

McDermott, A., C. Saunders, E. Zellman, T. Hope, and A. Fisher. 2008. *The key elements of success and failure in the NZ sheep meat industry from 1980-2007*. Research Report - Agribusiness & Economics Research Unit, Lincoln University 308(viii):84.

McLeay, F., S. Martin, and T. Zwart. 1996. Farm business marketing behavior and strategic groups in agriculture. *Agribusiness* 12(4):339-351.

McLeay, F., and T. Zwart. 1998. Factors Affecting Choice of Cash Sales Versus Forward Marketing Contracts. *Agribusiness* 14(4):299-309.

Ministry of Agriculture and Forestry. 2009. Meat: The Future. Opportunities and challenges for the New Zealand sheep meat and beef sector over the next 10 to 15 years. edited by M. o. A. a. Forestry. Wellington: MAF Policy.

Noordeweir, T., John, G., & Nevin, J. 1990. Performance outcomes of purchasing arrangements in industrial buyer-vendor relationships. *Journal of Marketing* 54:89-93.

Osborn, R., & Baughn, C. 1990. Forms of interorganisational governance for multinational alliances. *Academy of Management Journal* 33(3): 503-519.

Palay, T. 1984. Avoiding regulatory constraints: contractual safeguards and the role of informal agreements. *Journal of Legal Studies* 13:265-287.

Peterson, H.C., A. Wysocki, and S.B. Harsh. 2001. Strategic choice along the vertical coordination continuum. *International Food and Agribusiness Management Review* 4(2): 149-166.

Philliber, S.G., M.R. Schwab, and G.S. Sloss. 1980. *Social Research*: FE Peacock Publishers.

Polson, M. 2012. Why Do 'Sometimes Committers' Commit Sometimes? A dissertation presented in the partial fulfilment of the requirements for the degree of Honours in Agricommerce, Massey University, New Zealand

Poole, N. D. 2000. Production and Marketing Strategies of Spanish Citrus Farmers. *Journal of Agricultural Economics* 51(2):210-223.

Sahin, I. 2006. Detailed revire of Roger's diffusions of innovations theory and educational technology-related studies based on Roger's theory. *The Turkish Online Journal of Educational Technology* 5(2):14-23.

Schulze, B., and S. Schlecht. 2009. Changing relationships in the meat industry: on the future of livestock marketing cooperatives in Germany. In *International PENSA Conference*. Sao Paulo, Brazil.

Schulze, B., and A. Spiller. 2006. Determinants of trust between buyers and suppliers in agribusiness: Empirical evidence from the German pork sector.

Stanford, K., J. Hobbs, M. Gilbert, S. Jones, M. Price, K. Klein, and W. Kerr. 1999. Lamb-buying preferences of Canadian abattoirs and producer marketing groups: implications for the Canadian supply chain. *Supply Chain Management: An International Journal* 4 (2):86-94.

Theuvsen, L., and A. Franz. 2007. The Role and Success Factors of Livestock Trading Cooperatives: Lessons from German Pork Production. *International Food and Agribusiness Management Review* 10(3):90-112.

Trienekens, J.H., and A.J.M. Beulens. 2001. Views on inter-enterprise relationships. *Production Planning & Control* 12(5):466-477.

Tsourgiannis, L., J. Eddison, and M. Warren. 2008. Factors affecting the marketing channel choice of sheep and goat farmers in the region of east Macedonia in Greece regarding the distribution of their milk production. *Small Ruminant Research* 79(1):87-97.

Wachenheim, C.J., R. deHillerin, and M. Dumler. 2001. Producer perceptions of hog marketing cooperatives. *Journal of Cooperatives* 16.

Williamson, O. E. 1998. Transaction Cost Economics: How It Works; Where It is Headed. *De Economist* 146(1):23-58.

Woldie, G.A., and ZEA Nuppenau. 2009. Channel Choice Decision in the Ethiopian Banana Markets: A Transaction Cost Economics Perspective. *Journal of Economic Theoiy* 3 (4):80-90.

Wysocki, A, H. Peterson, and S Harsh. 2006. Quantifying strategic choice along the vertical coordination continuum. In *Quantifying the Agri-Food supply Chain*, edited by C. Ondersteijn, J. O. Wijnands, R. Huirne and O. Kooten: Springer Netherlands.

Young, LM, and JE Hobbs. 2002. Vertical linkages in agri-food supply chains: changing roles for producers, commodity groups, and government policy. *Review of Agricultural Economics* 24 (2):428.

