Contract Farming in Costa Rica: Opportunities for smallholders?

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Abstract

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Diversification into new non-traditional export products and orientation towards alternative market outlets have become important strategies for Costa Rica to reduce its dependency on traditional agricultural crops. However, market failures and transaction costs derived from weak market integration may affect smallholders' competitiveness in the new open-market economy. Earlier literature refers to contract farming as an economic institution with the potential to incorporate smallholders into more advanced markets by strengthening supply chain integration. However, the reliance of contract farming in some Latin American countries has shown diverging experiences and the mere presence of contracts does not guarantee the sustainability of trade relationships. In this research, we have challenged the pessimistic viewpoints regarding the effectiveness of contract farming as a governance form between smallholders and agro-processing firms, by making a detailed assessment of two typical supply chains of non-traditional products in Costa Rica, namely pepper (*Piper nigrum* L.) and chayote (*Sechium edule* Sw.). Our analytical framework is based on the Structure-Conduct-Performance approach, which is complemented with a modeling assessment for simulating organizational strategies under monopsonistic market conditions. These frameworks enabled us to analyze and explain the different strategic interactions between two parties (firm and farm), given the set of expected asymmetries of information and transaction costs that they are facing. Our research has emphasized the analysis of supply chains for the pepper and chayote case studies by focusing on differences in the *characteristics of the commodities* as well as on the *types of farm households* and the derived *implications* for *market configuration* and *contract choice*. Making use of new institutional economics approaches enabled us to identify how contracts have different functions in particular market settings and for specific types of producers. Instead of focusing only on price and value arrangements, attention is also given to the non-price aspects and the life-cycle dimension of contracts during different stages of market development. The comparison of both supply chains provides insights in the endogenous character of the contractual arrangements selected and draws pertinent conclusions regarding the efficiency and equity effects of supply chain cooperation.

Keywords: contract farming, supply chains, new institutional economics, pepper, chayote, Costa Rica.

Acknowledgements

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Chapter 1

Introduction

1.1 Agricultural transformation and contract farming

The agrarian production structure of Costa Rica is characterized by a high diversity of production units or farm types. This historical fact shows that it is significantly different from other Central American countries. Large capital-intensive farms that produce for both the international and national markets coexist with extensive cattle production units (*haciendas ganaderas*) and small and medium size owner-operated farms. Within the latter category of family farms it is possible to differentiate between two types of producers: (1) a more traditional *peasant sector*, comprised of low-income farmers living in former agrarian frontier zones and in rural settlements created by the Agrarian Development Institute (IDA)[1] and (2) an important group of *commercial farmers* that produce both traditional crops (coffee, bananas, sugar cane) and non-traditional crops (tropical fruits, vegetables and ornamental plants) and usually show good production performance. Being part of either category depends on a number of endogenous and exogenous factors, such as typical farm and household characteristics (*i.e*. age, education, and dependency rate), scale of production, resource endowments, spatial location and regional infrastructure, market characteristics, and access to production factors and information. The agricultural sector in Costa Rica thus requires specific and rather differentiated agrarian policies to address the needs of this wide range of production units operating under different market and institutional conditions.

During the period 1950-1980, a range of different state-funded programs (such as subsidized credits, price guarantees for staple crops, input subsidies, and public research and extension activities) supported the agricultural sector in general and the traditional peasant sector in particular. These agrarian policies aimed to strengthen economic development based on the agricultural sector and guarantee national food security, by providing cheap basic grains to satisfy the demands of the emerging urban middle-class. Consequently, the socio-economic

[1] This traditional peasant sector produces mostly maize and other basic grains for self-consumption, livestock, and some cash crops. In many cases they use low-input production technologies, maintain simple post-harvest management practices, and devote some labor to off-farm activities.

development of Costa Rica relied mainly on traditional agricultural crops—coffee, sugar cane, bananas, basic grains and livestock. However, most of these policies ended up benefiting mainly large producers, rather than the large sector of small and medium size farmers that were the intended beneficiaries (Cartín and Piszk, 1980).

After 1980, agrarian policies in Costa Rica suddenly changed from the former import substitution policy oriented towards a progressive incorporation of the agricultural sector into an open-market economy with limited or no state interventions (Pomareda, 1996; SEPSA, 1997). Policies focused on a reduction of export and import taxes, currency devaluation, and favorable interest rates for export-oriented production, strengthening some traditional export crops (*i.e.* coffee, bananas, and sugar cane) while at the same time promoting investments in new agricultural export products (*i.e.* pineapple, flowers, ornamental plants, root and tuber crops, and fresh fish (Gonzalez Mejía, 1994; Masís and Rodríguez, 1994; Mora Alfaro *et al.* 1994; Umaña, 2002).

These structural adjustment policies were implemented to increase productivity and reinforce the competitiveness of the agricultural sector. It was expected that higher labor returns and positive effects on equity and welfare could be reached as well. According to data from the Central Bank of Costa Rica (BCCR), the agricultural sector shows an average annual economic growth rate of 4.16% for the period 1985-2001. However, the dynamism of the agricultural sector is lower than the overall economic dynamism for the same period. By the end of 2001, the agricultural sector represented 10.7% of the GDP (Umaña, 2002). In the same period, the agro-industry sector contributed approximately 5% per year to the GDP. If we include this share in the agricultural sector, its total contribution to the economy would be about 16% by 2001 (Umaña, 2002).

Some positive outcomes have been achieved in terms of technological change. At the beginning of 1980, traditional agricultural production (coffee, bananas and sugar cane) represents 50% of the agricultural gross product, followed by animal production (26%) and staple crops (7%). The remaining 17% corresponds to alternative production. By the second half of the 1980s, traditional products represented only 34.8% of the agricultural gross product, while the new non-traditional products contributed 30%. The remaining 35% corresponds to animal production (21.8%) and others like timber, fishery and horticulture.

Hence, the share of non-agricultural production in the agricultural gross product increased from 10% in 1980, to 19% in 1990, and 30.8% in 2001 (Umaña, 2002).

However, these adjustment policies had a negative effect on the traditional peasant sector, which faced higher production costs (due to price increases in imported inputs) and lower prices for their outputs (Mora Alfaro *et al.*, 1994). The new conditions led small peasants into a crisis, since they were not well prepared for these large changes. Peasant producers faced volatile markets and lacked the proper infrastructure for commercializing their production. Hence, input and output markets did not work as expected and high transaction costs particularly affected the least-prepared producers. In addition, poor market information, limited access to financial resources and a poor institutional environment restricted the possibility of shifting towards non-traditional but highly capital-intensive cash crop production. Thus, many small and medium size farmers suffered and still are suffering economic exclusion and poverty (Mora Alfaro *et al.*, 1994).[2] The new policies also resulted in negative effects on the quality of the natural resource base (occasioning soil and water depletion, as well as deforestation). Not only were non-traditional cash crops characterized by their higher productivity, but they also require higher input use, and this could lead to substantial levels of soil nutrient depletion, along with the pollution of soil and water resources (Kruseman *et al.*, 1994).

During the period 1994-1998, agricultural policies were re-defined in an attempt to revert the former situation. The new policies were intended to enhance an increase in rural welfare and reinforce environmental conservation, expressed in the following three specific objectives (SEPSA, 1995): (1) improvement of the competitiveness of agricultural production, thus implying an increase in the added value of raw materials and a higher participation of small producers in the market; (2) conservation of the natural resource base; and (3) an increase in the participation of small and medium scale farmers in the formulation of agricultural policies. Together, these three objectives aimed at making rural development more sustainable. The role of the state in the agricultural sector became more like that of a facilitator focused on creating adequate conditions by means of the so-called *Productive Reconversion Program*, which was approved by law in December 1997, by the Costa Rican Congress (Proyecto Estado de La Nación, 1998). The plan's main objective is to improve the

[2] Economic exclusion refers to a diminished access to product and factor markets (Mora *et al.*, 1994).

integration of small and medium scale farmers into the globalization process (SEPSA, 1995; SEPSA, 1997; La Gaceta, 1998).[3] Since then, agricultural policies in Costa Rica have experienced only a few changes and the outcomes of these policies have been relatively successful for some producers, but certainly not for all of them.

The change from an import substitution scheme to a more open market-oriented model brought both opportunities and threats for the agricultural sector of Costa Rica. On the one hand, it has certainly increased the potential competitiveness of many new activities, but at the same time a lack of coordination between the government and the private sector has become evident, inhibiting some sectors from taking advantage of the new challenges (SEPSA, 1999). Consequently, the peasant producer sector experienced winners and losers. The former moved into agro-export activities, using new production technologies and achieving vertical integration, capital accumulation and economic diversification, while the latter remained with their traditional activities, using low-input technologies and competing in spot markets (Pomareda, 2000). The new agrarian policies in Costa Rica could not, however, prevent the former group from also remaining vulnerable to poverty, since they could not always overcome specific constraints related to access to new technologies, institutional innovations, input and output markets, land markets and market information (Gonzalez Mejía, 1998; Proyecto Estado de La Nación, 1998).

To address these problems, a stronger relationship is required among different actors within different supply commodity chains (producer + agro-processing firms + consumers). In the past, the national agricultural structure became more consolidated when the relation between farmers and the agro-industrial sector was strengthened (Pomareda, 1998). However, such strategies are still lacking or poorly developed as part of recent agricultural policies. The poor integration of primary production and agro-industry has recently led to a number of negative experiences, such as the disadvantageous conditions in the Free Trade Agreement with Mexico (especially for the sugar and milk sector) and the strong reduction in the local supply of animal feed supplements, causing a loss of dynamism in the livestock sector (both cattle production and processing). In addition, public institutions assumed a more passive role in the promotion of peasant organizations and remained limited to the encouragement of global

[3] Globalization is referred to as the reduction in communication and transportation costs in order to increase international trade in goods and services, cross border flows of capital as well as exchanges of technology (van der Noord, 1996).

alliances with the private sector. With the implementation of structural adjustment programs it was argued that the country should produce highly competitive commodities, while assuming a rapid integration of different types of farmers into the agro-export sector. Recent experiences have shown, however, that this process is slower and far more complex than expected, and that there is still an important role for local institutions in promoting the development of new service markets and strengthening peasant organization (Pomareda, 1998).

Contract farming has recently been mentioned as a possible way to overcome, or at least considerably reduce, the problems caused by market failures and thus provide a better institutional environment for integrating primary producers into agro-industry. Actually, the potential of contract farming is considered quite attractive as a mechanism for incorporating small and low-income farmers into the open-market economy (Glover, 1984; Key and Runsten, 1999). Contract farming is mainly an agreement between a farmer and a firm, where the farmer produces a fresh or partially processed product and the firm has a commitment to buy it (Grosh, 1994). From this basic arrangement, there are various types of contracts with different flows of inputs and outputs, providing a number of exchange conditions. Contract farming operates as an intermediate economic institution between spot markets and vertical integration (Grosh, 1994; Key and Runsten, 1999), providing a response to market failures for credit, insurance, information, inputs and outputs, thus reducing transaction costs associated with search, monitoring, transfer of goods, bargaining and enforcement (Key and Runsten, 1999).

Recent applications of contract farming in some Latin American countries have shown diverging experiences, where in some cases firms have preferred to deal only with large capitalized growers, while in other cases linkages between firms and small farmers have been successful (Key and Runsten, 1999; Escobal *et al*., 2000). Moreover, there are situations in which firms establish contracts with both small and larger producers, whereas there are other settings in which firms maintain contracts exclusively with *microfundistas* (see case studies by von Braun and Immink; Glover and Kusterer; Bivings and Runsten, in Key and Runsten, 1999). Consequently, the types of contracts provided by the firm and the type of producer that are selected as partners (*e.g.* small family farmer or large entrepreneur growers) are two intimately related factors (Key and Runsten, 1999). A better understanding of the factors that

make contracts succeed between firms and smallholders is important for designing policies that can contribute to an inclusive pattern of rural development.

The application of contract farming has become an attractive option for the agricultural sector of Costa Rica. Recent agricultural policies point toward the promotion of higher competitiveness in the sector, linking primary production to agro-industry and supporting services (SEPSA, 1999). This requires the design of new mechanisms for achieving integration, coordination and cooperation between agents involved in the supply chain. Hence, contract farming may play an important role in the new rural development strategy and its improved performance could contribute to the welfare and sustainability objectives of agri-food supply chains in developing countries.

1.2 How useful is contract farming?

Small and medium size farmers in developing countries usually face market constraints or imperfections, such as restricted access to credit, insurance and specialized inputs at above-average costs. In addition, poor market information and other transaction costs derived from weak market integration make these smallholders less competitive in the new open-market economy, often causing economic exclusion and poverty. These negative effects are particularly important in Costa Rica, where about 40% of the total population still lives in rural areas (directly or indirectly related to agricultural production), and the peasantry sector still represents a large share of the rural population. Furthermore, access and information constraints may discourage the development of production activities that can, in principle, be efficiently performed by small and medium-scale farmers (*e.g.* labor-intensive crops) and could hide the potential contribution of this type of producer to the rural and national economy.

A weak relationship between farms and agro-processing firms can also affect the agro-industry sector, since the latter need to face problems related to the continuous supply of raw material, quality conditions, timing, growing practices, post-harvest management and loyalty. In other words, relying on spot markets for the supply of raw materials may not be the best solution for some agro-industries, since a poor arrangement with a provider may imply delays in the delivery of raw materials. While agro-industrial firms may apply a vertical integration strategy, this option may not be suitable for every sector (*i.e.* production cost disadvantages

due to reduced flexibility), and could be less attractive when strict monitoring efforts are required to maintain product quality. Hence, in many particular cases, strong farm-firm coordination tends to be the preferred option that could lead to a *win-win* situation for both parties.

When input or output markets fail, farmers can rely on alternative agrarian institutions in order to carry out the necessary exchange transactions. It has been argued that contract farming can be considered an effective institutional response to overcome such market imperfections (Glover and Kusterer, 1990). Therefore, the positive effect of contracts can be expected on farm-gate prices and on the farmer's level of certainty (price risk), since contracts permit a relocation of farm households into a secure market niche. It is also expected that strengthening the degree of integration of the supply chain, at least in the initial stages, will contribute to reduced enforcement costs when agency relations are maintained over a longer period.

