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Tutor: Örjan Sjöberg
Examinator: David Domeij
Discussant: Sebastian Östling.
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Why do seaweed farmers join farmer organizations?

Otto Rathsman[1]
MSc Thesis in International Economics
Stockholm School of Economics

ABSTRACT

This paper seeks to evaluate whether members of farmer organizations (FOs) receive higher seaweed prices than non-members. FOs have a good reputation among academics and policy makers for allowing farmers to achieve collectively what lies beyond the scope of the individual farmer, in some cases leading to higher prices. However, based on theory on quasi-credit contracts, cartels and adverse selection, this study predicts that cooperatives will not succeed in raising prices for seaweed farmers. This hypothesis is tested using data from a cross sectional survey of 91 seaweed farmers in Bali, finding no significant difference in mean prices for members and non-members. In fact, controlling for size, this study finds that members of FOs actually receive lower prices than non-members. Suggesting that farmers who earn lower prices are more likely to be attracted by membership in FOs. If this interpretation is correct, FOs play an important role in providing credit to the farmers who need it the most.

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[1] 20870@student.hhs.se

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Contents

Abbreviations and acronyms

ADB	-	Asian Development Bank
BI	-	*Bank Indonesia*
EAH	-	efficient alignment hypothesis
FAO	-	Food and Agriculture Organization (United Nations)
GoI	-	Government of Indonesia
KPRL	-	*Kelompok Petani Rumput Laut* (seaweed farmer group)
KUD	-	Koperasi Unit Desa (village cooperative unit)
LPD	-	*Lembaga Perkreditatan Desa* (village credit institution)
NGO	-	Non-government organisation
RC	-	refined carrageenan
RDS	-	Raw Dried Seaweed
SHG	-	self-help group
SRC	-	semi refined carrageenan
WB	-	World Bank

Weights & measures

d.w.	-	dry weight
ha	-	hectare
h.c.	-	harvest cycle
IDR	-	Indonesian Rupiah
kg	-	kilogram
km	-	kilometre
m	-	meter
USD	-	United States Dollar
t	-	ton (metric)

1. Introduction

A study on the ability of farmer organizations (FOs) to generate economic benefits for seaweed farmers is warranted for at least three reasons.

First, there is a consensus among agricultural policy makers, government as well as non-government organizations (NGOs), that FOs can generate economic benefits for farmers and their respective markets (Coordinating Ministry for Economic Affairs 2011 p. 149, Neish 2009 p. 40). Underlying this perception is a wealth of empirical evidence, and the prevalence of FOs in agriculture has received a lot of attention in economics, especially in the context of economic development (Bijman & Wollni 2008 p. 2). Second, the organization of seaweed farming into small-scale family farms, rather than corporate, "plantation-style", farms is seen as providing better incentives for farmers (McHugh 2003 p. 56). However, small-scale farming also prohibits farmers from taking advantage of economies of scale, such as in marketing. Cooperatives could provide a way of combining the best of both worlds (Valderrama et al. 2013 p. 42).

Third, notwithstanding the enormous positive impact seaweed farming has had on thousands of coastal communities in developing countries, the industry has suffered from volatility in prices and quality, sometimes with devastating consequences. For example, in 2008 – despite excellent (and unchanged) natural conditions – seaweed production in Sabah (Malaysia) collapsed because of quality problems, falling prices and "communication breakdowns" between farmers and buyers (Bahron 2013, presentation at the 21st International Seaweed Symposium). Researchers and policy makers have become increasingly aware that social conditions, in addition to natural conditions, are crucial for seaweed farming to prosper and it has been suggested that FOs could help secure consistent prices and quality to mutual benefit for farmers and their end consumers, processors (Valderrama et al. 2013 p. 52).

However, the experiences of FO's in the seaweed industry have been mixed. In some locations, FOs represent an important marketing channel for seaweed farmers, allowing members to earn higher prices by circumventing one or two layers of middlemen (Hurtado 2013 p. 105). Furthermore, a study from Tanzania showed that, by organizing into a credit cooperative; seaweed farmers were able to achieve higher prices by eliminating their dependency on traders for credit (Msuya et al. 2007). However, FOs in Tanzania have also been criticized for being artificial constructions formed on the initiative of aid donors rather than farmers themselves (Valderrama et al. 2013 p. 42) and in the Philippines, direct sales arrangements through FOs have had only limited success (Hurtado 2013 p. 105). Seen in terms of the industry as a whole, marketing through FOs reflects the exception rather than the

norm, causing some industry observers to conclude that individual farmers may obtain better results than farmers working collectively (ibid).

It is often taken for granted that more direct value chains between farmers and their end consumers (processors), whereby FOs play a key role, are of mutual benefit to farmers and processors (Valderrama et al. 2013 p. 52). However, as Valderrama et al. point out, "disintermediation" does not eliminate the need to trade and the activities involved, such as post-harvest treatment, packaging, consolidation and quality control, but rather shifts the burden of these responsibilities to farmers or FOs. The advantages FOs have over traders with respect to these functions is unclear. Furthermore, traders often provide farmers with credit (McHugh 2003 p. 60, Valderrama et al. 2013 p. 14), a practise that has received a lot of criticism for putting farmers at a disadvantage. However, although credit cooperatives have enjoyed some success, like in Tanzania, collector-credit remains status quo for many farmers and the view that collectors are an integral part of the seaweed value chain is gaining some traction (Neish 2004a p. 8).

A review of the literature on agricultural cooperatives quickly instils the fact that FOs *can* generate a multitude of economic and non-economic benefits for farmers, their communities and consumers [Mather & Preston (1990) discuss the benefits and limitations of FOs]. This paper seeks to evaluate whether members of FOs receive higher prices than non-members, thereby providing (or ruling out) a reason for why farmers join or establish cooperatives. The literature on cooperatives suggests two means by which farmers can achieve higher prices through membership in FOs, collective bargaining and improved quality (Mather & Preston 1990). However, it has also been shown that FOs can help seaweed farmers receive higher prices through providing them with credit, increasing their bargaining power vis-à-vis local traders. Each of these three propositions are evaluated independently in the context of seaweed farming.

Research question: Do members of FOs receive higher prices than non-members?

The paper is structured as follows. The first section describes the data collection method. Section two covers some basic theory on FOs, their benefits and limitations and outlines the theoretical approach used in this paper. Third, seaweed farming is introduced, its significance for rural economic development; and some more in more in-depth topics so that price and quality issues can be understood more clearly. Having discussed the particulars of seaweed farming, I turn the propositions above, on how FOs might generate higher prices for farmers. These propositions are evaluated independently, resulting in hypotheses, which are tested in the last section.

2. Data Collection

To answer the research question, a field study in Nusa Penida was conducted in April 2013, the site where seaweed farming was first introduced to Indonesia and where seaweed farming is the principal source of employment and income (Burges Watson 1999 p. 34). Data collection consisted of three parts,

1. A stratified random sample of seaweed farmers from three different villages where seaweed farming is widespread. The purpose of the sample was to obtain a data set for testing for differences in price between members and non-members. In total, this survey generated 91 respondents, 42 members and 49 non-members. Each farmer was asked to complete a questionnaire, which can be found in both the original version and English translation in Appendices 2A and 2B respectively.

2. Second, a focus group meeting was held with the leaders of 11 FOs aimed at better understanding their underlying motivations for heading their respective organizations, the functions of their cooperatives and perceived benefits and limitations. The leaders were asked to compete a questionnaire with questions regarding their FOs such as, the date of establishment, number of members, original motivation for creating the group, current functions, and perceived challenges. The original questionnaire and English translation can be found in the Appendix (3A, 3B).

3. Finally interviews, on and off site with collectors, traders, village leaders, NGO staff, and others, such as diving instructors and hotel employees provided me with the basic information on seaweed farming and it's socio-economic dimensions necessary for carrying out this study and knowing which questions to ask. On-site interviews include those with collectors and traders, village leaders and NGO staff. Interviews off-site were held at mainly at the 21st International Seaweed Symposium in Nusa Dua, Bali in April 2013 and consisted of discussions with seaweed experts, NGO staff and policy-makers. Furthermore a meeting was held with the Vice President of Bank Indonesia (BI), a state-owned bank that provided me with valuable information on Indonesian economic policy with respect to seaweed farming, where the "pilot project in Sumenep" (Java) was used as an illustrative example. Key slides of the presentation are included in the Appendix (3).

Currencies are reported in Indonesian Rupiah (USD 1.00 = approx. IDR 9800 at time of writing) unless otherwise stated.

3. Theoretical framework

Farmer organizations[2] (FOs) are often conceived as self-help initiatives (Helmberger & Hoos 1962 p. 1430), whereby farmers achieve (or try to achieve) some goal that can be more readily reached collectively than individually. It follows that FOs are as diverse as the difficulties they hope to overcome. Given the variation underlying farmer cooperation, definitions of FOs tend to avoid identifying these by specific functions, such as joint marketing or collective bargaining, referring instead to more general "cooperative principles" such as the definition proposed by Dunn (1988),

> **1** A cooperative is a user-owned and controlled business from which benefits are derived and distributed on the basis of use. (**Dunn 1988)**

That said, within FOs, a few types are discernible – such as producer organizations (POs), which have the function of marketing their members produce, often acting as an intermediary between farmers and their customers downstream (Bijman 2012a p. 19). Other types of FOs include farmer unions, which typically have political rather than economic goals, and bargaining associations, where the FO bargains on behalf of its members, typically without assuming ownership of the product at hand (Bijman & Wollni 2008 p. 3). However, to emphasize such "functions" can be misleading since many functions of FOs go unstated, such as information sharing, for example, which, although elemental, can be equally or more significant to the nature of cooperation. Furthermore, although economic FOs are typically distinguished from political FOs, in practise many FOs combine economic, political and social functions, especially in developing countries (ibid).

Economic incentives thus represent a subset of motivations underlying farmer cooperation. Non-economic motivations include solidarity, community empowerment and spiritual motivations (Leather 2006 p. 668). However, as the definition above suggests, economic incentives are considered important. Mather & Preston (1990 p. 2) note that, "farmers usually judge the benefit of belonging to a cooperative by its net margins or savings – a tangible measure". Leathers (2006 p. 668) identifies three categories of economic motivations for cooperative membership, (1) when marketing costs are lower with a cooperative, (2) when cooperative marketing reduces marketing risk and uncertainty faced by risk averse farmers and (3) when selling prices are higher with a cooperative; where this paper focuses on the latter.

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[2] Farmer organizations go by many names, see Bijman & Wollni (2008 p. 3) for a summary of the variation in terms used in the literature. In this thesis the term farmer organization is used because it corresponds to the Indonesian term "Kelompok Petani Rumput Laut", which literally translates to "Group Farmer Seaweed". However in some cases the term cooperative is used interchangeably with FO.