Zanquetto-Filho, H., A. Fearne, and N.D. Pizzolato. 2003. The measurement of benefits from and enablers for supply chain partnerships in the UK fresh produce industry. *Journal on Chain and Network Science* 3(1):59-74.

Appendix A

PCA Analysis Groups, Components and Variable Loadings

The tables below outline the components used in the modelling analysis for each of the four groups of questions. Each component had a loading for each variable in the group, however only loadings greater than 0.10 or the top ten loadings are displayed in the tables below. The number of components per group reflects the amount of variance explained by each component. The proportion of variance for each group explained by each component is illustrated below.

Table 3. Strategic Orientation Market Focus Construct Variable Loadings

Strategic Orientation - Market Focus	Comp 1
I only think about selling my lambs when I have lambs ready to be sold	-0.242
I enquire as to where my lamb is being consumed	0.212
I am actively involved in a producer group that is linked to a particular supermarket	0.187
I have made changes to my farming operation to better meet customer requirements	0.184
I can't worry much about marketing because my main concerns are the animals on the farm	-0.184
I have production targets I am aiming to meet each year	0.148
I have made substantial investments on my farm that tie me to a particular supply channel or company	0.142
If the price is right I don t care who I sell to	-0.135
I plan for the long term	0.132
There is little room to change my farming operation due to natural production constraints	-0.127
If an opportunity comes up to make an additional margin I buy stock even if it isn't part of my normal operations	0.124
I always use the latest technology on my farm	0.123

Table 4. Strategic Orientation Trader Construct Variable Loadings

Strategic Orientation - Trader	Comp 2
If an opportunity comes up to make an additional margin I buy stock even if it isn't part of my normal operations	0.517
If the price is right I don t care who I sell to	0.507
I only think about selling my lambs when I have lambs ready to be sold	0.387
I get a sense of anticipation at the beginning of each season to see what will happen in the market	0.233
I can't worry much about marketing because my main concerns are the animals on the farm	0.216
I am skeptical about the value of the latest market led supply programs	0.198
I have made changes to my farming operation to better meet customer requirements	0.184
Production systems take priority on my farm	0.163
I have production targets I am aiming to meet each year	0.163
I plan for the long term	0.129

Table 5. Selling Behavior Active Construct Variable Loadings

Selling Behavior - Active	Comp 1
I would sell to a processing plant further away than the local plant to sell to my company of choice	0.767
If I say I will send my stock to one company I will do so even if it turns out to be better to send them somewhere else on the day	0.518
I recommend my meat company to other farmers	0.374

Table 6. Selling Behavior Influencer Construct Variable Loadings

Selling Behavior -Influencer	Comp 2
In discussions with fellow farmers are you often used as a source of advice	0.738
I feel I have the following amount of influence on lamb sales negotiations	0.467
I am tempted to try out new supply plan options	0.377
I recommend my meat company to other farmers	0.116

Table 7. Values Conscientiousness Construct Variable Loadings

Values - Conscientiousness	Comp 1
It is important to be committed to one meat company	0.427
I regularly weigh my lambs or get them in to the yards to monitor when to sell them	0.381
If you were to select from several companies and supply plans available and they offered the same price would you say that you care a lot who you sell to	0.366
It's easier to let my buyer agent arrange when and where my livestock are processed	-0.343
I will only sell to a farmer owned cooperative meat company	0.336
I consistently target premiums for producing to the preferred range of weights and grades	0.283
The various companies and supply plans for lamb available are all different	0.243
I use information from my previous killing sheets to influence decisions about my next draft of lambs	0.225
You will always get better prices over a season by being able to play the market	-0.225
I would be ok joining a supply plan that requires me to change how I produce my stock	0.200

Table 8. Values Convenience Construct Variable Loadings

Values Convenience	Comp 2
It's easier to let my buyer agent arrange when and where my livestock are processed	0.630
I will only sell to a farmer owned cooperative meat company	0.587
It is important to be committed to one meat company	0.316
Prices offered by different meat companies are different	-0.248
The various companies and supply plans for lamb available are all different	-0.222
If prices are high I sell some lambs that may not meet preferred weight and grade ranges	0.202