In spite of the attractiveness of contracts for reaching a Pareto improvement between parties, the mere presence of contracts does not assure the sustainability of the trade relationships. As an institutional mechanism, contract farming requires a continuous adjustment process, according to the characteristics of the agents and the exogenous conditions they are facing. Thus, the weak performance of contracts may also lead to losses for both parties, when asymmetric information and other transaction costs cause uncertainty or distrust between the agents. This situation may become even worse under a restrictive market condition (*i.e.* monopsony). Hence, a better understanding of the interactions between the contracting parties and the driving forces in the relationship will enable us to understand the causes and effects of contract engagement and the options for reducing distrust between parties to make the contractual exchange more efficient.

1.3 Assessing the effectiveness of contracts

The subject of this study is the appraisal of the effectiveness of contracts as an alternative market institution between small farmers and agro-processing firms. The research aims to identify and analyze the following key issues: (1) structural characteristics of the two typical agri-food supply chains for non-traditional products, namely pepper (*Piper nigrum* L.) and chayote (*Sechium edule* Sw.), focusing on the organization of exchange transactions between

the agents involved; (2) patterns of behavior adopted by the agents for adapting or adjusting to the market where they operate under given contractual arrangements; (3) effectiveness and rationale of the current contractual arrangement; and (4) opportunities and constraints for improving the contractual arrangement between the firm and the farmers.

To address the issues mentioned above, we rely on an analytical framework based on the Structure-Conduct-Performance approach. This framework enables us to analyze and explain the different strategic interactions between two parties (firm and farm), given the set of expected asymmetries of information and transaction costs that they are facing.

The research focuses on two non-traditional labor-intensive commodities: (1) chayote (*Sechium edule* Sw.), which is produced for both international and domestic markets; and (2) pepper (*Piper nigrum* L.), which is mostly delivered to the domestic market, in particular as a condiment for the food industry. Although small peasant producers are involved in growing both commodities, it is interesting to compare pepper with chayote since there are major differences with respect to the type of agency relationships and the regional competitive conditions. Moreover, in the case of pepper there is no access to spot markets, whereas alternative market options are available for chayote. Therefore, we would expect different responses to market failures, variability in contract conditions and performance, and ultimately also different bargaining strategies.

The subject of this research is highly relevant to small and medium size farmers in Costa Rica, since they usually lack competitiveness *vis-à-vis* larger producers that are better incorporated into the market (Ellis, 1988; Ruben *et al.*, 1994). The Costa Rican countryside is facing high transaction costs and information problems that influence farmers' decision-making processes. Furthermore, this research is important in a country where recent agrarian policies have continuously promoted an open market economy, neglecting the effects of such policies on the less prepared peasant sector (Mora *et al.*, 1994; Pelupessy and Ruben, 1999). Transaction costs and other market failures imply that each farm household must face a farm-specific set of effective prices. Since most decisions are based on the farm-gate price, we would expect an additional negative effect of transaction costs on farmers' resource use decisions. The negative effect of transaction costs and other market failures, combined with rational choice behavior, creates incentives for opportunistic behavior, resulting in an adverse

selection process and moral hazards in the transactions between the parties (and among farmers) (Sadoulet and de Janvry, 1995).

Contract farming between agro-processing firms and farm households is an institution that has been applied recently in Costa Rica. Together with peasant organization, contracts have a challenging potential for making small farmers more competitive, and could reduce uncertainties related to prices and market outlets. However, a better understanding of the interactions between the contracting parties and the driving forces shaping the contractual relationship is still required to be able to evaluate their development potential.

The specific research questions addressed in this study are therefore defined as follows:

1. How are the agri-food supply chains for each of the two chosen commodities currently organized?
2. What type of farmers and processing firms participate in contract farming, and what market failures are motivating them to engage in these contractual relations?
3. Can contracts be considered as a suitable mechanism for implementing efficient exchange relationships between agro-processing firms and farm households?
4. What characteristics should both parties (the firm and the farmer) exhibit in order to assure that contract farming becomes a feasible institution for enforcing loyalty, transparency and information sharing?

The formulation of these research questions focuses on the identification of key conditions for the successful market integration of smallholder producers, the prospects of contract relations for enhancing sustainable international business chains, and the implications of such contracts for the individual and group welfare of local producers.

1.4 Outline of the study

This study is organized into six chapters. Chapter 1 provides an introduction to the research subject and the definition of the problem, as well as outlining the research objectives and questions. Chapter 2 reviews the theoretical foundations of this research, focusing on the contract farming debate and its role as an alternative market institution for small farmers and agro-processing firms. In Chapter 3, we describe the market structure of pepper in Costa Rica and analyze how producers and processors use contracts as an alternative institutional

arrangement for exchange. Pepper trade takes place in the region of *Huetar Norte*, under competitive and monopsonic market conditions, and farmers prefer different contractual conditions under each of these trade regimes. We analyze the characteristics of processors and identify the type of contractual arrangements that they offer to producers, given the market conditions under which they operate. In addition, we analyze what type of farmers typically engage in contract farming and what the implications are for their production and investment decisions.

Chapter 4 focuses on the determinants of market and contract choice for the chayote sector and analyses the possibilities for involving local producers in global agro-food chains through delivery relationships with packers and brokers. Attention is given mainly to the importance of quality requirements for entering the export market and the impact of contractual arrangements on loyal behavior. Core stipulations in the contract regarding the frequency of delivery and the provision of technical assistance are identified as factors mediating between quality and loyalty.

In Chapter 5, we develop a more generic framework for supply chain analysis taking the case of pepper as a starting point. We explore the bargaining options between producers and a processor under the restrictive market conditions of a local monopsony, since there are no spot markets for pepper in Costa Rica and only one processor buys fresh pepper from producers but under certain quality conditions (with high average rejection rates). We explore possible forms of collective action amongst farmers with the aim of increasing the quality of pepper, by improving transport conditions and self-organized monitoring at the point of collection. This should lower rejection rates and increase the farmers' bargaining power. Yet, the costs of organizing collective action should be less than the potential increase in income resulting from a reduction of rejected pepper. Different scenarios are compared whereby we search for the private contract enforcement mechanism that would maximize both parties' income and simulate the scenario under which breaching the contract would maximize the farmers' income.

In chapter 6 we summarize the main conclusions derived from the research and make some relevant recommendations for relying on contract choice as a mechanism for enhancing smallholder market participation.

Chapter 2

Market failures, contracts and farmers welfare

2.1 Introduction

Contract farming is usually considered as an alternative institution to substitute for markets that do not function well, or are totally absent. Contract farming is thus defined as an agreement between a farmer and a firm—ranging from simple verbal commitments to written documents—where the farmer delivers fresh or partially processed products and the firm is committed to purchasing the produce under certain agreed (price and non-price) conditions.

Contracts have the potential to provide mechanisms for the incorporation of small and low-income farmers into the market economy (Glover, 1984; Key and Runsten, 1999). However, several authors argue that contracts could also lead to market segmentation and exclusion, thus generating more negative effects on farmers than positive ones (Glover and Kusterer, 1990; Grosh, 1994; Little and Watts, 1994; Porter and Phillips-Howard K, 1995; 1997; Torres, 1997; Siddiqui, 1998).

This chapter reviews the theory behind contract farming as an alternative agrarian market institution and the conditions under which contractual exchange is preferred by the parties. The chapter is organized as follows. In section 2.2 we discuss the causes of agrarian market failures in developing countries; this is further examined in section 2.3 by an analysis of the emergence of institutions in the presence of such market failures. Section 2.4 provides an overview of debate on contract farming and its role as an alternative market institution for small farmers and agro-processing firms. Section 2.5 outlines the major advantages and disadvantages of contracts and identifies the key conditions for creating dynamic comparative advantages through contractual exchange. Section 2.6 discusses the typical farm and household characteristics that influence contract choice and market outlet choice, paying particular attention to the implications for investments and quality performance. In section 2.7 we summarize the major conclusions and review the hypothesis underlying our field research presented in subsequent chapters.

2.2 Market failures in developing country agriculture

The structural adjustment strategies launched in many developing countries during the last two decades (in Central America during the period 1980-2000) entailed substantial economic reforms that changed the role of the state in the agricultural development process. The reduction in public expenditures for credit and investment programs, the elimination of input subsidies and price support for staple crops, as well as the privatization of research and extension programs meant the withdrawal of the state, and favored a new economic paradigm where the free market can efficiently rule the agricultural sector (Schejtman, 1994; Dirven, 1996; Key and Runsten, 1999). Most structural adjustment programs were based on the neoclassical assumption of well functioning input and output markets that could reach a competitive equilibrium. Under such conditions, production factors such as labor and capital would produce equal marginal returns in all areas of use and the national product would increase due to long-term effects of capital formation, labor force expansion and technological development (Meier, 1995). Perfect competition also emphasizes the neutrality of a price mechanism and its role as the arbiter of all economic decisions (Ellis, 1988).

The neoclassical point of view of economic efficiency assumes that all farmers comply with the following conditions: (1) similar access to production technologies, (2) same market conditions in terms of input and output prices (competitive markets), and (3) all farms maximize profits perfectly and instantaneously (Yotopoulos P.A. and Nuget J.B. in Ellis, 1988). Furthermore, well-functioning markets require all potential buyers and sellers to have perfect information regarding input and output relations, supply and demand conditions and prevailing prices (Upton, 1996). The farmer is assumed to be an individual decision maker who decides how many inputs will be allocated, in what proportions, and for what kind of activities. The consumption side of the farm-household is ignored and profit maximization is farmer's only objective (Ellis, 1988). Finally, transactions between agents occur in a costless market and the product transacted is assumed to be homogenous (*i.e.* no quality differentiation). When product differentiation occurs, it is assumed that different products compete in separate market segments (Hobbs, 1996).

In many cases, this approach is not directly applicable to the agricultural sector in developing countries due to the existence of different types of farms and the so-called market imperfections or market failures. Following the main argument of Coase (1937), we argue

that the neoclassical economic paradigm does not fully take into account the characteristics of small and medium scale farmers in Latin America—the nature of family-based production units—nor does it consider the typical characteristics of the economic environment in which these farmers operate.

The New Institutional Economics (NIE) approach offers important analytical tools for an alternative understanding of the rural economy. NIE emerged as an interdisciplinary school of thought that combines economics, law, organization theory, political science, sociology and anthropology to understand the development of institutions. Its goal is to explain the nature of institutions, how and why they emerge, what purposes they serve, how they evolve over time, and how, if at all, they could be reformed (Martin, 1993; Ayala Espino, 1999). NIE is especially concerned with the emergence of institutions to enable exchange to take place in a context of pervasive market failures.

In the light of NIE, the neoclassical hypothesis of economic efficiency requires amending because there are structural differences among farms in terms of availability and access to productive resources, levels of technology levels, access to information, and ultimately, production strategies based on variability in farmers' objectives and behavior regarding risk and uncertainty (Ellis, 1988; Ruben *et al.*, 1994). Most of the small and medium size farms are family enterprises; this means that decision-making procedures regarding production, consumption and reproduction are interlinked in imperfect markets (Ellis, 1988; Sadoulet and de Janvry, 1995). Consequently, these peasant households tend to value risk reduction more than profit, and therefore appreciate any institutional opportunities to acquire certainty regarding access to market outlets and delivery prices.

Market imperfections are usually defined by comparison with the ideal of perfect competition. A market fails when the transaction cost for market exchange creates disutility greater than the utility gained in the marketing process, with the result that the market is not used for that particular transaction. Non-existence of a market is the extreme case of market failure (Ellis, 1988; Sadoulet and de Janvry, 1995). Transaction costs are simply the costs of using the market (Coase, 1937), the costs of running the economic system (Williamson, 1985), or all the costs related to the exchange of goods and services when the neoclassical assumption of costless trade is relaxed (Hobbs, 1996). There are three main categories of transaction costs: information cost, negotiation costs and monitoring costs. The costs of acquiring product and market

information constitute the major part of transaction costs. Other costs originate in transportation, negotiation and writing contracts, recruitment and payment of services, coordination, and monitoring or enforcement of the agreed terms in the transaction (Sadoulet and de Janvry, 1995; Hobbs, 1996).

The non-existence of a full set of markets that the neoclassical approach assumes is characteristic of the agricultural sector in many developing countries (Stiglitz, 1985, 1989; Ellis, 1988; Meier, 1995). For many farm households, there are either no markets or incomplete markets for land, labor credit and other services, or for outlets for their production (Ellis, 1988; Sadoulet and de Janvry, 1995). The magnitude of market failure is determined by the following three factors:

A) Transaction costs and asymmetrical information

Well-functioning markets suppose that all potential buyers and sellers have perfect information regarding input and output markets, supply and demand conditions, and prevailing prices (Upton, 1996). Buyers and sellers are assumed to act as price takers under perfect competition.[4] In addition, farm households are assumed to be homogenous and face the same set of market prices. However, this is not particularly true in many developing countries due to the existence of exogenous factors that affect the household, such as: (1) distance to the markets and poor infrastructure (roads, bridges, market facilities); (2) a lack of modern communication facilities (telephone, fax, internet, etc.) which in turn leads to the problem of imperfect or asymmetrical information; (3) a highly dispersed farmer population; (4) a low degree of peasant organization; and (5) unbalanced bargaining power between market parties and high marketing margins (*i.e.* monopoly/monopsony problem) (Ellis, 1988; Sadoulet and de Janvry, 1995; Upton, 1996).

Market failures can also be household-specific and therefore endogenous. Farmers have different resource endowments and objective functions. According to de Janvry *et al.* (1991), markets exist in general, but they fail selectively for particular categories of households, meaning that the corresponding commodity becomes non-tradable for that particular household. Hence, due to these differences among farmers, some can rely on the market while

[4] The price-taking assumption implies that market prices are beyond the influence of the consumer and the producer (Mas-Collel *et al.*, 1995).

others cannot, thus causing household-specific market failures (de Janvry *et al.*, 1991; Sadoulet and de Janvry, 1995).