Benefits

On a fundamental level, FOs enable farmers to take advantage of economies of scale, which can take many different forms – from insurance to simple forums of exchange, where the dissemination of information among farmers reduces uncertainty and increases awareness of new farming techniques (for example). As a result, FOs have been associated with a proliferation of economic and socio-economic benefits such as, higher sales prices, increased competitiveness, improved quality, reduced risk, diversification into downstream value-adding activities, improved credit and market access, ownership and democratic control, assured markets and sources of supplies, legislative support and local leadership development (Mather & Preston 1990). Or none at all, if the FO is "a cooperative" in name only. Given the large number of qualities ascribed to FOs, they are popular policy tool among governments and NGOs, especially in developing countries where farmers are especially vulnerable to economic hardship (Bijman & Wollni 2008 p. 2).

> **2** The importance of agricultural cooperatives in improving the lives of millions of smallholder farmers and their families cannot be overstated… Empowered by being a part of a larger group, smallholder farmers can negotiate better terms in contract farming and lower prices for agricultural inputs like seeds, fertilizer and equipment. In addition, cooperatives offer prospects that smallholder farmers would not be able to achieve individually such as helping them to secure land rights and better market opportunities. **(FAO 2011)**

There is a wealth of empirical evidence to suggest that FOs can generate benefits for farmers. For example, Singh (2006) argues that FOs in organic cotton industry in India have been crucial in allowing farmers to upgrade and break into international markets. Francesconi & Reuben (2007) find that among Ethiopian dairy farmers, members of FOs were, on average, more successful in terms of commercialization than non-members. However, large variations in the ability of FOs to generate economic benefits for their members are a sobering reminder that FOs also face limitations (Mather & Preston 1990 p. 1).

Limitations

According to Mather & Preston (1990 p. 16), FOs face two types of limitations, general limitations; "the same economic forces, laws, and human relationships that contribute to the success or failure of other types of businesses" and limitations *intrinsic* to FOs. Intrinsic limitations include (1) those associated with nature of agricultural industry as a whole, such as imperfect competition, and (2) the inherent nature of cooperative organizations (FOs), such as democratic decision making, a common attribute among FOs that has both strengths and weaknesses.

This distinction, between external and internal limitations. bears a relationship with the factors Bijman et al. (2012 p. 16) suggest determine the performance of FOs, (1)

internal governance (2) institutional environment/ policy measures and (3) position in the food chain. Where internal governance refers to “the decision-making processes adopted, the role of different governing bodies and the allocation of control rights to members and professional management”. Institutional environment refers to the “social, cultural, political and legal context in which cooperatives operate”. Third, “the position of the cooperative in the food chain” refers to “the competitiveness of cooperatives vis-á-vis its partners, such as processors, wholesalers and retailers”.

Approach

In evaluating the ability of FOs to generate higher prices for seaweed farmers, each of these three perspectives could be used.

As Valderrama et al. (2013 p. 52) suggest, a study into the internal governance of seaweed FOs and how they relate to performance would undoubtedly yield important insights into the distinguishing traits of successful FOs, such as with respect to the organization of decision-making and the distribution of risks and benefits. Furthermore, evidence suggests that institutional environment has a significant impact on the organization of seaweed farming. For example, in locations where seaweed farmers are predominantly Muslim, women generally do not take part in farming, whereas in many other places, such as Zanzibar and Bali, women often play a central role (Neish 2008a p. 15). Another example of the effects of social institutions on seaweed farming can be found in Kiribati (small group of islands in the Pacific Ocean), where a strong sense of equality prohibits buyers from paying different farmers different prices (McHugh 2006 p. 18). This paper, however, takes the third approach suggested by Bijman (2012); that the ability of FOs to generate benefits for members depends on the competitiveness of FOs versus other forms of organization.

The competitiveness of an organizational form is closely related to the concept of “governance”. In 1937 Coase pointed out firms and markets are alternative ways of doing the same thing, namely coordinating economic activity. This insight was taken a crucial step further when Williamson developed a framework for relating transactions to forms of organization, or “governance structures”. The fundamental hypothesis underlying TCE is that, given a certain environment; a certain way of organizing transactions (governance) arises naturally, with the effect of minimizing transaction costs (Williamson 2009 p. 465). This hypothesis, sometimes known as the efficient alignment hypothesis (EAH), has received broad empirical support and has been applied by a number of studies on the competitiveness of FOs versus other forms of organization (e.g. Bijman & Wollni 2008, Leather 2006, Kassam 2011).

Turned around, the EAH states that we can *infer* from the governance apparatuses "chosen" to mediate transactions, such as markets, firms or FOs, that these have not developed randomly, but are the result of a complex optimization process where the nature of the transactions involved, in terms of asset-specificity, uncertainty and transaction frequency, go to the heart of the equation. TCE is therefore useful for distinguishing between different forms of economic organization and the reasons for their existence. However, although the EAH can help us understand why certain governance structures develop in certain environments, it does not predict which side of the transaction will benefit, or how.

TCE describes how the nature of transactions, in terms of asset-specificity, uncertainty and frequency determine which governance structures (firms, markets or hybrids such as cooperatives), will be used to mediate transactions, *assuming* that the transacting parties have something to gain from exchange. However, TCE does not predict when parties have such an incentive. The literature on FOs does; suggesting economic incentives and specifically higher prices are an important reason for farmer cooperation (Leathers 2006). Ultimately whether FOs prove a competitive form of governance will depend on their ability to minimize transaction costs versus other forms of organization, however in evaluating whether farmers can receive *higher prices* the literature suggests three means by which this can be accomplished (1) reduced dependency on local traders for credit (increased *individual* bargaining power vis-á-vis traders), (2) collective bargaining (increased *collective* bargaining power), (3) improved quality/ quality control. These mechanisms, although sharing the same result are theoretically detached and therefore evaluated independently in the context of seaweed farming. The purpose of the next section is to describe that context.

3 Context

The seaweed[3] industry[4]

Seaweeds are an important source of food for millions of people, particularly in Asia and for sushi-lovers. However, compounds extracted from seaweeds, "hydrocolloids", are used in many products that we use on a daily basis, such as, dairy products, cosmetics, and toothpaste, where seaweed stops the toothpaste from drying inside the tube (Burges Watson, pers. comm.). The seaweeds concerned in this paper, *Kappaphycus Alvarezii* (known as cottonii) and *Euchema Denticulatum* (known as spinosum) are used to extract carrageenan, a type of hydrocolloid. In future references these will be referred to as cottonii and spinosum as they are known to the trade, and to seaweed farmers around the world. Also, for the remainder of this thesis, seaweed(s) can be understood to refer to these two species only, unless otherwise stated.

Seaweed *farming*

Prior to 1971, demand for carrageenan relied on harvests of a variety of "wild" (non-cultivated) seaweeds from around the world (Valderrama et al. 2013 p. 4). However, this picture changed radically when cottonii was successfully cultivated for the first time in the Philippines, where the species is native. Launched by this discovery, seaweed farming spread rapidly – reaching Indonesia in 1975, Malaysia 1977, China 1985, Tanzania and India 1989 and Madagascar 1998 (Neish 2008a p. 8). In fact, attempts to farm cottonii have been made in 29 countries, although farming on a commercial scale currently only exists in those countries listed. In Indonesia, seaweed production was first introduced on the island of Bali (at the site chosen for this study), since then, seaweed farming has reached even the most remote parts of the archipelago. The largest production regions in Indonesia are, South Sulawesi, Bali and West Nusa Tenaggara, East Nusa Tengara, and Madura (Java) (Neish 2013 p. 59).

Since the discovery that cottonii, and its relative spinosum, could be farmed, production of carrageenan has increased exponentially. Commercial seaweed farming now accounts for more than 90% of carrageenan supply with Indonesia and the Philippines accounting for vast majority of supply, with 61% and 32% of the

[3] "Seaweed" is a term used to describe the plethora of aquatic plants that live in the world's oceans. The more technically correct term, "macro-algae" is equally uncomplimentary, and therefor throughout this thesis, against my better judgement, I resort to the word seaweed.
[4] The purpose of this section is to provide cursory background for readers who have never heard of seaweed farming. For a comprehensive view of the global seaweed market "A guide to the seaweed industry" by McHugh (2003) for the Food and Agricultural Organization (FAO) is very useful.

market respectively (Valderrama et al. 2013 p. 6). According the FAO, carrageenan seaweed production increased by a factor greater than five between 2000 and 2010 (ibid p. 5), however, both the magnitude and distribution of seaweed production is broadly disputed among organisations (Panlibuton et al. 2007 p.11). Nevertheless, there is some consensus that global production of carrageenan seaweeds is around 200,000 tons dry weight (d.w.) per year (Panlibuton et al. 2007 p. 6), bringing the value of the carrageenan market to USD 375 million (ibid p. iv), which represents roughly 6% of the USD 6 billion global seaweed market.

Social impact

The carrageenan seaweed farming industry generates roughly USD 100 million in farm-gate revenues (Neish 2008a p.6). Given that seaweed production only exists in coastal (rural) areas in developing countries it goes almost without saying that the emergence of the industry has had a profound impact on hundreds of thousands of people and their communities. In Zanzibar, for example, seaweed farming is now the second largest export earner after tourism, accounting for 90% of marine export products and providing employment for roughly 15,000 – 20,000 families (Msuya et al. 2011 p. 1). In the Philippines, it is estimated that 100,000 – 150,000 people are employed in seaweed farming and that the industry creates an additional 50,000 – 70,000 jobs in ancillary businesses such as collecting and trading (Valderrama et al. 2013 p. 37).

Blankenhorn (2007) describes the impact of seaweed farming in Puntondo (Sulawesi, Indonesia). Where ten years after the introduction of seaweed farming, 94% of households were employed in seaweed farming, accounting for 81% of average household income. Similarly high rates of adoption are also described in Sievanen et al. (2005), who refer to a number of studies from Northern Sulawesi and the Bohol province in the Philippines. Pollnac et al. (2001) find a statistically significant relationship between the size of the farm and material style of life ("MSL"), making the link between seaweed farming and economic growth/development explicit. In addition to employment and income, several evaluations of the economic effects of seaweed farming have documented profound impacts on the communities where seaweed farming is adopted[5]. Neish (2008a p. 15) describes these as "multiplier effects". Lowe (2003), for example, documents how income from seaweed farming allowed a community to build new schools, Mosques and health centre.

[5] Unless production reaches a critical level that makes it profitable for traders to serve a location, seaweed farming will not be established there. Seaweed farming is therefore usually a community endeavour (McHugh 2006 p. 30).