Table 9. Values Autonomy Construct Variable Loadings

Values Autonomy	Comp 3
It's easier to let my buyer agent arrange when and where my livestock are processed	-0 540
Prices offered by different meat companies are different	-0.400
I regularly weigh my lambs or get them in to the yards to monitor when to sell them	-0.318
The various companies and supply plans for lamb available are all different	-0.306
I would be ok joining a supply plan that requires me to change how I produce my stock	-0.260
I use information from my previous killing sheets to influence decisions about my next draft of lambs	-0.248
You will always get better prices over a season by being able to play the market	-0.234
I will only sell to a farmer owned cooperative meat company	0.218
If prices are high I sell some lambs that may not meet preferred weight and grade ranges	-0.212
It is important to be committed to one meat company	0.207

Table 10. Relationship Trusting Construct Variable Loadings

Relationship Quality Trusting	Comp 1
I sometimes worry that the buyer will not act in my best interests	-0.341
The buyer understands how my business fits into the bigger picture	0.325
Sometimes I feel the buyer uses their power against me	-0.307
The buyer has broken promises in the past	-0.307
I have a high level of trust in the buyer	0.297
I feel like I could call anytime and be listened to	0.275
I make better sales decisions because of my buyer	0.272
My buyer and I share similar values	0.268
My business is important to the buyer	0.265
I depend on my buyer when making selling decisions	0.243
The buyer communicates with me as frequently as I think is necessary	0.237

Table 11. Relationship Adversarial Construct Variable Loadings

Relationship Adversarial	Comp 2
The relationship is mostly a marriage of convenience	0.478
I depend on my buyer when making selling decisions	0.436
I sometimes worry that the buyer will not act in my best interests	0.361
The buyer has broken promises in the past	0.316
I make better sales decisions because of my buyer	0.279
Sometimes I feel the buyer uses their power against me	0.278
My business is important to the buyer	0.243
The buyer offers me good prices relative to other buyers	0.207

Appendix B. Logistic Regression Models
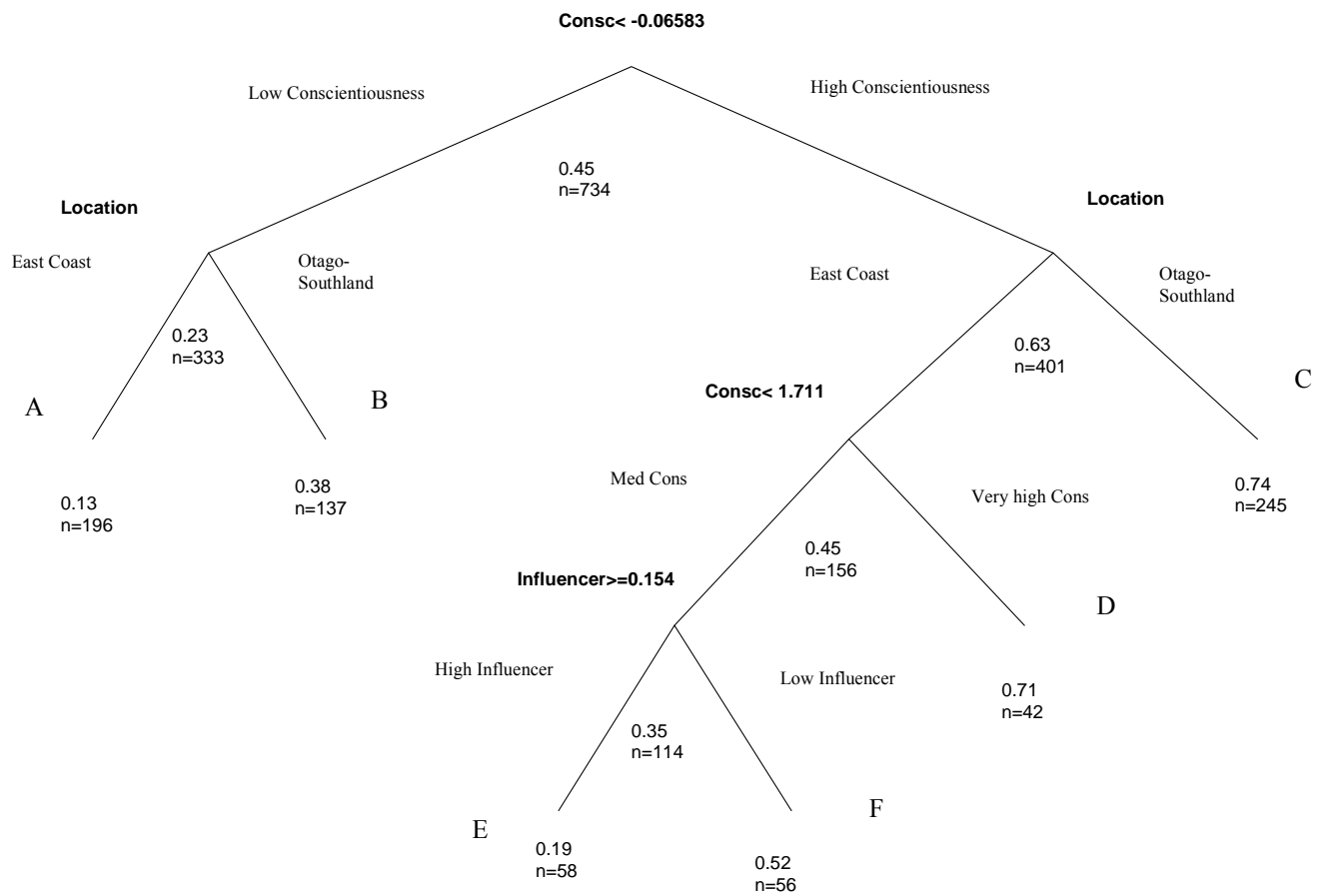
Figure 6. Model One: Likelihood Committer