Information problems could lead to the wrong decisions and moral hazards, as a consequence of the opportunistic behavior arising between the economic actors (Sadoulet and de Janvry, 1995). Furthermore, poor spatial and temporal flows of information result in the fragmentation of markets, and exchange cannot be replicated at different places and times (Ellis, 1988). Transaction costs for acquiring information and for negotiating and enforcing exchange arrangements are usually high (Upton, 1996). Inadequate information favors the actors in the market that have access to information (i.e. middlemen, processors, and wholesalers) over those that are less informed (usually small and medium-size farmers) (Ellis, 1988). Therefore, insufficient information allows individuals or companies to gain comparative advantages at the expense of other agents (Upton, 1996).

B) Shallow local markets

According to Sadoulet and de Janvry (1995) shallow markets result in a high negative co-variation between household supply and effective prices. A decrease in the market price of a commodity can be expected if all households successfully produce that commodity, whereas the opposite would occur if households cease to produce it. Shallow markets with limited transactions also increase coordination and information problems regarding what to produce and when.

C) Price risk and risk aversion

The effective price used for the decision-making process at the farm-household level is highly dependent on risk behavior. The level of price risk and the degree of risk aversion tend to increase the expected farm price. Therefore, sales prices are corrected negatively as a hedge against risk, while purchase prices for inputs suffer from positive adjustments (Sadoulet and de Janvry, 1995).

The existence of these market failures constrains the ability of smallholders to become involved in commercial and profitable (but risky) activities like non-traditional cash crop production (de Janvry *et al.*, 1991). Some typical examples of such constraints are:

- To become competitive in cash crop production, capital investments are required and demand credit that is often less easily available to small farmers.
- Producing cash crops for the market is riskier than producing food crops; credit or insurance for lowering this risk involves high transaction costs.
- Producing cash crops often involves specialized inputs like seeds or harvesting and planting machinery; either these are not available on local markets or the initial investment in these inputs is too high.
- Efficient production that meets quality requirements for cash crops requires information about optimal cultivation techniques and the demands of the customers. For non-traditional crops, this information might be difficult to obtain. In addition, the fulfillment of the desired level of product quality requires technical assistance, which may be unavailable or expensive to obtain.

When markets fail for specific goods or for a particular factor, the price is no longer determined by supply and demand, but internally defined by the household as a shadow price (Sadoulet and de Janvry, 1995). Therefore, market failures affect allocation decisions regarding land use, labor intensity and investments that are important issues for policy-making regarding rural development and poverty alleviation in developing countries. Unfortunately, the structural adjustment process intended to enhance the market mechanism remained fairly limited in enforcing the involvement of smallholders in market exchange and on many occasions replaced state dominance with local market monopolies (Pelupessy and Ruben, 1999). High transaction costs observed in many developing countries also explain why peasants cannot be fully responsive to price incentives and are hesitant to adopt new crops or adjust production technologies. This low responsiveness has been rightfully associated with farmers' risk perceptions under conditions of shallow markets and missing information (de Janvry *et al.*, 1991).

2.3 Institutional development and coordination problems

According to the New Institutional Economics, when market failures occur, either a surrogate institution emerges to allow the transaction to take place or the transaction simply does not occur at all (de Janvry *et al.*, 1991). There are a number of definitions of institutions, but the most commonly accepted is that of Douglas North (1990, pg 3): *Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape*

human interaction; in consequence they structure incentives in human exchange, whether political, social, or economic. These so-called 'economic institutions' emerge to perform the functions that otherwise would have been served by markets (Ellis, 1988; Stiglitz, 1989; Sadoulet E. and de Janvry A. 1995).

In the agricultural sector of developing countries, institutions evolve to deal with all kinds of market failures in an environment of pervasive risks, incomplete markets and information asymmetries (Key and Runsten, 1999). They often perform the functions of several imperfect markets, parallel to the spot market. Furthermore, they can involve vertical or horizontal relations or both. These alternative agrarian institutions can take the form of a cooperative, peasant association, marketing boards, insurance and credit groups, internal transactions within the household, as well as all types of contracts with interlinked transactions (Bardhan, 1980; Ellis, 1988). Thus, after the evaluation of their own resource endowments and transaction costs, individual farmers will make the best choice between the spot market and an alternative agrarian institution (Hayami and Otsuka, 1993). In developing countries a great variety of institutions are often difficult to identify and less formal than the examples listed above. In most cases, an alternative market institution is simply an arrangement for the coordination and organization of economic activities, found between spot markets and vertically integrated firms (Hobbs, 1996).

Summarizing, market institutions can solve market failures by providing alternative types of exchange. Institutions can potentially provide better information for small and medium size farmers to enhance their access to input, output and services markets, and thereby achieve better integration with the market to ensure profitable production. However, the fact that an institution evolves does not automatically mean that it performs its economic functions optimally (Stiglitz, 1989) or that it automatically works for the benefit of small farmers.

Supply chain management is a recently developed approach that deals with the analysis of how markets and actors are organized for the production, exchange and delivery of a specific commodity. There is a close relation between the emergence of alternative market institutions in response to market failures and the development of supply chains, where different levels of market integration correspond to different styles of management along the chain. According to Simchi-Levi *et al.* (2000), a supply chain is based on a (logistic) network, comprised of several agents, such as input suppliers, producers, middlemen, processors, brokers,

wholesalers and retailers. This network allows the flow of inputs, services, products, financial resources and information among these categories of agents in order to meet consumers' requirements.

Simchi-Levi *et al.* (2000, pg 1) defines supply chain management as *a set of methods and approaches utilized to efficiently integrate the agents involved into the chain. Therefore a given commodity can be produced and distributed at the right quantities, to the right places, at the right time, and fulfill the desired quality and presentation requirements. This integration should lead to a minimization of system-wide costs, while satisfying service level requirements.* Stated otherwise, adequate management of the supply chain is based on the implementation of collaborative-based strategies to link agents' business operations in order to achieve shared market opportunities. Relying on bilateral exchange and delivery arrangements, two or more agents can thus reduce transactions costs and gain a better position in the market.

In our research, we focus on a particular type of institution, namely the contractual arrangements for delivery and procurement that represent the first stage of the supply chain. We focus our attention on the exchange relationship between primary producers, basically smallholders, and the next agent, usually agro-processing firms, traders or middlemen. The analysis of this stage of the supply chain is particularly important for countries like Costa Rica, where only a limited number of agents operate as intermediaries in the agricultural sector (Mora Alfaro *et al.*, 1994). Therefore, it is widely argued that strengthening the incentives for agricultural development should be based on improving the efficiency of market operations (Pomareda, 1998; Proyecto Estado de La Nación, 1998). One of the pathways to enhance rural market integration is through the promotion of several strategic export-oriented commodities which generate positive multiplier effects for employment, income and trade, and thus reinforce both the local and the national economy. Despite the fact that past agricultural policies were formally favoring an open-market oriented model, they have been less effective in creating low-cost and frictionless exchange within the domestic economy. This poor performance of local collection and delivery systems is now a particularly significant constraint for developing non-traditional commodity markets that require efficient input provision, close supervision and higher security to guarantee the involvement of smallholder producers.

The study of the first stage of the supply chain (*i.e.* the relations between farmers and processors, middlemen or traders) is especially important, because here key decisions regarding input use and crop management influence the quality of the produce and the sustainability of the resource base. A weak relation at this stage may be reflected in the performance at subsequent stages, in terms of the quality, quantity, lead time and frequency of product delivery. In addition, if we pursue reliance on market-driven adjustments for the development of rural areas, we need to understand how the interactions between agents in the countryside are structured, what problems are present, and how these problems can be addressed. Particular attention should be given to the analysis of motives behind farmers' contracts and market outlet choice, due to the contractual characteristics and the market environment where both agents operate.

Strong relationships between different actors throughout the commodity supply chain (producer + agro-processing firms + consumers) are very important to enhance the competitiveness of developing countries in the world market. Improving integration between local and international agents within the chain requires dynamic information systems regarding market conditions, specifically on particular on quality standards and consumer requirements (Simchi-Levi *et al.*, 2000). An analysis of the supply chain should therefore start with identifying the practices and procedures influencing the quality and sustainability of the chain. By tightening intersectoral linkages—both downstream and upstream—farmers can take advantage of advanced technologies on the input side and benefit from vertical integration on the output side (Keyzer *et al*., 2000).

Agricultural development in Costa Rica has been traditionally based on strong market integration for traditional crops (coffee, bananas, sugar, meat) located in the central region, but the relationship between farmers and the agro-industry needs to be strengthened for non-traditional crops produced by smallholders in other regions (Pomareda, 1998). Improved integration of primary production and agro-industry becomes even more important with the signing of the Free Trade Agreement with Mexico (especially relevant for sugar and milk) and the loss of dynamism in certain traditional sectors (declining coffee prices and a crisis in the livestock sector). Given the reduced role of public institutions after structural adjustment, direct alternative arrangements between the peasant sector and industry are required to encourage new alliances with the private sector (Pomareda, 1998). The 'revival' of contract farming can be considered one of the alternatives for strengthening rural development.

2.4 Contract farming as an intermediate institution

Contract farming is frequently mentioned as a substitute for poorly functioning or absent markets. Contract farming is an agreement between a farmer and a firm—either a simple verbal commitment or one based on written documents— where the farmer produces a fresh or partially processed product and the firm is committed to buying it under certain stipulated conditions (Roy, 1972; Glover and Kusterer, 1990; Grosh, 1994). Contract farming serves as an economic institution operating between spot markets and vertical integration (Grosh, 1994; Key and Runsten, 1999), and arises as a response to selective or simultaneous market failures for credit, insurance, information, factors of production or products (Key and Runsten, 1999). Contracts are one of the various ways of coordinating economic activities between a farmer and a processing firm, thus enforcing a certain type of supply chain management for a given commodity (Hobbs, 1996).

There are a number of types of contractual arrangements, which can differ in the conditions of price and payment, the services provided, quality and production requirements and input supply provisions (Grosh, 1994). The choice of a contract depends on the characteristics of the parties and the market where they interact.

The effectiveness of contract farming can be considered from the perspective of the farmer and of the trading firm. Firms can use a variety of institutional arrangements to obtain raw products for processing or marketing, relying on different degrees of vertical co-ordination and related governance structures. One extreme is the *spot market,* where the transaction takes place among several actors and the price is set during the transaction. The firm does not participate at all in the production process, and all other aspects of the transaction (*i.e.* quality, quantity, and timing) are non-negotiable. In this situation there is no real supply chain management (Hobbs, 1996). The other extreme position is full *vertical integration*, where there is a continuous flow of products and information during different stages of a supply chain and transactions follow a corporate-based scheme rather than a negotiating-parties scheme. Here, the firm has complete control over production.

Contract farming takes an intermediate position, allowing the firm to participate and thus exert different levels of control over the production process without formally owning or operating the farms. It is mainly a way to distribute activities in the supply chain and the corresponding risk between the firm and farmers. The farmer bears most of the production

risk and the firm most of the processing and marketing risk. The exact allocation of risk depends on the specifications of the contract. The firm chooses an optimum contract considering transaction costs and profit (Key and Runsten, 1999), depending on the prevailing market uncertainty related to the transaction, the degree of asset specificity (influencing its bargaining position), the frequency of the transactions (Hobbs, 1996), and the monitoring costs surrounding the production process (Singh, 2002).

In general, contracts can be classified into three categories which are not mutually exclusive: (1) market specification contracts, (2) production management contracts and (3) resource-providing contracts (Minot, 1986; Williamson, 1991; Hobbs, 1996; Key and Runsten, 1999; Singh, 2002). Market specification or procurement contracts are simple pre-harvest agreements where the firm commits to provide a market outlet for the farmer (Hobbs, 1996). Usually there are stipulated conditions regarding price, quantity, quality, and timing (Singh, 2002). The farmer reduces market and price uncertainty and transfers it to the firm without losing control of the production process (Hobbs, 1996). Production management contracts require the farmer to adopt specific growing practices, input regimes and post-harvest management practices under the technical supervision of the firm. Resource-providing contracts require the firm not only to provide a market outlet for the farmer's production, but also to deliver specialized input packages and supervision to the production process. Hence, the firm obtains full control of the farm and the farmer almost becomes an employee. Resource-providing contracts are the closest situation to full vertical integration (Hobbs, 1996; Key and Runsten, 1999; Singh, 2002).

The selection of any of these contractual forms varies according to the type of commodity, the characteristics of the agents, and the market conditions for a given period of time (Hill and Ingersent, 1982; Key and Runsten, 1999). However, there are many different variants of contracts that can be derived from the former three main categories, and empirical analyses have focused on specific situations rather than on a generic contract institution (Singh, 2002).

While the firm decides on its organizational strategy, the farmers, in turn, can choose to engage in a contract or sell the harvest some other way. The decision of farmers to accept a contract typically depends on their attitude towards risk and on the specific market failures that they face. Since the contract guarantees the farmer an outlet, marketing risks are reduced. In addition, the input supply services provided under the contract can give farmers access to

markets they could not enter before. Key and Runsten (1999) specify different causes of market failure for which contract farming could be a Pareto-improving form of governance for both the farmer and the agro- processing firm: credit and insurance, information, production factors and product markets.

A) Market failure due to credit and insurance

Access to credit and the structure of the credit market are important motives for contract farming, since non-traditional crops generally require higher initial investments and use more inputs than traditional crops do. Most growers need credit to finance their production. Farmers with no access to the formal credit markets can obtain specialized credit from the firm with whom they have established a contract. The firm often has a superior ability to enforce credit contracts because it can deduct the grower's debt directly from the crop revenue. Moreover, the firm is in a better position to assure that the credit will be used in production if the loans are delivered in the form of inputs or seeds. Hence, compared to banks or other semi-formal and informal credit sources, the firm usually faces lower monitoring costs. Even if the firm does not offer credit directly, the contracted crop and buying guarantee can serve as collateral for a loan at formal credit institutions.