Given its positive social impacts, governments as well as NGOs in several developing countries with suitable coastal environments are actively promoting the development of seaweed farming. In many cases, support is channelled through FOs. Krishnan (2013), for example, reports that self-help groups (SHGs) have been a critical channel between seaweed farmers and policy-makers in India. Indonesian economic policy, in particular, is highly decentralized, and FOs are expected to play an important part in the development of seaweed farming and aquaculture in general (Nurdjana 2006). Policy-makers have reason to be optimistic, demand for carrageenan is projected to continue to rise steadily, partly in response to increased meat and dairy consumption from China (McHugh 2003) and Indonesia in particular, is well poised to take advantage of these developments, with the second largest coastline in the world, a large rural population, low labour costs and as-good-as-they-get conditions for seaweed cultivation.

Problems

Notwithstanding the enormous positive impact seaweed farming has had on the lives of hundreds of thousands of people, it has also been associated with some negative social aspects, such as child labour issues and marital tensions in cases where women seaweed farmers become the main income earners in the family (Neish 2008a p. 15) Furthermore, although seaweed farming is generally perceived as an environmentally sustainable activity, partly through a reduction in unsustainable fishing, in some places seaweed farming has had a negative effect on the environment. For example, in Nusa Penida farmers have removed coral to make way for farming areas. A practise that has been blamed for the erosion of beaches, leading to tensions between seaweed farmers and tourism-based businesses, such as dive-shops (personal observation).

However, a perception shared by many in the market, including farmers, processors and industry analysts is that the main problems in the seaweed industry are volatile prices and inconsistent quality (Valderrama et al. 2013 p. 11). Many factors contribute to these problems, including speculation on the price of carrageenan and uneven supply owing to severe variations in weather (e.g. typhoons). However, the problems of price and quality volatility are often considered endemic to the seaweed industry.

Given the low capital requirements involved with seaweed farming, farmers can quickly respond to higher prices, in some cases by harvesting seaweed early, resulting in low quality (ibid p. 12). Due to the large number of intermediaries (traders) in the seaweed market, processors receive this information after a lag, at which point the price for seaweed falls drastically. These types of “busts” have caused seaweed farming to disappear from some locations, despite having gotten off to a promising start. Policy-makers are therefore growing increasingly curious as to whether FOs

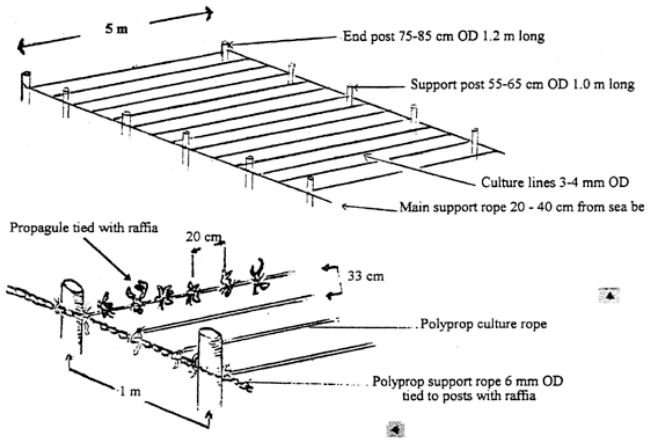
could improve these endemic problems through creating more direct value chains between farmers and processors. However, in order to understand price and quality issues more clearly it is necessary to know a little more about seaweed farming, and the market farmers face. The subsequent sections deal with these issues.

The off-bottom method

The most common methods for cultivating carrageenan seaweeds are the off-bottom and the floating-raft methods (McHugh 2003 p. 55). However, I limit my description to the former, given that this method accounts for the total of seaweed production at the site chosen for the survey. This section corresponds with the description by McHugh (2003) p. 55 – 58.

Put simply, the "off-bottom" method implies tying cuttings from healthy plants (also known as propagules) to lines, which are subsequently suspended just above the seafloor ("off-bottom"). The materials required are simple in nature; wooden stakes, nylon lines, plastic "raffia" for tying seaweed to line, propagules and preferably, depending on the location of the farm, a small boat.

Figure 1. Off-bottom method



Source: FAO (2003)

Once "culture lines" have been prepared with propagules, they are suspended approximately 30 cm off the seafloor using wooden stakes connected by "support lines", which act as a frame holding the lines in place. The length of culture lines depends on local conditions, but 5 – 10 m is common. The tide determines when work in water can take place, when the tide is high the distance to the bottom means that plants are much less accessible. When the tide is low, during the day or at night, farmers will work on their plots for anywhere up to eight hours per day (Burges Watson 1999 p. 29).

After 6-8 weeks the seaweed is mature and the lines can be removed (harvested) and replaced with new lines with fresh propagules (McHugh 2003 p. 55). The harvest cycle for seaweed is thus relatively short compared with other agricultural commodities, such as rice (4-5 months), for example. Furthermore, it is often assumed that seaweed can be cultivated regardless of season, giving approximately 9 harvests per year. However, generally speaking, yields during the rainy season are significantly lower, and in some places seaweed farmers will abandon farming altogether during this period, or move the location of the farm (Blankenhorn 2007 p. 37). Neish (2013 p. 6) reports that harvests can be 2.8 times average in the best season and 0.42 times average during the worst season, leading to substantial variations in income.

After harvest the crop is transported back to the beach where it is unloaded and carried inland. Assuming the dimensions of the plot in Figure 1., (a small plot), the harvest would weigh 375 kg straight out of the water[6]. Carrying 60 kg of seaweed at a time would imply six trips to and back from the drying location and as a result, seaweed is often dried close to the beach. There the seaweed is untied from the plastic raffia and spread out on the ground or on tarps for drying. During the drying process the seaweed is turned over regularly using rakes to ensure a uniform degree of moisture. Once the seaweed reaches 40% moisture content it is ready for sale[7], this takes approximately 2-3 days depending on the weather and the amount of sunlight. At this point the weight of the harvest is roughly 1/8 of what it was fresh out the water, and is known as Raw Dried Seaweed (RDS).

The main difficulty involved with seaweed farming lies in finding a site where seaweed will thrive. Conditions that affect the suitability of a location, although not completely understood, include the level of nutrients in the water, current, bottom composition and water temperature, light exposure and water salinity (Doty 1987 p. 5). Suitable spots are therefore found by trial and error and farm dimensions, in terms of the length and width of plots, require adaptation to particular sites and conditions, which may or may not be seasonal. Risks to seaweed farming can be categorised into natural risks and economic risks (Firdausy & Tisdell 1999 p. 64). Natural risks include diseases, grazing fish/turtles and bad weather like typhoons. The main economic risks is price volatility, as farmers do not know what price their harvest will fetch once it is dry and marketable.

[6] 15 lines, each 5 m long with line spacing of 0.5 m, propagules spacing of 0.2 m gives 375 plants.
[7] 40% moisture reflects the optimal compromise between risk of rotting in transport and the ease with which it can be compressed into bales.

Quality

Quality affecting variables can be grouped into those within the farmers control and those without. Where examples the latter are mentioned in the previous paragraph. The main quality-affecting variables under the farmers' control are, maintenance, harvest cycle and post-harvest treatment.

Regular maintenance of farms is crucial to ensuring both the quantity and quality of the final harvest and involves regularly checking plots to re-fix lines which have become detached, replacing propagules which have washed away and removing parasites or epiphytes growing on the seaweed, "the best fertilizer is a farmer's shadow on the field" (Chinese proverb, quoted by Neish 2003 p. 25).

McHugh (2003 p. 55) recommends a harvest cycle of 6-8 weeks, which corresponds to the recommendation of "40 days or more" by Neish (2006). The length of the harvest cycle is important because carrageenan yield and quality increases *exponentially* towards the end of the cycle (Trono 2005). However, this important biological change is invisible and is not reflected in the total yield the farmer receives at harvest. Instead, since the risk of breakage and loss increases as the plants grow, farmers may have an incentive to harvest immaturely (Hurtado 2013). The incentive to harvest early can be compounded by nature of tides. In some places, such as the location for this study, the tide is especially low twice a month during the new and full moon, at which time farmers have an added incentive to harvest. In this paper, I use the length of the harvest cycle as a proxy for quality[8].

The drying process ("post-harvest treatment") is also crucial to maintaining the quality of the harvest (McHugh 2003 p. 58), the main danger being contamination by sand and other impurities. It is therefore recommended that farmers use elevated drying racks, or tarps, to shield the seaweed from impurities on the ground.

Household farming

Families, or households, represent the standard unit of production in seaweed farming (Valderrama et al. 2013 p. 13). This is often attributed to two factors, low barriers to entry (labour intensive, see previous section) and low economies of scale (Neish 2013 p. 66).

[8] According to Neish, the harvest cycle can be reduced to approximately 30-45 days by planting bigger propagules (Neish 2008a p. 39). This corresponds to the view that that seaweed is mature once it reaches a certain weight (1kg) (Trono 1992 p. 64). However, in many recommendations no reference to weight is made. Given that this adjustment mechanism is equally available to members as well as non-members, a longer harvest cycle can be interpreted as an effort to produce better quality.

It follows that most estimates of farm sizes are small enough to accommodate one family[9]. Mantri and Rao (2005), estimate that 50,000 households are employed for every 10,000 ha brought under seaweed farming. This assumption, of 0.2 ha per household, receives support from numerous other studies, 0.19 ha (Blankenhorn 2007) and 0.25 ha (McHugh 2006, Panlibuton et al. 2007). Some studies use larger estimates, 0.4 ha (Eranza et al. 2013) and 1 ha (Firdausy & Tisdell 1999), however, Firdausy and Tisdell acknowledge that "most farms" are in the 0.05 ha – 0.25 ha range.

Krishnan & Narayanakumar (2010) report that households, in some cases organized into self-help groups (SHGs), account for the total of seaweed production in the district of Ramanathapuram, India. Family farming is also status quo the Philippines (Panlibuton et al. 2007 p. 9) and Fiji (Namadu & Pickering 2006). In all three locations company-owned farming models have been tried and failed (ibid). Likewise, in Nusa Penida, the sample of this study, household farming accounts for the total of seaweed production.

Company-owned farms have are seen as providing insufficient incentives to farmers; "small family farms have been the most successful, partly because there is more incentive to provide the necessary care and maintenance to the farm they own rather than one owned by an employer" (McHugh 2003 p. 56). Krishnan & Narayanakumar (2010 p. 507) also ascribe the failure of company-owned farming in India to negative incentives, describing the employer-employee relationship as a "major hindrance" for reaching company production targets. A survey on the socioeconomic factors that affect seaweed farming states, "Options are: Household, Community co-operatives; Company farms. Experience shows that Household farms are the least problematic" (Namadu & Pickering 2006 p. 248). The fact that company-owned farming has not, of yet, been implemented successfully is important because it limits the scope for vertical integration in seaweed farming, a governance mechanism that has achieved more stable prices and quality in other industries.