Market< 3.407

Low Market   High market

0.40
n = 324

Conven>=-1.04   A

Med-High
Convenience   0.84
                                                                         n=37

0.35
n = 287

Market< -0.777   Low Convenience   **Auton>=0.5374**

Low market   Med market   Low Autonomy

0.29   High Autonomy   0.53
n=213   n = 74

B   **Auton>=-0.522**   H   **Trusting>=0.9333**

0.13   High Autonomy   Low Autonomy
n=78   0.35   0.62
                                                                                n=26   n = 48
                          0.38   J
Influencer< -0.8861   n = 135

                                            Conven< 0.7489   I
0.28   0.48
n = 95   Med Conv   High Conv   n=21   0.74
                                                0.60   n=27
C   n = 40

0.042   **Age=4,5,6**   F   G
n=24
              D   0.37   0.45   0.75
                      n = 71   n=20   n=20

              0.27   E
              n=44   0.52
                            n=27

Figure 7. Model Three: Likelihood High Committer (If Committer)

Conven>=1.746

High Convenience   Low-Med
                                                    Convenience

0.53
n=398

Location   **Trader< 0.3692**

Otago-   East Coast   Low Trader   High Trader
Southland   0.23
               n=48   0.57
                                                         n=350

               0.071   0.45   B   **Consc>=-1.791**   **Consc>=1.15**
A   n=28   n=20
                                               0.48   High   Low
                                               n=198   Conscientiousness   Conscientiousness
                                                              Low
               Influencer<   Conscientiousness   0.68
               1.229   n=152
                                          High   **Education=1**   I   **Auton>=-1.571**
               0.41   Conscientiousness
               n=146   0.3
                                                                   0.67   r̶9̶=23
       Cycle=1,2,4   C   G   n=52   0.73
                                                                                                        n=129
                                          0.68   H   **Market< -0.2955**   J
       0.36   n=22   0.56   0.67
Consc>=-0.3969   n=124   n=32   0.85   n=102   0.96
                                     D   n=20   n=27
                          0.58   **Cycle=1,3,4**   K
                          n=33
               0.29   0.54   0.83
       0.18   n=91 F   n=56
E   n=51   L   M   n=46
       0.18   0.35   0.67
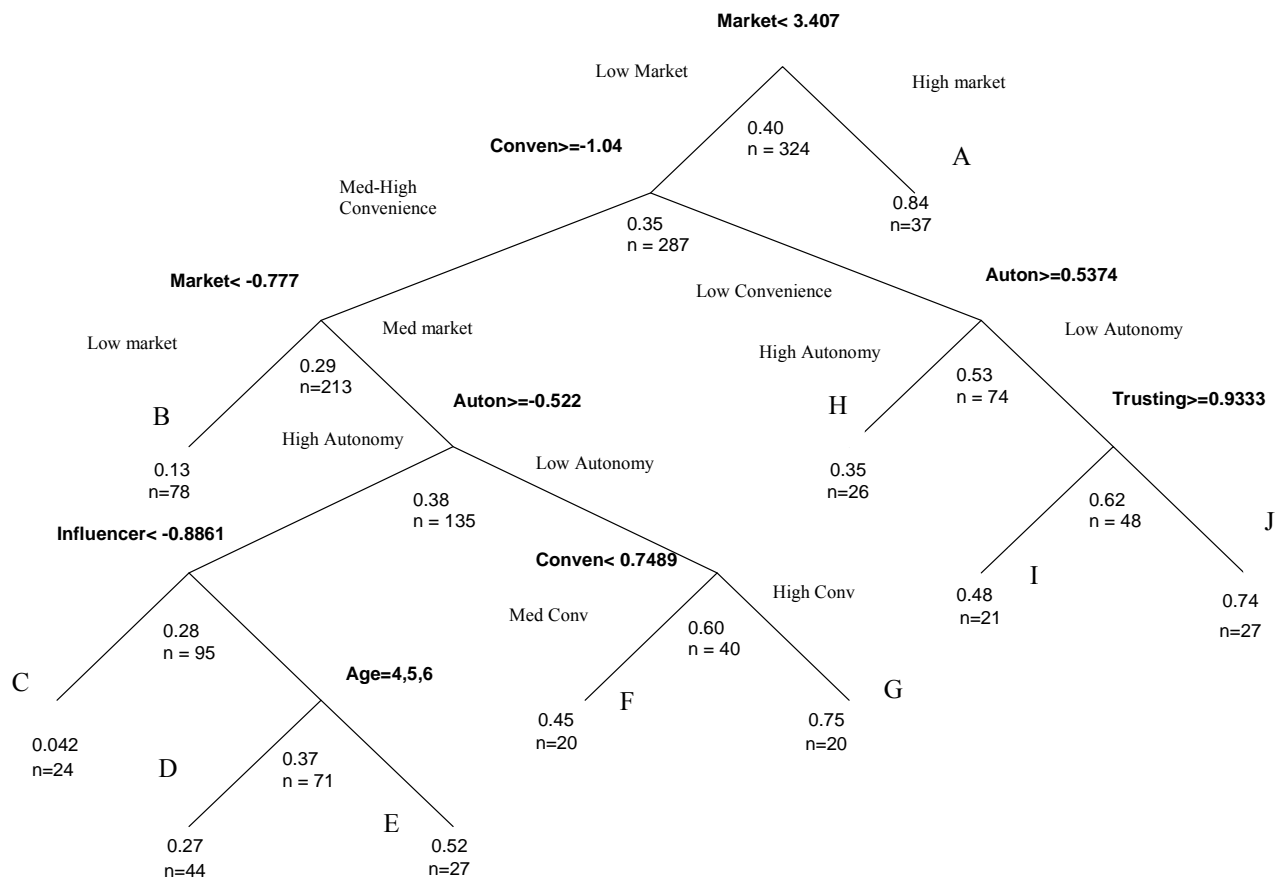   n=51   0.42   n=23   n=33
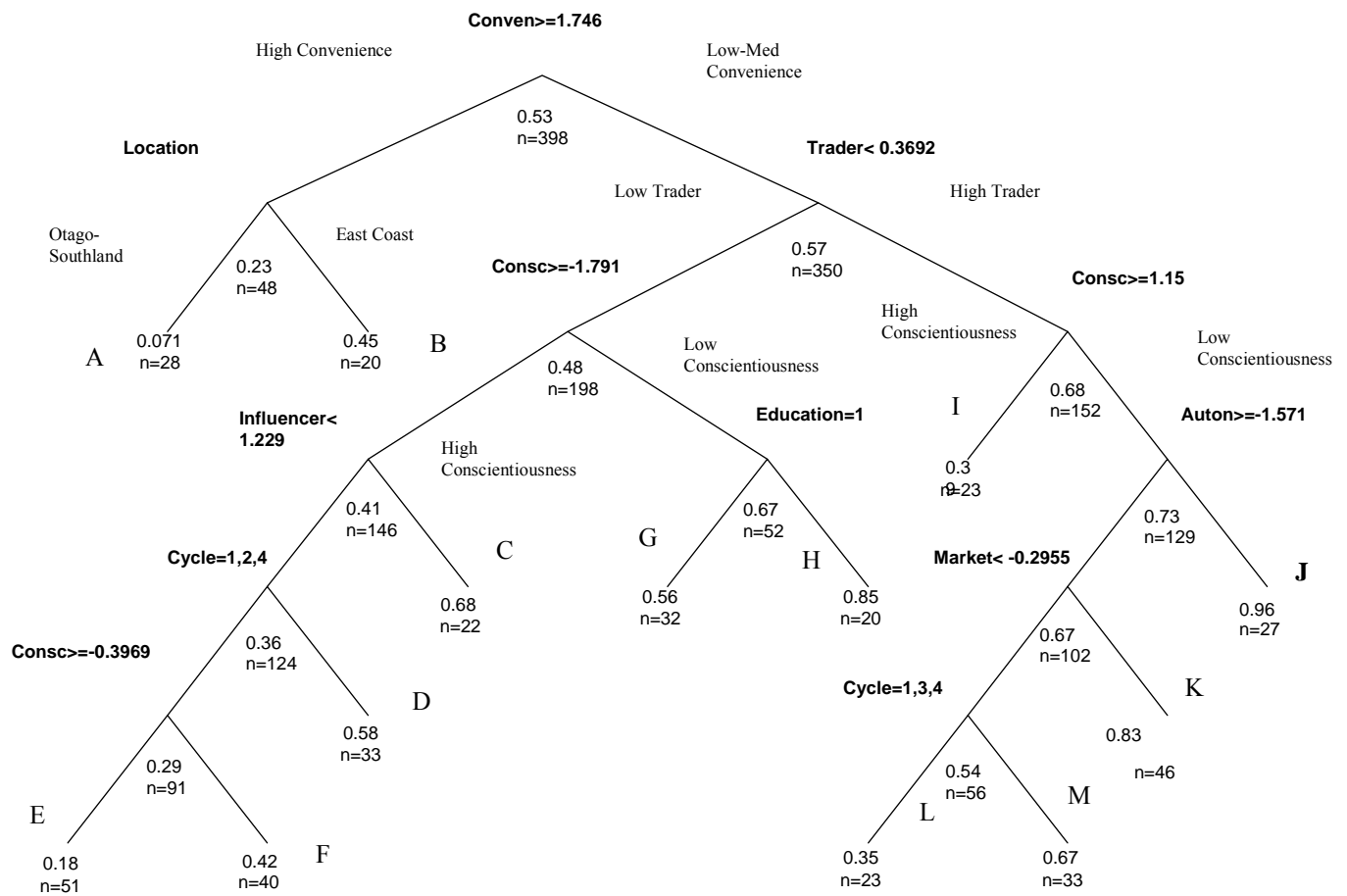   n=40