The functioning of the insurance market is also an important rationale for contract farming, since the production of non-traditional crops tends to be significantly more uncertain compared to traditional crops due to its susceptibility to disease and climatic hazards, and the often stronger price variability. Furthermore, the higher investment and production costs impose a greater income risk on the producer. If formal institutional arrangements for smoothing consumption are unavailable and informal credit is expensive, a contract offering a certain (but sometimes lower) price can serve as risk insurance for the farmer. The firm thus profits by earning a risk premium that the risk-averse farmer is willing to pay for the certainty of a guaranteed market outlet (Key and Runsten, 1999).

B) Market failure due to information

Production of non-traditional crops devoted to exports generally requires specialized information on product and quality requirements. Spot markets may not efficiently transfer such complex or rapidly changing information. Missing markets due to information on technology, timing and quality can result in sub-optimal market exchange and distrust, where both buyers and sellers are worse off. Furthermore, this can even cause a complete

breakdown of the market (Akerlof, 1970). When production is information-intensive, monitoring of quality ex-post is costly and growers lack the resources to acquire the information themselves. Contracts tend to include the delivery of firm-employed extension agents who perform two functions: communicating the demands of the firms and monitoring the behavior of farmers. For a farmer that starts with new crops, these extension services provide information and assistance regarding technological innovations, and this may even lead to spill-over effects for the production of other crops by the farmer.

C) Market failure due to production factors

Family labor, farming experience and land are usually the production factors controlled by farm households. These variables are valued by firms when selecting a farmer who is eligible for a contract. Monitoring of hired labor may be very costly for a firm when cropping activities are labor-intensive. In most cases, the efficiency of the hired labor force is determined by the amount of supervision that is applied. In an environment where labor markets are missing, the farmer would have a clear advantage for producing labor-intensive crops *vis-à-vis* the firm. Since family labor costs are lower compared to the costs of monitoring hired labor, the firm would have an incentive to contract the crop with the farmer. A similar situation occurs with land and faming experience. According to Key and Runsten (1999), a firm engaged in a labor-intensive crop would look for farmers with low endowments of land and a large family. Conversely, with a land-intensive crop, the firm would look for larger landholders in an area where the opportunity cost of land is high, or where poorly defined property rights are a disincentive for the firms to invest in land. In addition, for non-traditional crops the markets for specialized inputs or services are often thin or missing, and the provision of these inputs through a contract can assist firms when initiating production in new areas.

D) Market failure due to product markets

Many agro-industrial firms process or pack crops for which there is a thin or missing local market. In the case of missing product markets, producing the crop is only possible through vertical integration or contracts with farmers. If vertical integration is unattractive due to high investment risk or the national political climate, contract farming is a good alternative if the transaction costs are not prohibitive.

2.5 Advantages and disadvantages of contracts

The description of market failures and possible alternative contract arrangements does not directly indicate under what conditions firms will choose to make contracts with farmers and whether smallholders will be able to benefit from these contracts. In general, both parties are likely to choose contracts instead of vertical integration or spot market exchange when transaction costs can be reduced or risks prevented (Singh, 2002). On the producers' side, farmers prefer flexible, long-term contracts favoring production system intensification and/or specialization. With contracts, farmers can limit their responsibilities and transfer to the firm the uncertainties associated with the search for market outlets for their production (Hill and Ingersent, 1982). In addition to the gains in certainty, the contract would give them access to new and sometimes costly production technologies, specialized inputs and technical assistance (Goldsmith, 1985).

From the firm's viewpoint there are several reasons for deciding to engage in a contract with small farmers. First and foremost, the firm will prefer a contract if the cost of contracting a farmer is lower than the cost of organizing and managing fully vertically integrated operations (Key and Runsten, 1999). For some crops, small farmers are efficient producers and therefore attractive counterparts for the firm. By contracting farmers, the agro-processing firm could gain certainty regarding a stable flow of raw materials, with the required quality characteristics and timely provision. Under market uncertainty, flexible contracts provide the firm with the necessary primary product, without making high investments in land, assets, labor supervision and management operations (Singh, 2002). Thus the firm can transfer some asset specificity to the contracted farmers. Moreover, improvements in quality and added-value to the commodity can be better achieved at the first stage of the supply chain, rather than during the upstream stages. This is another incentive for the firms to establish a stronger contractual relationship with farmers (Singh, 2002).

Firms can also obtain extra benefits from contracting farmers by joining special governmental and non-governmental programs that seek rural development through enhanced market integration (Singh, 2002). From an institutional economics perspective, the promotion of contract farming can create positive spill-over effects for rural income and employment generation, making investment in infrastructure feasible, along with the creation of other economic activities (Key and Runsten, 1999).

The former set of general advantages for both contracting parties has been challenged by some. It has been argued that contracts emerge only after the withdrawal of state programs from the agricultural sector and that they represent a form of entrepreneurial control over peasant agriculture, which tends to lock in and exploit small farmers through a disadvantageous trade relationship (Singh, 2002). The inequality of the bargaining power between farmers and the firm and the increasingly stringent quality requirements lead to product differentiation and tend to reinforce monopolistic or monopsonistic tendencies in the contract arrangements (Wilson, 1986).

In spite of the potential benefits of contracts for farmers, several studies have shown that in developing countries contracts have more negative than positive effects (Glover and Kusterer, 1990; Grosh, 1994; Little and Watts, 1994; Porter and Phillips-Howard, 1995; Torres, 1997; Siddiqui, 1998). Contracts might disturb local social relations, causing intra-household tension between the household head and his wife and children (Carney and Watts, 1990) and friction within communities between contracted and non-contracted farmers (Little and Watts in Singh, 2002). Contracts are likely to cause more class differentiation, whereas from the organizational point of view they can hinder endogenous and more inclusive communal arrangements, and contradict classical interest organizations (Singh, 2002).

It is also argued that firms tend to contract larger farmers or can be tempted to offer different types of contracts to different types of farmers, thereby increasing social inequalities in a region (Singh, 2002). High specialization of the contracted cash crop production transforms farmers into single commodity producers, thus increasing their asset specificity and making them more vulnerable to exploitative contract terms, food shortages and price fluctuations. Moreover, contracts restrain producers from deviating to other processors to benefit from the highest price (Key and Runsten, 1999).

Glover (1984) addresses the problem of manipulation of quality standards within contracts. Processors could raise their quality standards if supply exceeds the market demand, and reject the surplus produce. Related problems include the poor technical assistance and in many cases the overpriced services that firms provide. Most contracts require farmers to follow the company's advice, but absolve the firm from responsibility for the results. Furthermore, problems of soil contamination or resource depletion easily can occur when intensive crops are grown under tropical conditions without adequate crop rotation and soil conservation

measures (Siddiqui, 1998). On the other hand, ambiguous quality standards and costly pesticide use monitoring regimes may incite farmers to violate international norms and regulations when they fear higher rejection rates at the processor's plant (Key and Runsten, 1999).

In spite of the above disadvantages and drawbacks of contracting arrangements, there are certain typical conditions under which firms and small farmers are likely to engage in contracts. Uncertainty, bargaining power, asset specificity and enforcement are four key issues for selecting a contractual form of governance (Williamson, 1991; Key and Runsten, 1999; Dorward, 2001). Uncertainty is related to missing information markets, bounded rationality and opportunistic behavior. It represents the high costs of finding information and is a major cause of default in product coordination (*i.e.* quality and timing requirements) and distrust between parties (Dorward, 2001). Bargaining power refers to the distribution of power in trade relations and is intrinsically associated with asset specificity. Enforcement has to do with the permanence of the contractual relationship over time and thereby with the frequency of transactions.

Williamson (1985) combined the concepts of bounded rationality and opportunistic behavior to explain contractual choice and the ownership structure of firms. Bounded rationality refers to the fact that people have limited memories and cognitive processing power. Opportunistic behavior is the possibility that people will act out of self-interest. This implies that agents might try to take advantage of a situation by hiding relevant information. Due to this bounded rationality, complete contracts do not exist, given the complexity of all relevant aspects of transactions. The incompleteness of a contract might enhance moral hazards by parties involved in an effort to exploit any situation that has not been specified in the contract.

Key and Runsten (1999) analyze the determinants of power relationships between the contracting parties by using a basic Principal-Agent theory, where the assumed higher bargaining power on the firm's side could impose contract conditions on the farmers. However, the firm has to face uncertainty regarding the farmer's response, since monitoring a farmer's behavior is expensive and the production process is subject to unpredictable factors (climatological hazards and attacks by pests). Hence, the firm maximizes profits subject to two constraints, namely (1) the farmer's loyalty for not deviating from the contractual terms and (2) the maintenance of stable trade relationships over time.

The first constraint implies that the farmer will accept the contractual conditions when the firm offers terms that satisfy the farmer, when compared to other alternatives. The capacity of the firm to provide attractive contractual terms depends on the structure of the market, and especially on the number of other agro-processors. In a monopsonistic market, the firm could set the purchase price for farmers just beyond the minimum price accepted by the farmers before shifting to another activity (Key and Runsten, 1999). Hence, the firm can exert its bargaining power, which will diminish when more processors enter the market offering better contract terms. Firms can reach the most profitable contracts (*i.e.* low transaction costs and high rents) with small farmers when they are able to exert higher bargaining power and if farmers are willing to pay more for the services provided by the contract and the reduction of risk.

The relative bargaining power of both parties is intrinsically related to their level of asset specificity. Asset specificity means high specialization of an investment for an almost unique commercial purpose (Williamson, 1991; Hobbs, 1996; Key and Runsten, 1999). Higher asset specificity for a firm, like a large specialized processing facility or a plantation, would reduce its bargaining power, since unused capacity implies a loss. On the other hand, the farmers' bargaining power is weaker when there are many spatially dispersed producers with high asset-specific investments (in permanent crops, farm infrastructure and equipment) with low levels of institutional organization. Conversely, farmers will gain bargaining power if they act as a group or as a cartel controlling the supply conditions. More diversified farmers with more income sources exert better control on production factors like land, labor and managerial skills. They are also likely to be less dependent and could thus improve their bargaining position (Key and Runsten, 1999).

According to Dorward (2001), uncertainty and asset specificity, together with the level of exposure to risk for both the processor and the farmers, determine what type of contractual arrangement will be adopted. When the uncertainty associated with the transaction is low and asset specificity low as well, spot market exchange will be the preferred market governance structure. Conversely, as risk exposure and asset specificity increase, first contractual arrangements and later on full vertical integration will be preferred. Moreover, Williamson (1991) states that besides pure transaction costs, there are costs associated with the use of a certain contractual form, namely "associated transformation costs." In addition, there are costs related to potential losses because transactions can fail or the contract may not be

fulfilled by the parties; these are defined as the "risks of loss" (Dorward, 2001). Finally, asset specificity is also related to the distinctive techno-economic characteristics of individual commodities, defined by Jaffe and Morton, in Dorward (2001), as technical requirements and investments which determine firms' decisions regarding, transport, processing and storage conditions.

The second constraint for the firm in making profit from contracting with farmers refers to their ability to maintain stable contractual relations over time. Hence, the incentive for the farmers to comply with the agreement should be greater than the potential results that might be obtained from contract deviation. Stable relationships are more easily maintained with a high frequency of (repeated) transactions where agents are able to build up their reputation, loyalty and confidence. Moreover, frequent transactions provide more information to both parties about their credentials. Conversely, less frequent transactions could easily lead to opportunistic behavior where agents take advantage of asymmetric information (Hobbs, 1996). Firms can enforce agreements by either rewarding good farmers or punishing the others, but this may be costly and difficult to enforce due to complicated legal systems or because the disloyal farmers lack resources to pay the penalties (Key and Runsten, 1999). Reputation and loyalty can thus be considered as cost-effective mechanisms for stimulating contract compliance.

2.6 Contract farming and farmers welfare

The engagement of smallholders in contractual exchange depends on the purchase conditions offered by the firm, the availability of other market outlets, the possibilities for compliance with increasingly stringent quality demands and environmental regulations, and the options for keeping supply continuous.

2.6.1 Contract choice

There is little literature on the precise determinants of small farmer's contract choice, although some general characteristics of farmers' preferences for specific types of delivery conditions can be deduced by linking the theory of market failure with the theory of peasant behavior. A selection of the farm household characteristics applicable to this study includes the following:

- Contracts will be preferred by risk-averse farmers with a poor capacity for self-insurance. Since risk-aversion is generally held to be negatively correlated with income, poorer producers will be more likely to select contracts (Key and Runsten, 1999).
- A credit-providing contract will be preferred by farmers who are facing high costs of credit or are less able to obtain credit through formal banking institutions. These are generally smaller producers with insufficient assets to satisfy collateral requirements.
- Farmers with less access to markets for off-farm employment will maintain relatively cheaper (non-tradable) family labor. They are more likely to engage in contracts for labor-intensive crops and will accept a lower price due to their low opportunity costs of labor. This effect is even stronger when farmers have large families and the land market discourages leasing land (Key and Runsten, 1999).

In general, farmers with less alternative production or income opportunities will be more likely to accept contracts, since they possess less bargaining power and have fewer exit options. Generally this holds for poor farmers with limited production assets, like capital, family labor and land (Key and Runsten, 1999). More specifically, this depends on the alternative opportunities available in the region.

2.6.2 Market conditions

Although contract farming can serve as an anti-competitive strategy, for contract farming monopsonistic markets are generally more favorable than more competitive markets (Glover and Kusterer, 1990; Grosh, 1994; Key and Runsten, 1999). In new (and sometimes remote) areas of production—*e.g.* settlement schemes in the agrarian frontier—firms can initiate production relatively quickly by offering growers resource-providing contracts. Once production has started, the firm can use contracts to consolidate its initial monopsony power. When other firms enter the region to supply inputs, or when farmers are concentrated or organized enough to supply each other with information and assistance, the firm may no longer be able to exercise market power and contract rents will decrease.

In a more competitive environment, growers gain the ability to choose among contracts, and firms have to compete to offer the best contract 'package' (Key and Runsten, 1999). Free-rider behaviors of new firms that take advantage of services provided farmers by the first-mover firm are likely to emerge. Hence, contracts will be relatively less profitable in a more

competitive market. Furthermore, the possibilities of default tend to increase in such environment, thus raising the firm's enforcement costs (Glover and Kusterer, 1990). If the growers become better organized, this also increases their bargaining power due to the possibilities for disseminating information between contract farmers and other farmers. From the farmers' perspective, a contract will become less attractive in the case of a stable, established market with buyers competing on price (and non-price) conditions offered to the farmer (Key and Runsten, 1999). In such a setting, the utility of abiding by the contract must be greater than that received from any other alternative. If firms cannot fully enforce their contracts, farmers can rely on contracts as a kind of safety net that will be used only in adverse market conditions.