Given the subject of this study, it is important to distinguish between the "Community-cooperatives" mentioned above and FOs. During the course of their study Namadu & Pickering (2006 p. 246) found that in farmers in Fiji perceived problems with community-operated farms with respect to *maintenance* and the equitable distribution of benefits. The term "Community-cooperatives", and the fact that farm maintenance is raised as a concern, strongly suggests common ownership of assets. FOs where farmers pool their assets and where returns are based on labour input reflect only a sub set of FOs and the problems with cooperation in Fiji seem to

[9] A farm of 0.25 ha, measuring 50 by 50 meters, is considered a small enough for one family to operate (Panlibuton et al. 2007 p. 9).

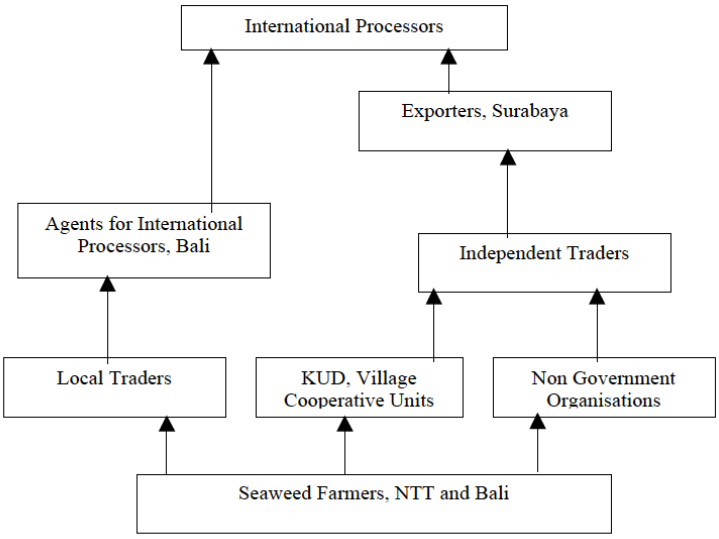
have stemmed from the pooling of assets and not cooperation per se. Mather & Preston (1990 p. 17), call these types of FOs "Farming Cooperatives".

However, this does not mean that farmers are independent entrepreneurs. Although company-farming models where farmers are paid wages rather than according to output have not yet been successful, contracting between farmers and buyers does take place to a significant extent (Valderrama et al. 2013 p. 41). The purpose of the next section is to describe these relationships.

The market for RDS

In theory, farmers can choose from three different marketing channels, local traders (also known as collectors), FOs or NGO's/government purchasing programs (Figure 2.) However, local traders have been reported as the status quo marketing channel for seaweed farmers in Indonesia (Neish 2008), the Philippines (Nyan Taw 1996), Fiji (McHugh 2006), Malaysia (Alin & Mahmud 2013) and Tanzania (Msuya et al. 2007).

Figure 2: The Raw Dried Seaweed (RDS) Market



Source: Burges Watson (1999)

Although not depicted in the flow chart above, there are often several layers of local traders. In a study from Indonesia (from the same site surveyed in this paper) Burges Watson (1999 p. 37) identifies three levels of traders, "collectors" (*pengumpul*), "local buyers" (*pengusaha*) and "traders" (*pengantara*). However, the number of intermediaries is by no means fixed but rather depends on the number of seaweed farmers in an area. In this paper I use the term "collector(s)" to describe the first tier of traders who purchase seaweed from farmers, referring to traders further downstream as "traders".

Burges Watson lists two other marketing channels for farmers, FOs and NGOs. Trono (2005) also lists FOs as one of the "main marketing channels" for seaweed farmers, however, the extent to which farmers sell to FOs is unclear as there have been no systematic studies documenting the significance of cooperatives in purchasing seaweed. Data suggests that the extent to which FOs engage in trading varies significantly by country and even by region. For example, in Tanzania and Malaysia, collectors are described as the only marketing option available to seaweed farmers. However, in a study from Indonesia, Neish (2013 p. 64) found that 32% of farmers in East Nusa Tengara and 100% of farmers in South Central Sulawesi sold to FOs. However, in South Sulawesi and Bali 100% of farmers sold to local collectors (ibid). Hurtado (2013) also describes FOs, in liaison with NGO's, as the second most important marketing channel for famers,

> **3** Another channel is through farmers associations… Members sell their products directly to their own associations, which dry and then sell them directly to a processor through the assistance of a business development service (BDS) or a nongovernmental organization (NGO). This scheme eliminates one or two layers of trading/ marketing and hence increases profit margins for the growers.[3] As an association can hoard large volumes… it is in a position to demand a premium price, provided the moisture content, percentage of impurities and seaweed age are within the specifications of the processor. Despite the obvious benefits of operating through associations, some farmers do not follow consistent marketing strategies, selling instead to local traders in small volumes; hence, they cannot negotiate good prices. **(Hurtado 2013 p. 93)**

This statement mirrors the situation described by Krishnan (2013 p. 178) from India, where farmers, organized into FOs or "self help groups" (SHGs), sell directly to a processor, ("Aquagri"). However it should be noted, as in Figure 2, that FOs are not always linked directly to processors but may sell to traders further downstream or even to the same collectors as other farmers.

The extent to which farmers sell directly to NGOs is unclear. Since Burges Watson study, the NGO in question had stopped purchasing seaweed from farmers. Instead a state owned bank, BRI, had begun purchasing operations, but only when prices fell below a predetermined minimum value (personal observation)[10].

[10] Governments also sometimes *indirectly* purchase seaweed by providing subsidies to farmers by establishing minimum prices for farmers or offering subsidies to traders and shipping companies (McHugh 2006)

4. PREVIOUS RESEARCH

As far as I am aware there have been no studies dedicated to the subject of seaweed FOs specifically[11]. However, some studies on seaweed farming mention FOs in passing, lending important insights into the role cooperatives play for farmers, but perhaps more importantly – the expectations third parties have of them. Most mentions of cooperatives tend to be favourable, however, fortunately, for the sake of this study, few studies have attempted to measure the benefits generated by farmer cooperation.

First, it has been argued that FOs are an effective way of channelling technical and financial assistance from government and NGOs (Nurdjana 2006). Many, some might even venture to say *most*, programs concerned with promoting seaweed farming, such as training and microcredit programs, indirectly or directly encourage farmers to form FOs. The Pilot Project in Sumenep, an initiative by Bank Indonesia (BI) to promote seaweed farming, is one of many examples. However, in several studies, FOs are seen as much more than a practical way of administrating aid. A common theme is that FOs *empower* seaweed farmers. Delmendo et al. (1992), for example, argue that cooperatives strengthen socioeconomic conditions by creating a "farmer-oriented marketing structure"; similarly, Nyan Taw (1996) states that FOs strengthen "marketing and communication linkages". However, what these propositions mean in terms of economic benefit to farmers is not made explicit.

It has also been suggested that cooperatives could provide a vehicle for farmers to diversify downstream into processing, as has been the case with Gracilaria farming in the Philippines (Delmendo et al. 1992, Nyan Taw 1996) or into other value-adding businesses, such as seaweed related foodstuffs. In Indonesia and abroad, several attempts have been made to promote seaweed-based food products, such as crackers and jellies (personal observation). An example of such a project, conducted at the site surveyed for this study, involved a group of technical officers from an NGO supplying a FO with the equipment necessary to make seaweed-based foods (Poeloengasih et al. 2013). However shortly after the project was completed the efforts to produce and market these foodstuffs were abandoned due to difficulties in marketing (personal observation).

Some studies have argued that FOs enable farmers to achieve higher prices by increasing their bargaining power. Firdausy & Tisdell (1999), for example, state

> **4** The establishment of farmers' cooperatives may result in some positive influences on the marketing system, e.g. by establishing minimum prices paid to

[11] Iain Neish, President of the ISS Seaweed Symposium and a leading authority on carrageenan seaweed farming, confirmed this gap in research.

> farmers for their production and providing market information. Seaweed-farmer cooperatives have only been established in Bali. Perhaps, this is one reason why farmers in Bali obtain a higher price for seaweed**. (Firdausy & Tisdell 1999 p. 64)**

The hypothesis that FOs enable seaweed farmers to receive higher prices receives support from Msuya et al. (2007), in a study that comes closest to measuring the benefits from cooperation. The study finds that, by organizing into a *credit cooperative*, "buyer-independent" farmers in the "Msichoke group" were able to achieve 18% (TSZ 40, IDR 244) higher RDS prices per kilo than farmers dependent on collector-credit ("buyer-dependent" farmers). The results confirm that members in FOs receive higher prices, however not through increased bargaining power as suggested by Firdausy & Tisdell (1999) but through reduced dependency on traders for credit.

Msuya et al. do not find evidence of economies of scale in purchasing, except with regards to the cost a boat, which they assume will be shared by members in the FO. The lack of bargaining power with respect to purchasing (bulk-buying) underscores the simple nature of inputs in seaweed farming and why it has *not* been suggested that FOs could exert market power upstream. In fact, the study finds the opposite – farmers in the Msichoke group incurred *higher* input costs, since members were forced to purchase inputs normally provided "free of charge" by local traders[12]. Factoring in the increased costs of inputs (per kilo) they estimate that the price premium from being buyer-independent shrinks to 11% (TSZ 23, IDR 141) and even further, to 7% (TSZ 16.8, IDR 102), under the assumption that these additional costs are loan financed.

Related Research

Francesconi and Ruben (2007) study the effect of cooperation on the "commercialisation" of Ethiopian dairy farmers. Although not related to seaweed farming their research is highly relevant for this paper. They define "commercialisation" in terms of (1) market access (output sold/total output), (2) herd size, (3) productivity and (4) quality (fat/protein content, and bacteria). However, they do not analyse the effect of cooperation on price since farm-gate milk prices were fixed in the area of their study.

Their results suggest that cooperative farmers had better market access, larger herds and higher productivity, and that the difference was "imputable" to the cooperative effect (p. 25). However, seen over time, productivity and market access did not

[12] It should be noted that the assumption that members of a FO is a strong assumption given that household farming is the nom in seaweed farming. By removing this assumption so that even buyer-independent farmers must incur the cost of a boat, the price premium of being buyer-independent shrinks even further.

intensify, something they attribute to organizational problems with FOs ("intrinsic limitations"). With respect to quality, they found that members of the FO produced *poorer* quality milk and even found that quality fell when farmers joined the FO in question. They attribute the negative effect on quality to a lack of public standards and free riding. The study by Francesconi and Ruben (2007) thus cautions that FOs not only generate benefits for farmers but can also cause some problems.