Figure 8. Likelihood Switcher (If Non-Committer)

Appendix C. Regression Modelling Variables

Table 12. Model Dependent Variables

Dependent Variable	Model One Commit/Not Commit	Model Two High Commit/Low Commit	Model Three Not Commit + Switch /Not Commit + Non-Switch

Table 13. Model Independent Variables

Independent Variables (for all three models)		
PCA Component Scores	Market, Trader Active, Influencer Conscientiousness, Convenience, Autonomy Trusting, Adversarial	
Relationship score for quality (out of ten)	1-10	1: Low Quality 10: High Quality
Demographics		
Location	Otago-Southland	East Coast
Business cycle	1:Entry 2:Consolidation	3:Growth/Expansion 4:Exit
Age	1:20-29 2:30-39 3:40-49	4:50-59 5: 60-69 6: 70+
Education	1:<1 year 2:1	3:2-3 4:4+
Debt as percentage of income	1: 0-9% 2:10-19% 3:20-29%	4:30-39% 5:40+%
Lamb sales as proportion of income	1:0-19% 2:20-39% 3:40-59%	4:60-79% 5:80-100%
Proportion of non-farm income as percentage of gross income	1:0-10% 2:10-20% 3:20-40%	4: 40-60% 5:60+%
Class	1: Hill country 2: Breeding Finishing	3:Intensive
Effective hectares	1:0-250 2:250-500	3:500+
Total stock units	1:0-2,500 2:2,500-5,000	3:5,000+
Sheep Stock units as proportion Total Stock units	1:0-19% 2:20-39% 3:40-59%	4:60-79% 5:80-100%
Total annual lambs sales	1:0-999 2:1,000-1,999	3:2,000—4,999 4:5,000+
Farm Owner-operator Number of people working on farm (including self)	1: Yes 1:1 2:1-2	2:No 3:2-4 4:4+
Experience (years farming)	1:0-5 2:5-10 3:10-20	4:20-30 5:30+