2.6.3 Environmental concerns

Over the last few decades, many developing countries have initiated soil conservation or watershed programs or projects (de Graaff, 1993). Projects for enhancing sustainable land use of small farmers have been costly and have not always met the desired adoption rates of conservation techniques (Rickson and Burch, 1996). Farmers usually have strong values regarding their land and are aware that they need to preserve it for future use as their most important asset. However, in many cases they may be reluctant to invest scarce resources (capital and labor force) for expensive, time-consuming conservation activities. Moreover, markets for environmentally sound products are usually thin and not accessible for low-income farmers (Key and Runsten, 1999). Farmers may be reluctant to follow technical recommendations if they operate in a setting of price and market uncertainty.

Under these circumstances, contract farming can be a feasible way for promoting improved input use or soil conservation practices. Simple market-specification or procurement contracts tend to have a negative effect on the adoption of soil conservation measures (Siddiqui in Singh, 2002). Short-term production goals needed by the firms may inhibit farmers' investments in long-term conservation that would usually require extensive labor time (Rickson and Burch, 1996). Conversely, production-management and resource-providing contracts are better ways to promote technologies for more sustainable land use in a cost-efficient way. This is only reliable as long as the firm recognizes that farmers' land conservation efforts are in its own commercial interest and part of its social corporate responsibility (Rickson and Burch, 1996). Including technical assistance and input-supply

systems as a part of contract farming provides farmers with information on better fertilizer regimes, adequate pesticide use and soil conservation measures. Hence, contracts could function as a cost-effective mechanism to reduce farmers' uncertainty and increase their willingness to invest in these techniques.

2.6.4 Quality performance

When producing for export markets, farmers face a number of demands regarding the organization of their production system. Production choices depend not only on the costs that are involved with the different activities, but also on other factors such as the quality performance of the produce, pesticide residues and delivery frequency (lead time).

The term quality has two dimensions. The first is the physical appearance of the produce required by retailers or consumers. The second aspect refers to international standards for, among other things, input residues and the use of certain types of agrochemicals in production, processing or storage. Farmers producing for exports are often faced with the cosmetic specifications of foreign buyers that differ from those of local consumers. These physical standards frequently force farmers to use specialized inputs, for example insecticides, to prevent external damage to the produce. Moreover, chain partners have to cope with international standards for food safety. After a review of the General Agreement on Tariffs and Trade (GATT) in 1986, modifications were introduced to reduce unfair competition and inequities in market access. With respect to food safety, the Uruguay Round confirmed the FAO Codex Alimentarius as the preferred standard. The Codex contains rules for residues, contaminants and additives permitted in internationally traded crops. An important consequence of these efforts to control food safety is the rejection and sometimes destruction of significant quantities of products. This causes serious interruptions of trade and induces relatively large financial losses. For example, during the second half of 1997, 4,795 shipments of food from all over the world were detained by authorities in United States, and seven percent was attributed to unacceptable levels of pesticide residue (even though only five percent of all shipments to the United States can be examined on arrival) (Hammer, 1999).

There are many reasons for the detention and rejection of food imports. The most important include the inability of some food-exporting industries—especially in less-developed countries—to handle, process, package and transport products that meet the mandatory sensory, safety and quality requirements of importing countries. This is due to the limited acquaintance of governments and industries in exporting countries with the mandatory requirements of food-importing countries and the lack of adequate export control programs and related infrastructures in food-exporting countries. The costs for exporting countries to meet these standards are high and steadily rising, thus posing a serious problem for least-developed countries. Another important aspect to take into account is the loss of commercial reputation of countries that fail to meet the required standards.

In addition to the financial loss, rejection in the target market has negative consequences also for the stability of the trade relationship at the first stage of the chain, leading to distrust between parties and loss of loyalty amongst less-informed farmers. The contract itself is not a sufficient condition for a stable trade relationship between a processor and a farmer, since it requires a continuous flow of reliable product and market information between parties.

Loyalty in contractual arrangements is of mutual importance to both parties and is strongly influenced by the degree of quality compliance. Farmers need guarantees that the firm will purchase their produce at reasonable prices, with a certain frequency and maintaining regular terms of payment, while the firm should be assured that it can obtain a regular flow of raw material, at the right moment and with the desired quality characteristics. The compliance of these basic agreements is not always easy for the parties to fulfill. An agro-processing firm may be tempted to manipulate quality standards when there is oversupply of raw material, in order to reject what cannot be processed (Grosh, 1994). On the other hand, monitoring farmers is costly and it cannot always be determined whether quality default is caused by mismanagement or by uncontrollable hazards. Moreover, overly ambiguous quality standards imposed by the firm may incite farmers to violate pesticide usage norms since they fear high rejection rates at the processing level (Key and Runsten, 1999).

2.6.5 Scale and delivery frequency

Scale of production is an important factor to ensure continuous delivery and is a significant determinant of prices.[5] The smaller the farmer's scale of production, the weaker the bargaining power and the greater the vulnerability to price deductions. Economies of scale lead to a reduction in long-run average cost when the size of the plantation and equipment increases (Schiller, 2002). There are different viewpoints about the relevance of economies of scale in agriculture. They may exist because certain kinds of equipment can be used more efficiently on large farms (Gillis *et al.*, 1992). In developing countries, however, economies of scale are less important for peasant agriculture. Family labor has the important merit that the incentive to work hard is substantially larger than it is for hired workers. These efficiency gains seem to outweigh the costs of losing some of the benefits related to scale. Therefore, economies of scale mainly emerge in the processing and marketing stages, where specialized equipment can reduce unit costs.

Contract farming appears to be a way to benefit from these economies of scale at processing and marketing levels, since it combines the output of a large amount of farmers (Hayami, 1998). This is important for the firm as well, since continuous delivery of raw produce guarantees the full occupation of the plant capacity and thus reduces lead times. In order to maintain a stable position in the market, lead time reduction appears nowadays as one of the key areas of competitiveness. Dovetailing the scale requirements of firms with detailed delivery frequency agreements with farmers is therefore of critical importance for efficient chain integration.

2.7 Conclusions

Contract farming can—under certain conditions—be an appropriate tool to overcome or at least reduce the adverse effects of market failures, risks and transactions costs present in many developing countries. Several studies have documented the potential of contracts for enhancing rural development through the incorporation of small and medium size farmers into the market economy (Glover, 1987: Key and Runsten, 1999). Contract farming could improve the overall competitiveness of the agricultural sector and reinforce its contribution to

[5] The concepts of farm size and scale have different definitions. Farm size usually refers to the total land area, whereas farm scale refers to the economic size of the farm in terms of the combination of all resources used in production (Ellis, 1988).

economic growth. Contracts may also be a way to promote the adoption of environmentally friendly technologies and sustainable land use practices. However, having a contract does not automatically mean that all problems with transaction costs are fully solved (Stiglitz, 1989). In fact, there are several other studies that show how contracts may have negative implications for local social relations and could lead to a loss of autonomy and bargaining power (Grosh, 1994; Siddiqui, 1998; Key and Runsten, 1999; Singh, 2002).

In this chapter, we have provided an overview of the contract farming debate and identified the conditions under which contracts can function as an adequate alternative market institution. The major conclusions can be summarized as follows.

First, contract farming is a form of governance that emerges in response to market failures, takes an intermediate position between pure spot markets and full vertical integration, and corresponds to a coordination style of supply chain management based on mutual dependence between the agents involved. Contracts are thus a suitable mechanism for distributing risk between agro-processing firms and (groups of) farmers. The exact distribution of these risks is a matter of negotiation and depends on the specifications in the contract.

Second, contracts at the first stage of the supply chain play an important role for the integration of the supply chain, tightening intersectoral linkages both downstream and upstream, whereby farmers benefit from access to advanced technologies on the input side and from guaranteed outlets on the output side. Major improvements in the supply chain can be better achieved in early stages rather than downstream in the chain. Contracts are of major importance to establish the conditions for meeting customers' preferences.

Third, market specification, production management and resource-providing contracts are the three main non-exclusive categories for contracts. The selection of a specific type of contract depends on the type of commodity, the characteristics of the contracting parties, and the prevailing market conditions at a certain period of time. Resource-providing contracts are particularly important for enforcing sustainability criteria or for promoting quality upgrading.

Fourth, the expected positive effects from contracting for the farmers are: (1) higher certainty level regarding price and market outlets, (2) better access to credit, production techniques and specialized inputs, (3) better access to product and market information, (4) provision of

source of employment for family members, and (5) a greater willingness to invest in resource conservation activities. The advantages for the firm are: (1) assurance of timely supply of raw material, (2) a continuous supply of inputs, (3) a reduction of labor supervision costs, (4) no costs for leasing land. Contract farming is attractive to the firm only when the cost of contracting is lower than that of operating a vertically integrated system.

Fifth, uncertainty, bargaining power, asset specificity and enforcement are key issues for the selection of supply chain governance regimes. The opportunities for reaching and maintaining a *win-win* situation through an agreement depends on the level of mutual trust, the exchange of information between agents, the relative distribution of bargaining power, and the enforcement costs of the contractual terms. Successful integration of small and medium size farmers into export markets seems to depend particularly on the type of contract they maintain with the firm. This contract determines their income levels, degree of autonomy and the level of risk they accept or share with the firm, and influences their willingness to invest in quality improvements or resource conservation measures. Dynamic chain advantages can only be maintained when contracts enable farmers to adapt to these changing market demands.

Finally, contract farming can become an integral part of agrarian policy-making, where the government, together with farmers and firms, joins efforts and interests in order to promote an inclusive strategy of local sustainable development. This implies that the state also defines minimum public grades and standards, and offers a framework for legal enforcement and recourse (Farina and Reardon, 2000). Whereas private parties are fully responsible for the decisions regarding the design and operation of the supply chain contracts, the state plays a major role in regulating market access, providing information and control, and promoting farmers' organization. Through these interventions, a framework can be provided to enhance bargaining power and reduce the institutional risk for smallholder producers willing to participate in contract farming.

Chapter 3

Markets and contracts for smallholder pepper producers: Implications for production systems and resource management

3.1 Introduction

Delivery contracts between smallholders and agro-industrial processing firms are usually considered a device for reducing risk and a strategy for guaranteeing continuous supply (Glover, 1987; Grosh, 1994). For the start-up of non-traditional agro-export production, contracts provide farmers with security and facilitate necessary investments. In practice, however, a wide variety of contractual arrangements coexist, and local farmers may be able to negotiate different delivery conditions that serve their particular interests (Key and Runsten, 1999).

In this chapter, we analyze the rationale and effectiveness of different types of contractual regimes between small-scale producers of pepper and processors in Costa Rica, focusing on the implications for production and investment decisions. Pepper strongly increased its importance as a non-traditional crop since the 1970s both for the local market and for export.[6] Pepper is a very suitable crop for smallholders, since production requires detailed attention and frequent disease control throughout the cropping cycle. This gives family farms a competitive advantage compared to large commercial plantations. In addition, pepper is an attractive diversification activity because it is a labor-intensive crop, does not require complex technologies or machinery and can reach high, fairly stable yields per hectare. A major drawback for small farmers are the high entry costs during the start-up phase, necessary for initial investments in crop establishment and the long maturation time before the first harvest. Contracts may be helpful as a strategy for overcoming these constraints and permit market access at reduced levels of uncertainty (Dorward, 2001).

Pepper production in Costa Rica is managed in a small number of farmers' settlements in the northern region known as *Huetar Norte*, where appropriate agro-climatic conditions for this crop prevail. The market is mainly controlled by three major buying and processing companies that have more or less stable delivery relationships with the farmers. The processing firms differ in terms of their scale of operations and handling practices. The market is structured in such a way that each company is active in a particular region of influence, whereas in other regions their operations may overlap. All companies offer some kind of contract, ranging from fully informal verbal agreements to written contracts for periods up to 15 years. These contracts also differ with respect to input supply services, technical assistance facilities, delivery conditions and quality requirements. Apart from the agro-processing companies, itinerant traders are also active as intermediaries for the food industry. These agents buy rather infrequently and do not have agreements with the primary producers.

In the Costa Rican pepper sector we can distinguish two different market situations (competitive market and local monopsony[7]) and three types of contractual arrangements (none, verbal or written commitments). We interviewed local producers involved in these different networks and analyzed their production, marketing and investment decisions. Attention is focused on the implications of diverse market situations and contractual arrangements for farmers' land use and resource management strategies. When farmers depend on a single trader-processor, investments are likely to be more risky. Local competition between traders may therefore be required as an incentive for enhancing farmers' willingness to improve input use in pepper production.

Particular emphasis is given to the changing nature of the contracts during the farm household life cycle. Farmers need formal contracts in early phases of the crop establishment process to safeguard their initial investments, but in subsequent phases and when more competitive market conditions arise, they tend to prefer verbal commitments (Lutz and van Tilburg, 1998). The latter are far more difficult to enforce and could easily lead to disloyal

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[6] Non-traditional crops include mini-vegetables, macadamia nuts, melon, strawberry, palmheart and others, which make the country less dependent on traditional exports (coffee, bananas, meat and sugar).

[7] A monopsony market refers to a situation where there is only one buyer who meets the supply of various producers and will therefore be able to set purchasing conditions (Henderson and Quandt, 1980).

behavior. Contracts can thus serve as a vehicle for overcoming transaction and information costs, but may no longer operate once farmers become further integrated into the market.
This chapter analyzes the rationale and effectiveness of different contractual arrangements between small-scale producers of pepper and agro-processing firms. The specific research questions are defined as follows:

1. How is the current agri-food supply chain for pepper organized in Costa Rica?
2. What type of farm households participates in contract farming and under what market environment?
3. What are the characteristics of the different contractual regimes offered by the different agro-processing firms?
4. What are the effects of contract choice on pepper production systems?