Having covered the nature of seaweed farming and previous research on the ability of FOs to generate economic benefits for their members, the next section evaluates whether or not FOs will be able to generate higher prices for seaweed farmers. The literature suggests three ways in which FOs can raise prices for their members. (1) Reduced dependency on middlemen for credit, (2) collective bargaining and (3) improved quality. The ability of FOs to generate higher prices through each of these means is dealt with independently.

5. Reduced dependency on collector-credit

> **5** To three things he is passionately attached: his religion, his family, and his land; and for one thing he cares nothing at all: politics; while there is one person he hates: the money lender. It is upon the adjustment of these five factors that his future depends. **(Darling 1923)**

Despite the fact that farmers have several sources of credit to choose from[13], it is often assumed that traders function as farmers' main source of credit (McHugh 2003), a practise that has received a lot of criticism for putting farmers at a disadvantage (Zamroni & Yamao 2013, Poeloengasih et al. 2013). In contrast to a typical contract-farming scheme, where the contractor provides materials and extension services to growers and commits to purchasing the harvest at predetermined prices (Valderrama et al. 2013 p. 41), farmers and collectors do not agree on a price at the time farming materials or any other form of credit is offered/accepted. The underlying theme in the objections against this practise is that farmers are made vulnerable to exploitation, a perspective that corresponds closely with what Reardon et al. (2001), describe as the "traditional view" of middlemen in agriculture,

> **6** "When farmers turn to the market, they are facing at the farm gate a rapacious and exploitative rural broker—a "tied" output–credit market where the trader holds the farmers in thrall by providing credit at the start of the season and requiring that they sell their harvests to the trader at disadvantageous terms." **(Reardon et al. 2001 p. 48)**

Zamroni & Yamao (2013), for example, state that collects exploit farmers, such as by refusing repayment in order to continue extracting low prices. Poeloengasih et al. (2013) make the same observation in unpublished research from the site chosen for this study. Indeed, Burges Watson's finding, that "once seaweed farmers have repaid their debts to collectors many are more inclined to loan money from cooperatives so that they are no longer 'tied' to collectors" seems to confirm that farmers perceive problems with collector-credit (Burges Watson 1999 p. 37)

The negative perception of collector-credit in seaweed farming provides further imperative to evaluating the ability of FOs to generate economic benefits for their members. Especially in light of the study by Msuya et al. (2007), which suggests that farmers can achieve higher prices through borrowing from each other, rather than from collectors. In fact, offering farmers alternative sources of credit is seen as *key* to

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[13] According to Neish (2008), farmers have four main[13] borrowing options, self-finance, trader-credit, banks with micro lending programs and non-bank financial institutions, such as village credit institutions *("Lembaga Perkreditan Desa")* and credit cooperatives (FOs). However, in those cases where farmers qualify for bank loans, they are often reluctant to borrow money from banks due to high interest rates and an unfamiliar bureaucratic process (Hurtado & Agbayani 2002).

breaking their dependency on collectors and allowing them to market their produce freely (Neish 2006).

> **7** Going forward, the program should commit its resources to boosting farmer income by altering market relationships and/or establishing value-added businesses. It should consider the potential for working with additional farmer groups to enable them to assume responsibility for aggregation, sorting, transport, and sale to exporters. While this will not increase total income in an area, it will redistribute more income from one group (collectors) to another group (farmers). **To be successful in this endeavor, financing requirements must be addressed. (Neish 2006)**

However, the notion that collectors are essentially evil, and the practice "bad" (Poeloengasih et al. 2013), appears too straightforward and begs the question, if cooperatives offer a superior solution, why is cooperative-credit relatively rare compared with collector-credit? Cooperative credit has achieved notable success in some cases, but the results have been mixed (World Bank 1989) and collector-credit remains status quo for many farmers in developing countries (Reardon et al. 2001). The next section aims to provide an alternative view of the relationship between middlemen and seaweed farmers.

Quasi-credit contracts

Seaweed farmers, like most farmers in developing countries, are typically poor and at the mercy of the weather, creating a strong demand for credit and **insurance**. In the absence of insurance markets, insurance can be achieved through individual or social mechanisms (Platteau & Abraham 1987 p. 466). However, the use of individual mechanisms (such as savings), is often prohibited. For example, in a study of Malaysian seaweed farmers, Alin & Mahmud (2013) found that only 18 % of farmers had identity cards, a requirement for opening a bank account in Malaysia. To save, farmers must therefore either save cash at home, under the mattress, for example, or invest in goods with resale value, like gold. In both cases security becomes an issue.

Lack of savings opportunities provide an explanation as to why expenditure among seaweed farmers is highly correlated with income, something that has been documented in several studies. "The low but frequent income from fisheries was used to cover the daily needs, whereas the much higher, but infrequent income from seaweed farming was used to send the children to school and to buy more expensive goods" (Blankenhorn 2007 p. 15). However, the practice of incurring non-recurrent expenditures on "lucky days" so that consumption can be reduced to the bare minimum when times are hard can also be interpreted as a type of self-insurance (Platteau & Abraham1987 p. 466). However, given that farmers often borrow from middlemen, it is often assumed that farmers *need* to do so, i.e. savings (or individual insurance mechanisms) do not suffice. However, Platteau & Abraham (1987)

present another theory that explains why farmers might *choose* to accept credit, essentially, whether they need to or not.

Insofar as farmers' fortunes are independent of each other, the risk farmers face is insurable; "in this context fishermen [or farmers] can clearly improve their situation collectively by transferring current incomes to one another so as to provide a time-pattern of expenditure different to that of income" (Platteau & Abraham p. 467). A credit system emerges, therefore, not for want of profit but from the need to insure. By lending surplus rather than holding it in cash, even though the loss in liquidity may or may not be compensate for, the "lucky" farmer insures himself against hunger knowing that if he runs into trouble he will be offered a helping hand. This idea that fishermen, or farmers, would lend to *each other* as insurance rather than moneymaking makes more sense in light of the fact the distinction between farmers and collectors is often artificial, collectors often are, or have been, seaweed farmers (Neish, 2008). Alin & Mahmud (2013) found that of the 20 middlemen interviewed in their study, 14 had previously been seaweed farmers.

The discussion on reciprocity as a distinctly separate motivation for lending applies in equal measure to credit cooperatives, however, Platteau & Abraham (1987 p. 479) argue that collectors have a distinct motivation to supply credit. Traders, they argue, are adamant about securing the right to auction farmers' produce, this is "a constant worry in their minds" (ibid p. 479). One "obvious way" of insuring against a loss in future trading business is to link credit with marketing transactions. However, just as in the preceding reasoning by which farmers would lend to each other, this practise is of mutual benefit to farmers and collectors. Farmers receive access to a long-term source of finance while traders insure themselves against a loss of future (trading) business.

The authors warn that traders *can* use interlinked transactions to exploit farmers but that several factors temper the extent to which this happens, competition among middlemen, for example. With enough competition, a middleman may find it profitable to pay off a farmer's debt in order to secure his output, something known as "shifting debts". Also, they describe the relationship between fishermen and traders as triadic, rather than dyadic, with the outside community playing an important role in curtailing dishonest practises both on the side of creditors and debtors. But most of all, traders are prohibited from abusing their standing as creditors because it is in both parties interest to act in such a way as to keep the relationship alive and healthy.

8 The search for enduring relations as a matter of confidence and security is a major feature of the societies under concern and a dominant manipulable technique here is the use of credit. It is indeed through the operation of credit that in a world where formal contracts are non-existent, regularity in relations can have an enduring and

> compulsive attraction and stable relations are worked out. **(Platteau & Abraham 1987)**

There is strong evidence to suggest that relationships between farmers and collectors conform more closely to that described by Platteau and Abraham, rather than the "traditional view" where unscrupulous collectors repeatedly exploit farmers.

First, it is often ignored that the distinction between collectors and farmers is artificial. Collectors live side by side with the farmers whose produce they collect and it is not uncommon for farmers to choose collector the basis of family ties. These factors, which strongly prohibit collectors from abusing their power, are often overlooked (Alin & Mahmud 2013)

Second, the loans between farmers and collectors are highly informal, in addition to proving cash and inputs for farming, collectors also provide farmers with discretionary items like televisions, motorbikes, building materials, items for ceremonies, food items and even pay for the education of farmers children blurring the distinction between loans and *gifts* (Burges Watson 1999 p. 37). This might be interpreted as a morally corrupt way of putting farmers in debt, or it hints that farmers and collectors share a fairly benign relationship. Furthermore, contracts are not written and repayment dates not stipulated (Burges Watson 1999, Alin & Mahmud 2013). According to Platteau and Abraham, "if loans are not secured by collateral" trust is essential to keep contracts from breaking down.

Third, studies suggest that farmers, in fact, are not as *dependent* on collector-credit as suggested elsewhere. In a survey from Sulawesi, Indonesia, Neish (2006) found that only 13% of farmers were bond to their collector by debt and that 60% of farmers chose collector depending on prices offered, convenience, honesty, and whether or not the collector was a family member. Similarly, Blankenhorn (2007) found that 67% of the farmers relied on their own savings for initial investments, 7% borrowed from friends and only 10% from seaweed dealers. Furthermore, with respect to prices and marketing, as an indication of whether farmer's felt as though they were being cheated or not, 45 % of the farmers had no complaints while only 17% complained about dependency from the seaweed dealer and the low prices they were receiving as a result (ibid p. 55)

Fourth, studies dedicated to how seaweed farmers and collectors perceive their relationship corroborate that trust plays a central role. In a study of 66 Indonesian seaweed farmers, when asked to respond to the statement " I can always trust the collector" (where 7 represented the strongest level of agreement), the average answer was 6,32 (Neish 2013 p. 65). In a similar study from the Semporna islands (Malaysia), where 40 seaweed farmers and 40 collectors were interviewed, the bottom line is that farmers and collectors trust each other and that the relationship is

considered by both parties as mutually beneficial (Alin & Mahmud 2013). Alin & Mahmud conclude, “The perennial desire to eliminate middlemen is perennially thwarted by economic reality”.

The study by Platteau and Abraham (1987) thus suggests an alternative to the neoclassical explanation of money lending – the “specialised economic agent” who obtains rewards for abstaining from present consumption, namely that moneylenders (or collectors), and fishermen (or farmers), use credit as an insurance mechanism. In developing countries with low incomes, poor or non-existent insurance markets and savings opportunities and high risk, farmers and collectors can achieve some degree of insurance through “quasi-credit contracts” where reciprocity plays a central role. This theory receives support from several studies on the nature of the relationships between seaweed farmers and collectors.