The data analysis has been conducted making use of the Structure-Conduct-Performance framework (Bain, 1968; Martin, 1993) for the operations on the pepper market, followed by a statistical analysis of household and production characteristics to identify the determinants and effects of contract choice, and to estimate the importance of contracts for resource use efficiency. The analysis is divided into two parts: (a) a review of the organization of the pepper marketing chain focusing on the types of contracts existing between agro-processors and producers, and (b) a micro-level analysis of farm households' responses to contract choice in terms of input use and yields.

The remainder of this chapter is structured in six sections. In the second section, we describe the data collection process. In the third section we characterize the Costa Rican pepper sector in general terms, focusing on the agents involved in production, exchange and processing. Hereafter, we outline the major elements of the market structure, conduct and performance of pepper chains in Costa Rica. The next three sections describe the prevailing contractual agreements in the pepper market, discuss the reasons for selecting specific contract regimes and analyze their implications for farmers' resource use decisions under specific market configurations. Finally, we outline the changing functions attributed to different types of delivery contracts during specific phases of the farm household development cycle.

3.2 Materials and methods

The first part of the analysis focuses on the structure of the supply chain for pepper in Costa Rica, and provides a broad description of how the market and its actors are organized. The information about the market was gathered during in-depth interviews with processors, selected pepper producers and employees of the governmental institutions involved. This information was cross-checked by direct observation in the field, examination of processing-firms' data records and examination of governmental documents.

The second part of the analysis focuses on the characteristics and spatial distribution of the contracting parts, the characteristics of different contractual regimes and the effects of contract choice on pepper production systems. To determine what types of farm households participate under different contractual regimes, we conducted a survey amongst pepper producers in northern Costa Rica using a semi-structured questionnaire to obtain data on production systems and marketing arrangements. Table 3.1 shows the set of selected variables, divided into farm and household characteristics, production system features, and access to institutions and markets.

Because the number of the producers was not known, we implemented a non-random sampling method, called the "snowball" method (Babbie, 1992). Maps of peasant settlements (collected from the Institute of Agrarian Development, IDA) and topographic maps from the National Geographic Survey Institute were used to locate the main locations where pepper is produced. Pepper farmers were identified within these zones relying on information from the processing plants. Subsequently, other farmers could be found by reference.

After several rounds of observations in the field—assisted by agronomists from the local pepper companies—a spatial distribution of producers in three distinct market segments could be made. We analyzed the differences in production systems and delivery regimes between these market segments. Three locally operating agro-processing buyers were identified and their staff and management provided information regarding the history of the company, their relations with producers, and the future perspectives of the pepper sector. Additional secondary information regarding pepper imports and exports was obtained from the Ministry of International Commerce.

Table 3.1 Selected variables of pepper producers

FARM AND HOUSEHOLD	PRODUCTION SYSTEM	MARKET AND INSTITUTIONS
Farm characteristics	***General***	***Marketing of pepper***
Region *(five different cantons)* [1)]	Share arable farm land *(%)*	Market situation *(one buyer/several buyers)*
Farm area *(in "manzanas")* [2)]		Main buyer of pepper *(Company A, B, other buyer)*
		Type of agreement with buyer *(formal contract/verbal agreement/none)*
Soil fertility *(low/medium/high)*	Number of commercial crops *(all crops destined for the market)*	Years of relationship with buyer
		Willingness to deviate from a contract (*yes/no)*
Drainage problems *(yes/no)*		Access to institutions *(yes/no)*
Erosion problems *(yes/no)*	Number of subsistance crops	Access to technical assistance *(yes/no)*
Mountainous land *(yes/no)*		Use of credit *(yes/no)*
	Number of livestock activities *(cows, goats and pigs, and poultry)*	Membership of a farmers organization *(yes/no)*
		Increase pepper area for next period *(mz)*
Household Characteristics	***Pepper cultivation***	***Access to markets***
Household size *(number of persons)*	Experience producing pepper *(in years)*	Access to land *(sufficient access yes/no)*
Age of head of household *(in years)*	Area of pepper in production *(mz of mature plantation)*	Willingness to expand pepper area (*yes/no*)
Education of head of household *(primary school completed yes/ no)*	Area of pepper not in production *(mz of young plantation)*	Access to input markets (fertilizer/ pesticides) *(possible to buy desired inputs yes/no)*
Farming experience *(in years)*	Age of the plantation *(in years)*	Access to information on farming activities *(possible to obtain sufficient info yes/no)*
Years of land ownership *(in years)*	Degree of specialization *(% of land under pepper)*	
	Yield of pepper *(kg per manzana per year)*	
	Fertilizers, pesticides and other products use *(amount in kilos or liters)*	
Gross household income *($/year)*	Value of fertilizers, pesticides and other products *(Colones and US Dollars/year)*	
	Mean price of pepper sold *($ per kg harvest)*	
Off-farm employment *(yes/no)*		
Share of household income from agricultural and non agricultural activities *(%)*	Total labor *(In hours per week)*	
	Hired/own labor *(ratio of hired and own labor)*	

Notes: 1) A *canton* is a political-administrative division comprised of two or more districts.
2) A *manzana* (mz) is the common unit of measure in Central America (1 mz = 0.7 hectare).

We collected data on pepper production systems and delivery contracts from 50 producers—representing 65% of all pepper producers—related to three processing companies. Table 3.2 shows the variables and statistical methods used to address the research questions corresponding to the second part of the analysis. After analyzing market segmentation, this criterion is subsequently used to compare differences in contract choice and production systems. Finally, the impacts of contract choice and market segmentation for differences in pepper yields are assessed.

Table 3.2 Research questions and analytical methods

Research question	Section in chapter	Variables	Analytical method	Expected outcome
What type of farm households participates in contract farming and under what market environment?	Market segments (3.4)	Characteristics of farm and household, production, and market and institutions	T-test	Farm household characteristics according to the segmentation of the market
What are the characteristics of the different contractual regimes offered by the different agro-processing firms?	Contract choice (3.6)	Characteristics of farm and household, production, and market and institutions	T-test and ANOVA test	Farm household characteristics according to type of agreement
What are the effects of contract choice on pepper production systems?	Production systems (3.7)	Characteristics of farm and household, production, and market and institutions	T-test and ANOVA test	Effects of contracts on production systems and market access
	Pepper yields (3.7)		OLS regression	Determinants of pepper yields

3.3 Production and marketing of pepper in Costa Rica

3.3.1 Background

Pepper (*Piper nigrum* L.) production started in Costa Rica in the 1970s as an experimental crop for large plantations. The pioneer was the North American entrepreneur Charles Hunter, who started a plantation of about 15 hectares and a small processing facility in the northern region of *Sarapiquí*. The crop expanded rapidly in the lowlands of Costa Rica and covered a maximum area of 500 ha in 1990 (Rojas Zúñiga, 1994).

From the mid-1980s onwards, small farmers from *Sarapiquí* also started to cultivate pepper. Laborers from Hunter's pepper plantations took some seedlings home and started cultivating them in their own plots, selling the harvest to Hunter's enterprise, which had promised to buy it (Vega, personal communication). In 1987, another North American entrepreneur, Walter Kinsing, started a new production and processing company: *Pimienta y Especias de Centro América* S.A (PIMECA S.A.) and entered the market with his own 65-ha plantation (Cubillo, personal communication). By 1988, the Costa Rican Land Reform Agency (IDA) started a promotion campaign for pepper as a non-traditional crop for small and medium-scale producers (Rojas Zúñiga, 1989). This activity received strong support from the *Coalición Costarricense de Iniciativas de Desarrollo* (CINDE); an NGO funded by USAID,[8] in line with the export-promotion activities within the framework of the structural adjustment program and trade reform policies.

In 1988, the price of pepper was around US$12 per kilo, which was considered attractive for a new commodity. At the same time, *Piper and Capsicum Processors S.A.* (PROPICA S.A.) started pepper-processing operations in the northern region (Mora, personal communication). Pepper was still mainly a crop for large estates and by 1990 these holders amount to an area of about 300 ha, while smallholders controlled the remaining 200 ha. In 1989 an adverse price trend started and during five consecutive years prices dropped to US$0.80 per kilogram. This decline in international prices was caused by the collapse of the Soviet Union, occasioning the interruption of pepper imports by the former Islamic Soviet Republics from India, the largest world producer of pepper. India started to deliver its surplus in the international market and consequently prices dropped dramatically. Moreover, by 1990 fungus attacks caused extensive damage to the Costa Rican plantations, leading most of producers to withdraw from the activity. Only smallholders with low production costs and small plots could survive from this combination of low international prices and fungus attacks (Cubillo, personal communication).[9]

After a profound economic crisis in the beginning of the 1980s, the Costa Rican government policy changed from a model of import substitution towards a liberalization of the economy

[8] International Development Agency, United States of America.
[9] The National Program for Pepper continued until 1994, and is considered one of the few national programs of that period to be successful in stimulating small farmers to introduce non-traditional export crops. When the program ended, about 486 ha of pepper were in production all over the country. However, by the year 2000 the only remaining zone producing pepper is the northern region.

(Doryan Garrón, 1990; SEPSA, 1999). Within the framework of macroeconomic structural adjustment policies, the government strongly stimulated private and public investments for the development of non-traditional crops (Masís and Rodríguez, 1994; Mora Alfaro *et al.*, 1994). Emphasis is given to infrastructure improvement, import facilities for inputs, improved market information and commercialization systems, institutional modernization and an increased integration of agricultural commodity chains (SEPSA, 1999). Liberalization policies include—among others—reductions in trade tariffs, removal of trade barriers and a sequence of gradual devaluations for strengthening both traditional exports and stimulating investments in new agricultural export products such as ornamental plants and flowers, pineapples, vegetables, chili pepper, processed cheese, spices and seafood. The export of these non-traditional agricultural products grew steadily and represented already 25 percent of total agricultural exports by the end of the 1990s (PROCOMER, 2000).

3.3.2 Pepper production

Contractual systems are frequently used for the development of non-traditional crops. Pepper is a representative case, given the investment requirements for crop establishment and the features of an emerging market. Pepper production has been developed through contracting schemes with smallholders for over than ten years. Pepper is a very suitable crop for small-scale production due to the high labor requirements for crop management (*i.e.* preventive disease control through cultural practices) and the almost continuous harvest. Production is concentrated in the northern region of the country which has adequate soil and climate conditions, as well as good access. The major share of Costa Rican pepper production is located in farmers' settlements in the *Huetar Norte* region (see map in Appendix 3.1). The current cultivated area is around 74 mz (52 hectares), the average pepper plot is 1.22 mz, and production has increased to 2,458 kilos per year, most of which is processed and sold in the domestic market.

Pepper production requires a relatively hot and humid climate typically found at altitudes below 1,000 m (see a summary of technical characteristics in Appendix 3.2). The crop produces bunches of berries that are processed into the well-known black or white pepper. A simple drying fermentation process of the fruit is sufficient to obtain black pepper. The process for white pepper is more complex and requires wet fermentation to remove the peel of the fruit before it can be carefully dried. The pepper plant has a very superficial root

system (only 20 to 50 cm), requiring loose, fertile and well-drained soils. A plantation on slightly sloped land is preferred because of natural drainage. Cultivation of pepper can be started from seeds or cuttings. Currently, only cuttings are used because of their superior performance. The cuttings are first planted in a shady environment and then transplanted about 3 months later to their final location (Rojas Zúñiga, 1987; CONITTA, 1991; MAG, 1991). Pepper generally takes 1.5 to 2 years until the first harvest. Start-up costs for cuttings and material inputs add up to about US$2,500/ha Harvesting takes place year-round throughout the lifetime of the plants (10-15 years). Though the fruit can be harvested year-round, there is a clear production peak in the relatively dry period of the year, reaching yields that can be 10 times higher than the production during the rest of the year. Yields also vary with the age of the plant. Under optimal conditions, expected yields are 1.6 ton/ha in the third year, 7.5 ton/ha in the fourth year and 15 ton/ha in the fifth year. After the fifth year, yields slowly stabilize to a production maximum around the eighth year. The life cycle of the plant ranges from 12 to 15 years (Mora, personal communication).

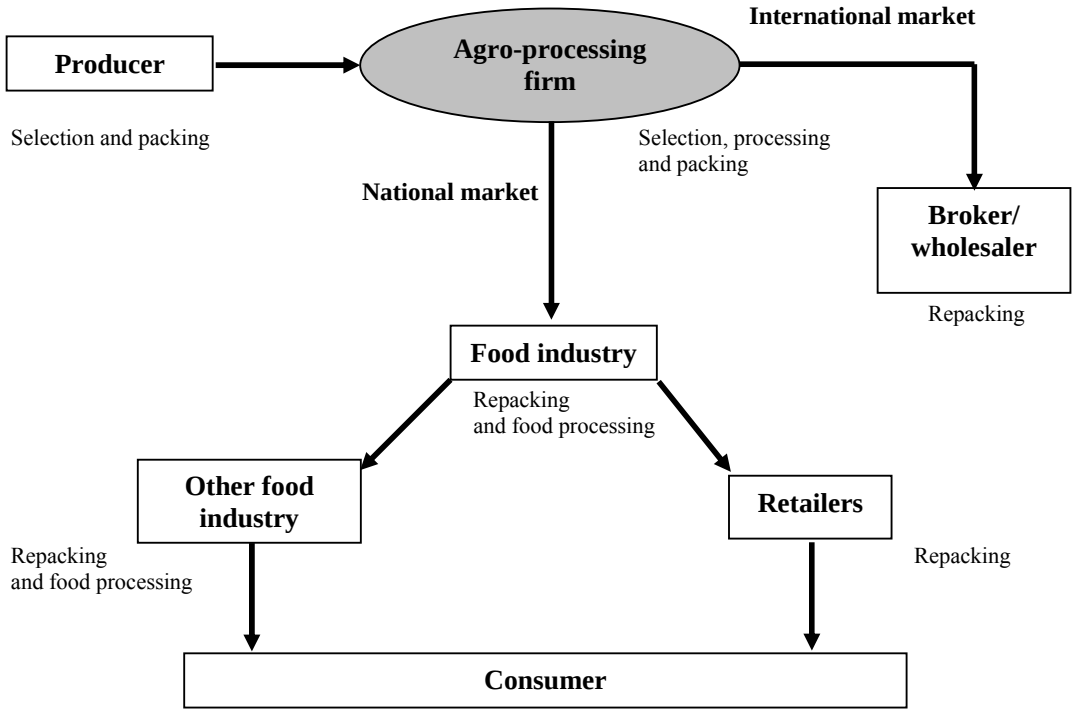
Since pepper plantations produce year-round, there is a continuous demand for labor to select and pick the ripe fruits. Total weekly labor requirements are about 30-40 labor hours/ha for maintenance and harvesting. Control of pests and diseases represents about 40% of total labor demand. The pepper plant is rather susceptible to diseases, and especially its shallow root system.[10] Disease control is labor-intensive and needs to be done carefully, both to prevent damage to the roots and to control diseases before they can spread. Some pesticides are used, but strict residue control measures make farmers rather reluctant to apply them.

3.3.3 Marketing chain

The marketing chain for pepper is relatively short and uniform (see Figure 3.1). Farmers sell their harvest individually and directly to wholesaler-assemblers that process it to produce dried black and/or white pepper and take care of packing. Processors can sell on both the national and the international market. For the international market, pepper is packed in sealed bags of 50 kg and sold either to a broker or directly to a wholesaler. The broker sells pepper on the spice market and wholesalers repack and distribute the pepper to retailers. In the national market, pepper is sold directly to food industries that repack the pepper for retailers

or use it as input for processed food. A small fraction of the processed pepper is directly distributed to retailers or restaurants.

Figure 3.1 Structure of the pepper supply chain



Source: Original, 2000.

3.3.4 Pepper trade

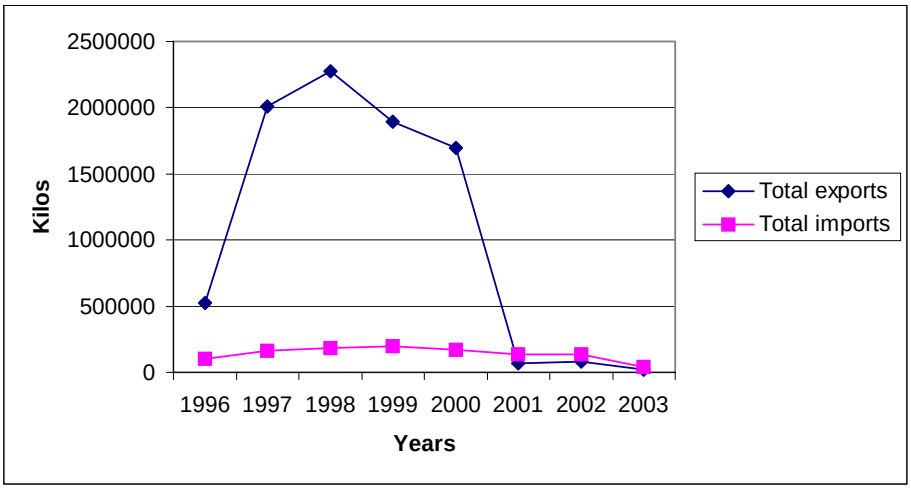
Six companies actively export and import pepper in Costa Rica, operating mainly as processors by importing non-milled dried pepper, milling and repacking the pepper and either exporting or selling it in the domestic market. Figure 3.2 shows that exports of pepper increased significantly between 1996 and 1998, reaching a peak of 2.7 million kg, and then collapsed to only 100,000 kg in 2001. This decline in exports is due to the fact that many of

[10] Most common diseases are fungi attacking the roots, such as *Fusarium solani* and *Phytopthora palmivora*, and to a lesser extent *Rosellinia.*

the processing firms gradually abandoned the activity, except for a small group of three enterprises.

Major export destinations for pepper are the United States and Canada, other countries in Central America, The Netherlands, the United Kingdom, Jamaica, the Dominican Republic, Panama and Colombia. Imports show a more constant behavior with an average amount of pepper ranging between 100,000 and 138,000 kg per year. Hence, there is a certain local demand for pepper that is not satisfied by local production.[11]

Figure 3.2 Total Costa Rican exports and imports of pepper (1996-2000)



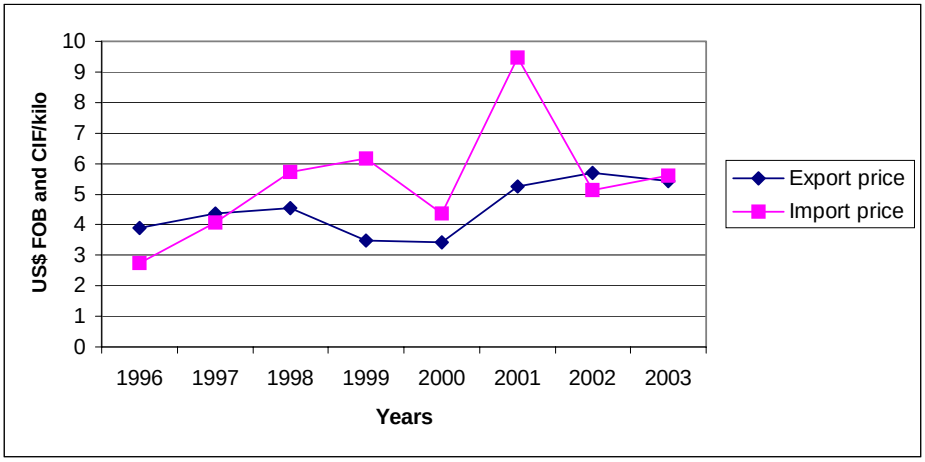
Source: Original, based on data from DGA (*Dirección General de Aduanas*, period 1996-2003).

Figure 3.3 shows the development of local pepper prices during the period 1996-2003. Before 1997, the CIF-price paid by importers was lower than the FOB-price obtained by exporters. Hence, for the food industry it was profitable to purchase non-milled pepper in the international market and sell it processed (milled and repacked), whereas processors preferred to export all the locally produced pepper. After 1998, and for a period of four years (up to 2001), this situation totally changed; for the food industry it became more attractive to buy locally produced pepper instead of importing. This provided local processors with a suitable alternative source for the food industry, since in many cases the latter did not have sufficient

[11] It is estimated that the unsatisfied local demand ranges between 17,000 and 70,000 kg of non-milled pepper, and between 47,000 and 153,000 kg of milled pepper per year.

raw material available for international shipments (Cubillo, personal communication; Mora, personal communication). However, prices paid for imported pepper show a more variable trend, with large fluctuations between 1999 and 2002 (*i.e.* a price increase of about 53% between 2000 and 2001). This price behavior may explain why several food industries decided to abandon the activity, as reflected by the large decline in exports (see Figure 3.2).

Figure 3.3 Average pepper prices (1996-2003)



Source: Original, based on data from DGA (*Dirección General de Aduanas*, period 1996-2003).

These price trends suggest that it is quite possible to produce pepper in Costa Rica at relatively low prices compared to those of the international market. Hence, the question arises: why do some food industries still import pepper at higher prices? Imported pepper is used for preparing specific food products and thus requires certain quality characteristics that are not fulfilled by locally-produced pepper. This is particularly the case for the largest US-owned transnational food industry operating in Costa Rica, which by the year 2000 represented 63% of all exports and 77% of all imports. Also some national enterprises that import pepper for the domestic market argue that the non-milled pepper available in the domestic market does not satisfy their quality requirements

The food processing industry measures the quality of pepper in terms of the amount of *piperine* found in the grains and by the degree of dryness. For processors it is very important to start with good raw material in order to obtain a high quality end product. Fresh bunches of

pepper need to be at a medium stage of maturity—neither immature nor over-ripe—to be accepted. This is a crucial issue for companies specializing in the production of white pepper (80% of total production), since producing one kilo of white pepper requires four kilos of good ripe fresh pepper. Proper tests for determining the amount of *piperine* are available but are not extensively used, and the technology for adequate drying of pepper grains is costly. This suggests the existence of deficiencies in the supply chain regarding the information exchange between producers-processors and the food industry in terms of the required amounts and quality of pepper.

In the consumer market, milled pepper is sold in bulk or mixed with other species in packages of different weights. Supermarkets and groceries also offer pepper in packages of 100 gr. Consumers in Costa Rica almost have no culture of using pepper as a table spice as occurs in Europe or United States. The largest amount of pepper is consumed through processed foods, such as sauces, mayonnaise, chips and the like. A quick survey performed in one the major supermarkets in Costa Rica showed 64 different food products with high pepper contents. In summary, consumers are barely informed about the properties of pepper itself, but they do consume a large amount of pepper in processed food products.

3.4 Market segmentation

Three different buyer-processors are currently active in the pepper market in the northern region of Costa Rica, with different scales of operation and varying degrees of professional organization. These agro-processing companies process the fresh pepper before selling to other agents in the marketing chain. They also offer different kinds of delivery conditions to producers, ranging from written contracts to informal verbal agreements. In some areas they compete with each other, whereas in others they maintain a local monopsony. Although no real spot market for pepper exists in Costa Rica, some producers can sell their harvest to any of these buyers without a delivery agreement.

The largest and most enterprise-oriented actor is *Company A*. This company has been active in the pepper market for twelve years and owns the largest processing plant with an advanced technology level. The company specializes in the production of white pepper,[12] and most of

[12] The company can also produce small amounts of black pepper at the request of their main customers.

the production is sold to an international food processor based in San Jose. *Company A* does not grow pepper itself, but is exclusively a processing company that obtains the raw produce from smallholders. The relation with the farmers was initially based on verbal agreements, but for the last three years the company has also offered written contracts.

The other agro-processor, *Company B,* operates a smaller plant with simple technology and is predominantly a processor-producer, owning a large plantation of about 110 ha of pepper at different stages of growth. Five years ago, *Company B* started to buy pepper from small producers to smooth its supply and keep the plant running at maximum capacity. Plant diseases have forced the company to renovate most of its own plantation. *Company B* processes black pepper and prefers to sell in the international market, but currently it is sold domestically because the company claims that with their current low output, transportation costs are too high to be able to sell profitably abroad.

Company C is a small private processor in the northern zone, owned by a former small pepper producer that used to sell the harvest to *Company A*. However, *Company C* decided to start doing its own processing when *Company A* refused its harvest several times, due to quality considerations. It is a very simple, small-scale plant and produces only whole grain black pepper for the domestic market. About two years ago *Company C* started buying regularly from other farmers. Though this firm claims to work without any type of agreement, some farmers stated that they do have an informal agreement, in which the processor promises to buy their harvest on a fixed day and the payment is made in cash at the moment of transaction.

In addition to these three processors, there are also an unidentified number of other intermediaries that buy directly from the farmers, but only sporadically (for instance, once or twice a year). They act mainly as middlemen between farmers and food processing companies in Costa Rica or Nicaragua, making emergency purchases when facing problems with their regular supplies of pepper.

The selection of a particular engagement with one processing company or another by a particular farmer mainly depends on the local commercial environment (Harris-White, 1999). In practice, different companies may compete for the same producers. We distinguish between two market segments consisting of (a) farmers that typically distribute their output to

one buyer and maintain a fixed relationship for the delivery of the product, and (b) farmers that may choose between different competing companies offering specific delivery conditions (see map in Appendix 3.1). In practice, this segmentation tends to be rather dynamic, since farmers shift to other outlets or negotiate modifications in their contracts.

For our analysis of pepper producers in northern Costa Rica, we can distinguish between regions where only one buyer was operating and others where a more competitive market has prevailed (see Table 3.3). Given the differences in contractual conditions, five different structural positions can be identified: (a) farmers with written contracts in a monopsony market, (b) farmers with verbal contracts in a monopsony market, (c) farmers delivering without any contract in a monopsony market, (d) farmers with verbal contracts in a competitive market, and (e) farmers delivering without any contract in a competitive market.

Table 3.3 Market segments and contracting arrangements

		Contracting Arrangements			
Type of Market	**Main Buyer**	Written contract	Verbal agreement	No agreement	**Total**
Monopsony market	Company A	9	11	3	23
Competitive market	Company A		7	3	10
	Company B.		9	1	10
	Company C		4	3	7
Total		**9**	**31**	**10**	**50**

Table 3.3 shows that only farmers in the monopsony market have written contracts, while in the competitive market farmers prefer not to tie themselves to one single buyer with a fixed agreement. It seems that farmers in the competitive market prefer to stay in a flexible position and sell to other buyers if prices rise. In order to make this flexible position possible, farmers have chosen a verbal agreement as the most popular contractual arrangement (58% in both types of market). From the firms' perspective, offering fixed contracts and committing farmers seems more logical in a competitive market, but the firm's bargaining power is diminished by competitors and its enforcement costs become higher (Key and Runsten,

1999). Therefore, *Compa*ny *A* actively promoted written contracts in the monopsonistic market in order to prepare for future competition.

Of all the farmers in the competitive market there are only four who sell their harvest to buyers other than the large agro-processors. A more popular strategy is selling part to one of the agro-processors and part to another buyer; this is the strategy of nine farmers. Another eight have an agreement with either *Company A* or *B*, obligating them to sell all of their harvest to this buyer. However, still the most popular strategy, used by the remaining 14 farmers, is selling the entire harvest to one of the agro-processors.

The proportion of defaults on contracts is surprisingly high in the competitive market: eight out of 20 farmers (40%) with an agreement are disloyal. This outcome confirms the statement in the literature (Glover and Kusterer, 1990; Grosh, 1994; Key and Runsten, 1999) that farmers are tempted to default on their contracts in markets with a sudden rise of competition and prices. In addition, disloyalty is difficult for firms to penalize in a competitive market; therefore selling for a higher price to another buyer is indeed tempting. The interviews confirmed a high degree of confidence in the current market and the idea held by producers that agro-processors need the farmers too much to refuse their harvest at future occasions. The absence of farmers with a formal contract can be explained by this much disloyalty. Though the farmers break their verbal agreements without any problems, a formal contract is easier for the buyer to enforce legally.