In conclusion, the study by Msuya et al. (2007) showed that by abstaining from collector loans, members of a credit cooperative (FO) were able to receive higher prices, even after discounting for higher input costs. However, Platteau and Abraham suggest that we must consider the implications for farmers, in terms of insurance, that such a switch might entail. It is hard to predict whether the benefits in terms of a higher price will outweigh the costs. On the one hand, we can expect that the incentive to borrow from cooperatives will be higher the greater the difference in price offered to “collector-dependent” and “collector-independent” farmers. On the other hand, the switch might come at a cost in insurance terms if cooperatives are not willing to offer credit to the same extent as collectors. Whether or not the switch will be “worth it” is an empirical question, however, given that collectors have an added incentive to secure future business we can expect FOs to meet resistance from collectors with regard to credit transactions.

6. Price fixing

A fundamental and historical reason for the establishment of agricultural cooperatives is to counterbalance the market power of their trading partners, leading to more equitable and efficient market outcomes (Galbraith 1956, Sexton 1994). This argument represents an early school of thought within cooperative theory (Staatz 1989) and is often attributed to Aaron Sapiro who argued that the major function of agricultural cooperatives is to "unify farmers on a commodity wide basis so that they could exert market power and raise total returns to agriculture" (Sapiro, Quoted from Staatz 1989).

The imbalance in market power between farmers and their trading partners is often attributed to imperfect competition in agriculture. In many agricultural markets, economies of scale in processing and trading imply that processors and traders often serve a large number of farmers (Bijman, 2002). Furthermore, farming is associated with diseconomies of scale; as suggested by the Chinese proverb "the best fertilizer is the gardener's shadow". Together, these factors give rise to oligopsony, a case of imperfect competition whereby buyers are said to have market power over sellers. Furthermore, the perishability of farm products implies that agricultural products cannot be transported indefinitely, reinforcing the market imperfection (Sexton 1994). Cooperative bargaining associations may be institutional responses to these imperfections (Hueth & Marcoul 2006, Helmberger and Hoos 1965)

It has been argued that smallholders in developing countries can attain higher prices through price fixing (Bienabe & Sautier 2005, FAO 2011, Kassam 2011). However, "while the desire to collude may be universal, the ability to collude is not nearly so widespread" (Filson, 2001); and the proposition that small-holders in developing countries can raise prices through collusion has also been greeted with scepticism from some corners (Mather & Preston 1990, Hueth & Marcoul 2003), both sets of authors pointing to a lack of evidencing supporting price enhancement from collective bargaining (ibid).

The framework of analysis for bargaining associations "is theory of market control or cartels, not the theory of the cooperative enterprise" (Helmberger & Hoos 1966 p. 1434) and by looking at cartel theory we find that the prospects of small holders for raising prices through collusion are slim. In order to raise prices, colluding firms must control supply, and in many cases, even through cooperation, farmers will not be able to influence supply. However, even under the assumption that a FO, or umbrella group of FOs, presides over a critical share of the market, it is not certain that farmers would succeed in colluding.

Even in oligopolies, where number of sellers is small and the number of buyers large, collusion faces several pitfalls – to be successful, cartels must succeed in, (1) selecting and coordinating the behaviour of all cartel participants; (2) monitoring the behaviour of cartel participants to detect and deter defections and (3) preventing entry (or expansion) by non-cartel firms (Levenstein 2006). Mather & Preston (1990) suggest that the possibility of cheating by colluding farmers, i.e. selling below collusion price, is a major factor inhibiting the successful establishment of bargaining associations (Mather & Preston 1990 p. 21).

> **9** Consideration has been given to the proposition that Pacific island countries might cooperate in marketing their seaweed, on the basis that their combined output would give them leverage for better international prices and improved freight costs. There is, however, insufficient production in the region at present to give this serious consideration; in 2005 the combined production might have reached 1,200 tones. In a world market of about 200,000–220,000 tons, a combined output of at least 5,000 tones would seem to be a minimum quantity needed to have any impact on price but it could take 3 years to reach this target. If and when the target is reached, would countries cooperate? Those that have only one internal buyer/exporter might consider it, but in countries like Solomon Islands with, say, 3–4 competing exporters it seems much less likely, unless they were all losing money. **(McHugh 2006)**

Another difficulty often associated with collective bargaining is free riding. Suppose that the three requirements Levenstein (2006) proposes as necessary for price fixing are fulfilled. Theoretically, circumstances would then allow farmers to raise prices by forming a cartel/bargaining association. However, assume further that collusion takes some degree of effort, but the net benefits to collusion are positive for each farmer. The problem of free rising arises if the benefits to collusion (higher prices) cannot be contained within the cooperative. For example, other farmers might find out about the price being offered to member of the bargaining association and reinforce their bargaining positions. The problem becomes even clearer if we suppose that the cooperative in question can gain from buying and selling seaweed from independent farmers. Likewise to the scenario before, independent farmers are then able to achieve higher prices without cooperating (albeit lower than colluding farmers). In anticipation of these problems there is a risk that farmers do not cooperate although each would benefit if all farmers cooperated. In economics this kind of situation if often described as the “Prisoners Dilemma”. Cechin et al. (2010) p. 8) argue that free riding is “one of the main challenges” undermining bargaining associations.

Finally, contrary to claims that traders have/exploit market power, it has been reported that gross RDS margins for traders are “thin” (Panlibuton et al. 2007 p. 19). In the absence of cost information, it is impossible to calculate gross margins for the intermediaries separating farmers and processors, however, data from the Philippines suggests that collectors charge somewhere in the region of 4 – 10% in

excess of what they pay to farmers, from which transportation costs need must be deduced (ibid). Suggesting that FOs do not have a lot of profits to infringe upon.

In the carrageenan seaweed industry, production estimates for specific locations are hard to find and often unreliable. Official statistics suggest that Nusa Penida supplies half of global carrageenan supply – which is highly unlikely. Neish (2013 p. 59) estimates the combined output of Bali and Nusa Tengara Tenggara Barat at approximately 10% of *Indonesian* supply. Given that Nusa Penida only supplies a fraction of this, farmers in Nusa Penida cannot effectively control supply and therefore cannot raise prices, not to mention the other difficulties associated with cartels and the "slim margins" in seaweed trading. However, as Levenstein (2006) notes, whether cartels succeed in price enhancement or not is an empirical question. Nevertheless, given this background the first hypothesis regarding cooperatives to generate higher prices for their member's leads:

Hypothesis 1: FOs will not be able to raise prices through price fixing.

7. Improved Quality

Given that the prospect of raising prices through collective bargaining are slim, raising the quality of seaweed represents an important avenue through which FOs could raise seaweed prices for their members.

In the seaweed market, quality matters, a lot. The end consumers of raw seaweed, processors, are only interested in the carrageenan contained therein, which represents roughly 20% of the plant in dry weight terms; the rest is waste and is discarded (Neish 2006 p. 1). Carrageenan quality varies significantly in terms of yield, gel strength, gelling temperature, melting temperature and colour (Mtolera 2004) and, as with many agricultural products, the quality of seaweed, or rather carrageenan, is largely determined at the farm.

Quality problems are a significant cause for concern in the carrageenan industry (Panlibuton et al. 2007, Ask 2002). In Sabah, Malaysia, for example, production is only slowly recovering from a breakdown in production, partly caused by an overall decline in quality (Bahron 2013). A similar story has been reported from Fiji (McHugh 2006). It has also been suggested that falling quality has caused Pilipino seaweed production to stagnate, where the "disconnect" between farmers, middlemen and processors has led to a "continuous struggle on pricing and quality issues, mistrust between and among the sub-sectors, [and] missed opportunities in terms of market expansion and industry growth" (Panlibuton et al. 2007 p. 31). A large processor, based the Philippines, has also suggested that the quality of Indonesian seaweed has been getting worse over time, speculating that the decline is a result of immature harvesting and stating that "it is almost like a law in this industry that quality declines as prices rise". (Siplanet Foundation: *The Danger Behind Rocketing Prices For Seaweed Raw Materials in The Carrageenan Industry,* October 23 2008).

Failure to meet quality requirements results in lower prices for famers, and consistently poor quality may force processors to source from other locations (McHugh 2006 p. 13). Conversely, quality improvements are not only seen as beneficial to the industry as a whole but also for farmers, in terms of continued business for their communities and higher prices. Why then, is quality a "perennial problem"? (Valderrama et al. 2013 p. 45)

One line of reasoning suggests that farmers are ignorant of quality and therefore need training (Panlibuton et al. 2007). Indeed, in a study from Sulawesi, Indonesia it was found that 79 % of farmers had not received any initial training other than learning from friends (Blankenhorn 2007 p. 52). Consequently, a lot of effort and funding goes into teaching farmers improved farming methods, for example, the

Seaweed Pilot Project in Sumenep. However, in a survey on farming practices it was found that knowledge of farming practices was high (Neish 2006 p. 2), contradicting the view that poor quality is a result of poor knowledge. Neish goes on to ask,

> **1** If the seaweed exporters were indeed demanding higher quality seaweed, why were collectors not informing farmers of methods to raise seaweed quality? Is quality difficult to recognize? It may be that the farmers are simply optimizing their production choice and simply choosing not to produce the highest quality product possible. (**Neish 2004)**

The proposition that farmers are not provided incentives to produce better quality seaweed is often overlooked. For example, a study from Zanzibar found that zero collectors offered price differentials for quality (Msuya et al 2007). In Indonesia, however, it has been found that price differentials for quality exist, although vary significantly by location (Neish 2006). In the study by Neish (seaplant) it was found that, in Sulawesi, 28% of collectors offer price differentials with an average price premium of 33% for good quality. In Bali, however, the number of collectors offering a price premium for quality was higher (66%) although the premium significantly lower (6%).

Unfortunately the report by Neish (2006) does not detail how collectors judge quality since carrageenan quality only becomes apparent at processing when it is extracted and tested (Doty 1987). While it is possible to *judge* the quality of seaweed by growth, colour, cleanliness and shape, these attributes are only proxies for the quality of carrageenan contained therein. Therefore, it is impossible for the collector, or the seaweed farmer, to *know* the quality of the harvest. However, by taking into account factors such as the quality of the initial seed, time spent caring to the plants and post harvest treatment farmers can make an *informed guess*, resulting in "constant quibbles" among buyers and sellers over moisture and quality factors (Neish 2012 p. 5).

Adverse Selection

> **7** Due to the low quality in average, seaweed dealers usually paid low prices regardless of the actual quality of the farmer's product, (**Blankenhorn 2007 p. 45)**

If risk neutral buyers cannot judge the quality of a product, without cost, and both high and low quality products exist in the market, buyers will offer a price reflective of the probability of buying a low quality product. This phenomenon is known as "adverse selection" and occurs in situations with asymmetrical information, where one party to a transaction is privy to the characteristics of what is being bought and sold, but those characteristics are not easily observable (Akerlof 1970). The implication of adverse selection is that, since buyers will offer a price that factors in

the probability of buying a low quality product, a “lemon”, high quality sellers will be driven out of the market (ibid).

Theory on adverse selection offers a different interpretation to why farmers are reluctant to invest in quality, because collectors cannot be expected to reward it. The causes of adverse selection are variations in quality, which are not easily observable (information asymmetry), and opportunism; it follows that adverse selection can only be improved through either reducing the level of information asymmetry or restricting opportunistic behaviour.

Information asymmetry can be reduced through actions taken by the less informed party or by the more informed party. Screening involves efforts on the part of the less informed party (in this case the buyer) to *screen,* or sort, good quality from bad quality items. For example, companies will try and find out as much as possible about potential job candidates by asking for information on education and previous employment and using interviews, all in an attempt to gauge whether that candidate will be a good or poor employee. Seaweed collectors surely use as much information they can, on the specific seller and the look of the seaweed, during price negotiations. However, until a cost-effective way of revealing true carrageenan quality at the farm-gate is developed screening will always be incomplete. McHugh (2006 p. 28) suggests that a third-party testing facility should be established to act as an honest broker between buyers and sellers in verifying quality. Such a measure would greatly enhancing the opportunities for screening and would therefore mitigate adverse selection.

Information asymmetry can also be reduced if the more informed party, in this case the farmer, takes action to signal quality. However, in order for such signals to be credible, these actions must be costly (otherwise low quality producers will simply copy the signal). The basic idea is that, given a higher probability of repeat sales, the value of costly signalling is relatively higher for high quality producers because they gain a good reputation. There are several ways in which seaweed farmers can and do signal quality. For example, they can invest in plastic tarps or elevated drying racks instead of drying seaweed directly on sand or tarmac, thereby reducing contamination from impurities.

The alternative to reducing information asymmetry is to restrict opportunistic behaviour. Guaranties and warranties, for example, prohibit sellers from passing off bad quality products as good quality. This can be interpreted both as a way of restricting opportunistic behaviour and signalling, since by offering a warranty, a costly signal from the seller, the buyer can infer that the quality of product is high. However, in many developing countries where seaweed farming takes place, the legal framework and institutions necessary to uphold formal contracts are missing, this,

however, does not mean that contracting is absent. Instead relations take the place of formal contracts, and the incentive on both party's sides to keep the relationship intact becomes key to restricting opportunistic behaviour.

However, lets assume that relationships, signalling or screening, solve adverse selection in the transaction between seaweed farmers and collectors. The ability of collectors to compensate seaweed farmers for quality depends on whether they in turn will be compensated for higher quality. This is far from certain since the degree of information asymmetry is equally high, if not worse downstream, as the size of batches and numbers of relationships involved grow, "traders have been known to mix raw seaweed with sand, salt and other contaminants in order to increase the weight" (SEAPLANT.net, 2008).

In fact, a commonly proposed solution to the problem of adverse selection is vertical integration, effectively removing the intermediaries separating farmers and processors (Staatz 1985 p. 11). Firms are often associated with a higher degree of control and can more effectively monitor and sanction the actions of their *employees*. The quality of agricultural products as been shown to increase with vertical integration, Kilmer et al. (2001), for example, find a significant negative relationship between vertical and insecticide residues in strawberries. However, as previously discussed, past attempts with company-owned farming have failed due to insufficient incentives and it seems unlikely that the benefits of vertical integration will outweigh the costs.

The Role of Cooperatives

Bijman (2007) argues that agricultural cooperatives are an efficient form of governance for transactions involving agricultural products where quality matters since members of cooperatives share in the gains from improving quality,

> **8** Because the producers are the owners of the PO, which means they receive the residual income, there are no conflicting interests between producers and their first customer (the PO). As producers and PO jointly decide on the quality of the product to be produced and processed/marketed, the transaction costs related to measuring compliance are low. **(Bijman 2007 p. 13)**

Because there is no conflict of interest between the seller and the purchaser (the FO), the argument goes, there is no risk of opportunistic behaviour. This argument receives support from Cook & Skyuta (2001 p. 1276) who state, "Since producers are involved on both sides of the transaction the incentive to withhold information is lower". However, Bijman (2007) also argues that, to the extent a conflict of interest exists, agricultural cooperatives restrict opportunistic behaviour through a combination of "contractual, organizational and social governance mechanisms".

However, if we accept, as Bijman (2007 p. 13) argues, that "as a representative of producers, a Producer Organization can guarantee a particular food quality to customers downstream in the chain" we must still consider whether such guarantees will matter for larger traders. If adverse selection exists among larger traders in their relationships with *their* buyers, such as exporters, good quality traders will be driven out of the market.

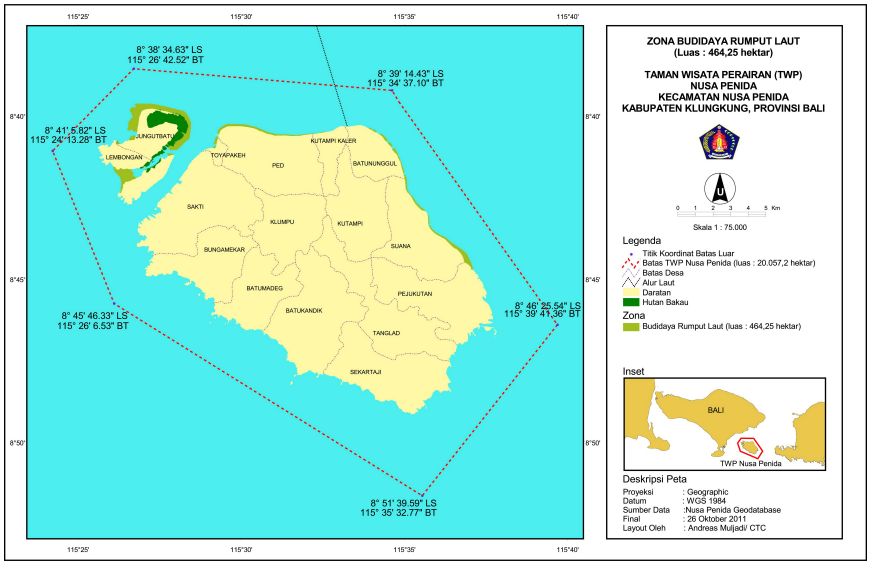
Some authors have also expressed doubt over whether cooperatives can ensure the quality of their members contributions, Sexton (1994 p. 187), for example, describes the pooling practices of cooperatives as "especially worrisome" in the context of adverse selection, suggesting that cooperatives may in fact be even less able to reward quality than other organizational forms. To conclude, it is hard to see how cooperatives will succeed in minimizing the effects of adverse selection, especially in light of the fact that adverse selection appears to be a problem further downstream.

Hypothesis 2: FOs will not generate achieve higher prices through improving the quality of seaweed.

6. Sample

Nusa Penida (-8.727807,115.544423) (*Kecamatan Nusa Penida, Kabupaten Klungkung, Propinsi Bali)* consists of three islands Nusa Penida, Nusa Lembongan and Nusa Ceningan, located approximately 20 kilometres off the East coast of Bali. Together, the three islands form a sub-district (*Kecamatan)* named after the largest of the three islands, Nusa Penida. For clarity, future references to the sub district will omit “Nusa”, which means island. Penida belongs to Klungkung Regency (*Kabupaten)*, on the east coast of Bali, a province of Indonesia.

Map of Nusa Penida



Source: Coral Triangle Centre

Penida consists of 16 villages *(Desa),* the majority of which are on the island of Nusa Penida, the remaining two on Nusa Lembongan and Nusa Ceningan. The combined population of the three islands is 47,589 (Klungkung 2008). Nusa Penida is the birthplace of seaweed farming in Indonesia, where it was introduced in 1975, however production did not take off until the early 80’s (Iain Neish, personal communication). Seaweed farming represents the main source of income followed by tourism (Burges Watson 1999).

7. Results

Farmer survey

Results of the random sample suggest that membership in cooperatives is high, but varies considerably by village.

Table 1. Cooperation, by village

Village	Members	Non-members	Total
Jungutbatu		20	20
		100.0%	
Lembongan	28	22	50
	56.0%	44.0%	
Ped	14	7	21
	66.6%	33.3%	
Total	42	49	91
	46.2%	53.8%	100%

We can infer from the high degree of membership in FOs that some form benefit to membership exists. In total, the 42 members were members of 14 different FOs.

The study by Burges-Watson (1999) provides an interesting hypothesis as to why cooperation among farmers in Jungutbatu is low. In contrast to other villages, where households rely predominantly on their own labour for farming, farmers in Jungutbatu employ guest workers from Nusa Penida, where incomes are lower. Burges-Watson proposes that examining the effects of such inter-village differences on "seaweed culture' would be an interesting topic for future research. Indeed, this distinguishing aspect of seaweed farming in Jungutbatu seems to have a profound effect on FO participation.

To evaluate whether members receive higher prices than non-members, it is not possible to compare the 42 cooperative farmers in the sample with the 49 non-cooperative farmers, since inter-village differences in prices would distort comparison. For example, cottonii prices in Jungutbatu are higher than in Lembongan or Ped. This would make it appear as though non-members receive higher prices, when in fact the difference in price might only be a result of superior natural conditions in Jungutbatu. Key inter-villages differences are summarized in Appendix 4.

One way to avoid such inter-village differences would be to compare cooperative with non-cooperative famers in all three locations. However, in the case of Jungutbatu, such comparison is not possible given that that the sample did not reveal

any cooperation among farmers. In the case of Ped, mean prices and harvest cycles were higher for members, however these differences are not statistically significant and the low number of observations (14 members, 7 non-members) restricts analysis. In the following table the data is restricted to the 50 observations from Lembongan village.

Table 2. Summary statistics, cooperative vs. non-cooperative farmers (Lembongan)

			Independent Variable		
	Obs	Av.	Members 28	Non-members 22	t – test
Control variables					
Age	50	42.38	39.25 (9.81)	46.36 (8.82)	2.66*
Household	50	4.34	4.29 (1.05)	4.41 (1.37)	ns
Years school	50	6.36	6.32 (4.71)	6.41 (3.96)	ns
Other emp. (Y/N)	47	72.34%	88.89% (0.32)	50.00% (0.51)	3.19**
Other emp. (IDR)	23	1,856,522	1,864,706 (856,549)	1,833,333 (1,169,045)	ns
Expenses	29	2,143,103	2,181,250 (1,233,947)	2,096,154 (1,073,247)	ns
Years farming	49	19.92	19.22 (6.53)	20.77 (8.61)	ns
Size (ha)	49	0.15	0.14 (0.08)	0.16 (0.08)	ns
Harvest Cycle	40	33.70	36.15 (6.62)	31.25 (4.83)	2.67*
Dependent variables					
Price Co	44	5,107	5,008 (631)	5,225 (349)	ns
Price Sp	10	3,260	3,178 (533)	4,000 -	

Standard deviations in parentheses, ns = not significant, Obs = observations
* p<0.05, ** p<0.01, *** p<0.001

The survey suggests that members, on average, receive lower prices than non-members, although the difference is not statistically significant. Despite the fact that members use significantly longer harvest cycles, however there is reason to believe that this is not out of quality concern as explained in Appendix 1.

Discussion

The following section goes beyond the scope of the research question and seeks to explain the underlying causes *why* average prices for members is not higher than non-members, and how this can be reconciled with the fact that membership in FOs is high.

Focus group meeting

On the 29th of April 2013, a focus group meeting was held with thee leaders of 11 FOs to better understand the benefits and limitation of seaweed FOs[14].

When presented with the hypothetical question, "can FOs achieve higher prices than individual farmers", most of the leaders (7/11) answered "**Yes"** (Table 3). Hurtado (2013 p. 93) also raises the same apparent contradiction; farmers can receive higher prices through marketing collectively but, for unknown reasons, do not always do so. How can we explain this apparent contradiction? One explanation is that FOs can but *do not* succeed in achieving higher prices for their members. Another possibility is that they can and *do* succeed in doing so, but that using non-members as a comparison group is wrong. These propositions are evaluated in order.

Achieving higher prices was listed as an important motivation underlying farmer cooperation. Except for one leader, who admitted the only motivation being government support, all of the leaders listed "Price power" as a motivation. However, despite price enhancement being the primary motivation for farmer cooperation, most of the FOs in the leader survey did not engage in *trading*, implying that members, for the most part, sell to collectors in the same way as non-members.

Leaders who did not list trading as a current function of their FOs (Column B below) were asked to detail the reasons for not trading (open-ended). (3/7) leaders answered competition from collectors, (1/7) answered "coordination problems" and (1/7) answered "insufficient capital" (2 blanks). Assuming, as the leaders suggested, that farmers can achieve higher prices through cooperating, why then might competition from collectors be a problem? Platteau and Abraham (1987) argue that collectors have a strong incentive to supply farmers with loans in order to secure future business. If collectors offer lower prices than FOs they will have to compensate farmers somehow, for example, by offering credit more generously. The

[14] It should be noted that of the FOs represented at the meeting, (4/11) were based around Lembongan village, the location of the farmer survey. However (7/11) were based in Nusa Penida, meaning that the information from the leader survey may not be representative of FOs from Lembongan.

leaders of the FOs argued that this was the case, with collectors effectively poaching farmers from FOs by offering them very generous loans.

Table 3. Leader survey, descriptive statistics

Name	Est.	Mem.	Motivation	Function	Cash (USD)	Gov (USD)
Segara Nadi	1997	32	1, 2, 3, 4	A	9,286	3,571
Padang Segara	2003	26	1, 2, 3, 4	A, B, C	11,224	6,633
Baruna Murti	2001	37	1, 3, 4	A	6,633	3,571
Merta Segara	2007	50	1, 2, 3, 4	A	17,143	3,571
Segara Raksa	2004	30	1, 2, 3, 4	A, C	12,755	15,816
Segara Asih	2003	42	1	A, B	9,184	3,673
D. Artha Segara	2005	105	1	A	7,194	2,041
Kerti Dharma	2000	30	1	A, B	3,571	2,041
P. Segara Sari	2004	21	1	B	8,163	
M. Sari Segara	1990	19	3	A	1,735	1,020
P. Segara Manik	1986	61	1	A	1,429	1,735
Av.	2000	41			8,029	3,970

Motivation		Function	
1	Price Power	A	Credit
2	Price/Market Info	B	Trading
3	Gov. Support	C	Seaweed food
4	Seaweed food		

In light of these circumstances, the result from the farmer survey, that members do not receive higher prices than non-members *might* be taken for granted. Although farmers *can* earn higher prices through cooperating, they *fail* in doing so due to poaching from collectors. However the fact that nearly all of the FOs in the leader survey provide credit services to their members contradicts this. If we assume that members take advantage of credit services provided by FOs we can infer that farmers are not forced to sell to collectors but rather do so by choice, as has been suggested elsewhere (e.g. Blankenhorn 2007 p. 55). This suggests that FOs are not competitive vis-á-vis traders with respect to *trading*

However the reasoning that FOs can but fail to generate higher prices for their members leaves several questions unanswered, for one, why is membership in FOs so high? Two, even FOs, which did not engage in trading, at the time of the survey, or previously, believed that membership in their FOs enabled members to receive higher prices (Table 4). This suggests that membership in FOs allows farmers to receive higher prices through a reduced dependency on collectors for credit, as demonstrated by Msuya et al. (2007) but that it is wrong to use non-members as a comparison group.

Table 4: On the ability of FOs to generate higher prices for farmers

Name	Trading	Can?	Ability?
Segara Nadi	In the past	No	Bad
Padang Segara	Yes	No	OK
Baruna Murti	No	Yes	OK/Good
Merta Segara	No	Yes	Good
Segara Raksa	In the past	Yes	Good
Segara Asih	Yes	Yes	OK
D. Artha Segara	In the past	Yes	OK
Kerti Dharma	Yes	No	Bad
P. Segara Sari	Yes	Yes	Good
M. Sari Segara	In the past	No	OK
P. Segara Manik	In the past	Yes	OK

Can? Can farmers achieve higher prices through joining a FO?
Ability? What is the ability of you FO to generate higher prices?

If members receive higher prices through reduced dependency on collector-credit then, would we not expect members to receive higher prices than non-members? Not necessarily, this assumes that non-members correctly reveal, on average, prices without membership (Ravaillon 2001 p. 118).

An analogy to this situation can be found in Ravaillon (2001) who describes a researcher trying to evaluate the effect of a poverty alleviation program on schooling. As with the difference in prices observed between members and non-members, the means in schooling in Ravaillon's example are not statistically significant between families participating in the program and families not participating. From a simple comparison of means in schooling one might be tempted to draw the conclusion that the program does not have an effect on schooling. "However, in the absence of the program, parents may well send their children to school less than other parents to" (p. 119). Similarly, we might expect prices to be lower for farmers, had they not been members of an FO (credit cooperative). In order to evaluate the effect on price of being a member of a credit cooperative we need to know the average price members *would* have received, had they not been members. However we cannot know this, since this is a counterfactual mean.

One way of removing the bias would be to randomize farmers into members and non members, effectively offering some farmers an additional source of finance but leaving other to borrow from collectors / other sources. The price of non members would then reveal the counterfactual, that is, the price we would have observed for members had they not been members.

However, the problem is that, membership is *not* random. For example, during discussions with a farmer I was informed that he was not a member because the size of his farm meant that he could command a "good" price and did not require any of the services, like credit, provided by FOs. The data in Table 2 supports this; members are on average, smaller than non-members (although the difference is not statistically significant). We can control for the effect of observable differences on price using multiple regression.

OLS Regression Model

	Model 1	**Model 2**	**Model 3**
Membership	-216.7	-523.7**	-512.6**
	(158.4)	(189.8)	(175.5)
Harvest Cycle		15.18	7.889
		(15.53)	(14.33)
Size			3445.7*
			(1331.8)
_cons	5225***	4748.3***	4456.8***
	(117.0)	(491.9)	(453.8)
N	44	35	34
Adj. R-sq	0.020	0.143	0.312

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

The regression supports the hypothesis that size and membership matters for price. According to the regression, if a farmer were to increase the size of her farm by 1 ha, the price she would receive would rise by IDR 3446 (nearly 150%). On the other hand, the coefficient for membership is negative, suggesting that members, on average, earn IDR 513 (roughly 10%) *less* than non-members, controlling for size and harvest cycle. This, however, does not mean that membership *causes* lower prices but only that the two are related in some way.

In economics, analysis of the average causal effect of binary variable, such as membership in a FO or participation in a poverty alleviation program, on an outcome variable of scientific or policy interest, in this case price, is known as a "treatment effect". In general, the most serious econometric concern that arises in the estimation of treatment effects is **omitted variables bias**, also known as "selection bias" (Angrist xxxx p. 2).

9 In practise simple comparisons or even regression-adjusted comparisons may provide misleading estimates of causal effects. For example, participants in subsidized training programmes are often observed to earn less than ostensibly comparable controls, even after adjusting for observable differences. This may

> reflect some sort of omitted variable bias arising from unobserved and uncontrollable differences in earnings potential between the two groups being compared. **(Angrist xxxx p. 1)**

Given that FOs in Nusa Penida provide credit services, and that reduced dependency on collector-credit is associated with *higher prices* (Msuya et al. 2007), the regression above suggests that selection bias is a problem in determining the effect of membership on price. However, that does not mean the result is wrong or uninteresting since we can infer from the coefficient that membership is related to lower prices for reasons I have not considered. This on its own is an interesting result because it suggests that farmers who receive lower prices than comparable farmers in terms of size are more likely to become members.

Conclusion

The purpose of this paper has been to evaluate whether members of FOs receive higher prices than non-members, in an attempt to provide or rule out one reason for establishing or joining a FO. I identify three means by which FOs can generate higher prices for their members, (1) reduced dependency on middlemen for credit, (2) collective bargaining and (3) improved quality. And predict that FOs will fail achieve higher prices through any of these three channels.

With respect to channels (2) & (3) I argue, that, given the nature of the seaweed market, FOs will not serve well as traders based on the doubtful ability of FOs to fix prices and the "worrisome" aspects of pooling in the context of adverse selection. The results do not confirm this, although most FOs did not engage in trading (4/11) FOs surveyed did. However, I argue against the view that farmers could earn higher prices though marketing though FOs if only farmers were less dependent on collectors for credit. Similarly to other studies which find that seaweed farmers are not bound to collectors but rather choose them, the data here suggest that even members of FOs, which do not rely on collectors for credit, sell to collectors. Suggesting that FOs are not competitive vis-á-vis traders with respect to *trading.*

Despite the strong incentive collectors have in using credit to secure future business, the data here suggests that FOs play an important role in providing seaweed farmers with credit. Given the high degree of membership and the fact that the primary function of FOs is in credit services, it appears that the benefit of membership in FOs lies in improved access to credit. At this point, the original research question, "Do members receive higher prices" appears to have been misguided. If we assume that farmers who receive lower prices are more likely to need the credit services provided by FOs, then we would expect members to receive *lower* prices than non-members. If we accept this proposition, the result from Table 2, that there is no significant difference in price between members and non-members may in fact be interpreted as a positive result. Under this scenario FOs play an important role, not only in supplying credit, but also to those who need it the most.

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