The characteristics of farm households and production systems are different in the monopsony market and the competitive market in a number of aspects (see Table 3.4). Average farm size is substantially larger in the competitive market environment, but soil fertility is significantly lower and soils are poorly drained. Moreover, land is used less intensively in this type of market. On the other hand, farmers operating in the monopsony market are significantly younger, devote a larger share of their land to pepper production and their pepper plots are younger. The latter types of farmers produce, however, less pepper and devote fewer hours per week to their pepper plots. In addition, they show a slightly higher degree of income diversification. Since the payback time for the initial investment in the plantation is two or three years, this group of farmers can be characterized as farmers in the risky start-up phase of their plantation. Pepper marketing through contracts is more frequent in the monopsony region, where farmers are also more likely to receive credit and technical

assistance. Farmers' organizations are more active in the latter region as a device for compensating for the monopsony power of the pepper processing firms. The mean price for delivered fresh pepper is lower, thus indicating the effect of the monopsony situation. Finally, prospects for expanding pepper production are significantly higher in the competitive market, probably because farmers expect to reach higher returns on land and labor under the conditions of open competition.

Table 3.4 Farm household characteristics according to market segmentation

	Monopsony Market		Competitive Market	
Number of Cases (*n*)	**23**		**27**	
Farm characteristics				
Farm area (*manzana*; 1 mz = 0.7 ha)	16.5	**	39.1	**
Soil fertility (3 = high)	2.43	*	1.96	*
Drainage (1 = poor)	0.57	**	0.78	**
Soil erosion (1 = yes)	0.35		0.26	
Mountainous land (1 = yes)	0.57		0.78	
% arable land on farm	53.6	**	33.6	**
Household characteristics				
Household size (number of persons)	4.6		4.2	
Age of head of household (years)	43.3	***	50.00	***
Education (primary completed = 1)	0.48		0.48	
Time living in the plot (years)	16.00		14.61	
Farming experience (years)	25.4		29.8	
Gross household income (US$/year)	6327		5992	
Production system characteristics				
Experience producing pepper (years)	6.24		7.22	
Area pepper in production (mz)	0.84	*	0.61	*
Area pepper not in production (mz)	0.59		0.50	
Age of plantation (years)	4.89	**	6.02	**
Degree of specialization (% land under pepper)	30.00	**	27.00	**
Output pepper (kg/mz per year)	3 440	***	7 100	***
Own labor (hours/week)	22.68	*	31.00	*
Share of income from pepper (%)	50.45		52.26	
Number of commercial crops	2.78	*	2.04	*
Amount of cattle production (including pigs)	5.57		9.93	
Number of subsistence crops	0.52	**	1.54	**
Institutional characteristics				
Number of buyers	1.06		1.19	
Mean purchase price	0.90	***	0.93	***
Have an agreement (1 = yes)	0.80	*	0.59	*
Willingness to deviate from agreement (1 = yes)	0.65		0.74	
Use of technical assistance (1 = yes)	0.96	**	0.74	**
Use of credit (1 = yes)	0.57	*	0.30	*
Access to information (1 = yes)	0.47		0.48	
Increase pepper area for next period (mz)	0.30	**	0.75	**
Member of a farmer organization (1 = yes)	0.65	**	0.33	**

T-test of significant differences of means:*** significant at 1% level; ** significant at 5% level; * significant at 10% level

3.5 Contractual arrangements

Pepper processors offer smallholders different types of contracting arrangements ranging from a written contract to an informal verbal agreement. Part of the pepper sales takes place without any prior arrangement, especially when processing firms face limited supply. The contractual arrangements include various obligations for the farmer regarding the use of specified seedlings, input applications, and frequency and place of delivery. Obligations for the buyer refer to the price paid for pepper, the payment system and the supply of technical assistance. Most important differences between the three buyers are related to type of guarantees used for enforcing delivery, the procedures for price determination, and whether instantaneous or delayed payments are preferred. The major characteristics of pepper firms and intermediaries are summarized in Table 3.5.

Table 3.5 Characteristics of processing firms in the Costa Rican Pepper Market

Buyer	Scale	Region of influence	Technology level	Years of experience	Years of relations with small farmers	Target market	Type of agreements with farmers
COMPANY A Agro-processor Preferred supplier arrangements	Large	San Carlos, San Ramón, Sarapiquí	High	10	10	(Inter) national	Written contract/ verbal agreements
COMPANY B Agro-processor-Producer Vertical Integration	Medium	Grecia	Middle	12	Buyer: 9 Agreements: 5	(Inter) national	Verbal agreements
COMPANY C Producer-small processor Delivery dates	Small	Sarapiquí Grecia	Low	Processor: 5 Producer: 10	2	National	Informal and verbal agreements
Intermediaries Buying for Costa Rican or Nicaraguan processors	Very Small	Guatuso/ Chachagua	Low	1-2	1-2	National/ international	None; buy only sporadically

A summary of the characteristics of the agreements offered by each of the buyers is presented in Table 3.6. *Company A* makes use of both written contracts and verbal agreements that differ in two aspects. First, the written contract offers a guaranteed minimum price that reduces the farmer's price risk. However, this facility is only provided when the farmers are willing to commit themselves to the buyer for a period of 15 years and will deliver the product to the processing plant. Second, farmers with written contracts have to sign a promissory note for the value of supplied seedlings that has to be paid when they cancel the contract. In practice however, these guarantees are not fully enforced and farmers are not

financially penalized when they show disloyal behavior. Currently, the only way of treating disloyal producers is reminding farmers of their moral obligations and cutting off their technical assistance. Verbal agreements with *Company A* stipulate delivery prices that are corrected for inflation. These agreements offer farmers the possibility to pay for the delivery of seedlings with reproduced seedlings, making it a cheap and low risk loan for the farmer. Since the company is most concerned about the quality of the raw material—which is crucial for white pepper production—free technical assistance is provided to the farmers. In addition, quality control is enforced at the processing plant gate and sub-standard pepper is refused and deducted from the payments. These payments are made one week after delivery (*i.e.* weekly during high season and every two weeks during the low season).

At first glance, the verbal agreements offered by *Company B* seem less beneficial to the farmers, since they are based on fixed prices defined in local currency. However, *Company B's* verbal agreements have different advantages compared to the conditions offered by other processors. First, this firm offers broad credit facilities that include all variable production inputs (seedlings, fertilizers, pesticides) without charging any interest. Second, the harvest is paid for immediately and collected at the farm gate, thus eliminating transport costs for the farmer. Moreover, technological requirements imposed by *Company B* are less strictly defined, leaving the farmer more room in his decision-making. Many farmers that preferring flexibility and requiring immediate payment therefore deliver to this company. *Companies A* and *B* respected each other's zone of influence, and avoided competition at the time this survey was taken.

Finally, the individual *Company C* does not offer any input supply or technical assistance services. Nevertheless, some farmers prefer delivery to *Company C*, not only because a slightly higher price is paid, but also since payments are made directly in cash at the time of transaction. In addition, *Company C* does not impose any restrictions on the production technology applied and collects the harvest at the farm gate. Recently, *Company C* started to buy at the farm-gate in regions where other buyers are active, thereby inducing competition in these market zones.

The essential difference between the contracts provided by the companies refers to product and process specifications. Written and verbal contracts by *Company A* and *B* are defined as *resource-providing* arrangements that include input delivery and technical assistance. These

contracts closely resemble *quasi-vertical integration* based on long-term co-investment activities (Hobbs, 1996). For *Company B*, resource provision is part of a strategy of backward integration in order to supplement the raw material delivery to the processing plant. On the other hand, verbal agreements provided by *Company C* are strictly *market-specification* contracts that are limited to provisions regarding price, delivery time and quantity. The latter types of arrangements refrain from any involvement in the production process and are limited to simple product delivery specifications.

It is hardly possible to establish a preference ranking between agreements on the basis of the differences described. Selection of specific agreements mainly depends on the needs and preferences of particular farmers. Risk-averse farmers may prefer the written contract of *Company A*, while farmers seeking maximum profits are likely to favor an agreement with *Company C*. In terms of input and service provision, farmers will generally be better off with an agreement from *Company B*. On the other hand, when farmers prefer flexibility, rapid payments and few restrictions, they will probably choose *Company C*.

Table 3.6: Types of contractual arrangements in the Costa Rican Pepper Market

Buyer	Type of services provided	Guarantee used	Type of payment	Contract duration	Type of price	Type of payment	Technology applied	Time of transaction	Place of transaction
Formal contract **COMPANY A**	- Seedlings (on credit) - Tutors - Free technical assistance	Promissory note All services have to be paid in case of contract breach (not enforced)	Payment with reproduced seedlings (1:3) or value in US$ (including interest)	15 years	Dollarized guaranteed minimum price	8-15 days after delivery With check	Strictly defined	< 24 hours between harvest and delivery	San Carlos: at plant Other regions: At farm gate
Verbal agreement	- Seedlings (on credit) - Tutors - Free technical assistance	Delivery of harvest (not enforced)	Payment with reproduced seedlings (1:3) or value in US$ (including interest)	Not specified	Dollarized price (inflation correction)	8-15 days after delivery With check	Strictly defined	< 24 hours between harvest and delivery	San Carlos: at plant Other regions: At farm gate
COMPANY B	- Seedlings (on credit) - Fertilizers and pesticides (on credit) - Free technical assistance - Buying at farm gate	Delivery of harvest (not enforced)	Percentage of sales of harvest (usually 30%; no interest included)	Not specified	Fixed price no guarantees	At time of delivery with check	Loosely defined	At time of harvest	At farm gate
COMPANY C	- Buying at farm gate	None	None	Not specified	Fixed price (5% more than other)	At time of delivery in cash	Not defined	At time of harvest	At farm gate

3.6 Contract choice

In order to identify what type of farmers typically engage in contractual delivery of pepper to local buyers, we conducted a statistical analysis regarding the farm-household and production characteristics in each market segment (see Table 3.7). Farmers with an agreement operating in the competitive market generally own smaller, less fertile farms on flatter land. Verbal agreements are preferred by more experienced and less educated farmers in this market segment. In addition, land is more intensively used, although their pepper production is lower than that of farmers with no agreements. Although producers operating in the competitive market use far less credit and technical assistance, their pepper yields are almost twice as high. The price paid for pepper in the competitive market is also higher.

On the other hand, in the monopsony market segment we find mostly younger farmers with smaller farms and a more specialized farming system. They operate more recently established plantations that are larger in size, but have considerably lower productivity. Most farmers are affiliated to farmers' organizations in order to reinforce their bargaining position. Further analysis shows that farmers related to *Company B* depend the least on pepper production but reach better yields, while farmers delivering to *Company A* are usually poorer and more engaged in off-farm activities, thus requiring additional technical assistance.

Comparing farm-household characteristics in relation to different types of contracts, we only find written contracts amongst farmers in the monopsony region. Such contracts are usually preferred by young better-educated producers owning small farms, with less farming experience, and limited land endowment and investments in pepper. Moreover, farmers with a contract have a lower income and rely more on other non-agricultural sources of income. These farmers rely on formal contracts to reduce risks during the initial establishment phase. Producers engaged in pepper production under verbal agreements are generally older, have less formal education and have been farming for a considerably longer period of time. They operate more mature plantations and seek guaranteed market outlets. Finally, farmers without any contractual arrangement own the largest farms, are less educated and less specialized in pepper production. They reach the highest yields in pepper but prefer to remain independent in their marketing operations. Besides, they have a higher share of their income from other commercial crops and rely less on income from non-agricultural activities.

Table 3.7 Farm household characteristics according to type of agreement

Variables	Monopsony market						Competitive market			
	Formal contract		Verbal agreement		No agreement		Verbal agreement		No agreement	
Number of Cases (N)	9		11		3		20		7	
Farm characteristics										
Farm area (*manzana*; 1 mz = 0.7 ha)	12.30	*	15.00		34.6	*	27.2		73.10	
Soil fertility (3 = high)	2.67		2.36		2.00		1.90	*	2.14	*
Drainage (1 = good)	.45		.36		.67		.25		.14	
Soil erosion (1 = yes)	.56		.18		.33		.25		.29	
Mountainous land (1 = yes)	.78	*	.36	*	.67		.70	**	1.00	**
Household characteristics										
Household size (number of persons)	4.70		4.50		5.00		4.50		3.40	
Age of head of household (years)	39.70	**	48.00	**	37.00		50.60		47.90	
Education level (secondary = 1)	.78	***	.18	***	.67		.45	*	.57	*
Farming experience (years)	17.20	***	33.50	***	20.30		32.90	*	21.00	*
Off-farm employment (1 = yes)	.67		.36		.33		.60		.43	
Gross household income (US$/year)	4,231	*	5,205		16,054	*	6,752		4,344	
Income from other non-agricultural actvities (share of gross household income)	39.02	**	32.50	**	3.02	**	24.02		41.52	
Production system characteristics										
Share of arable farm land (%)	52.9		45.80		84.40		40.90	***	9.40	***
Experience in pepper production (years)	5.60		7.00		9.30		6.80		8.60	
Area of pepper in production (mz)	.91		.79		.83		.64		.52	
Area of pepper not in production (mz)	.27	***	.67		1.87	***	.47		.63	
Age of plantation (years)	3.80		6.30	*	3.0	*	6.5	*	4.6	*
Degree of specialization (share of arable land under pepper)	29.20		36.00		25.40		31.00		24.10	
Pepper yield (kg/ mz per year)	3.64		3.22		3.65		7.25		8.43	
Output index [a)]	.80		.61	**	1.44	**	1.07	*	1.42	*
Mean price of pepper sold (US$)	.90		.90		.90		.92	***	.94	***
% of income from commercial crops (share of gross household income)	21.00		17.50	*	25.76	*	13.50		8.04	
% of income from cattle production (share of gross household income)	3.00		11.05		5.82		20.66		17.28	
% of income from pepper (share of gross household income)	30.20		31.50		22.30		34.76		33.12	
Institutional characteristics										
Use of technical assistance (1 = yes)	1.00		.91		1.00		.80	**	.57	**
Use of credit (1 = yes)	.56		.55		.67		.35		.14	
Member of farmers organization (1 = yes)	.67		.55		1.00		.30		.43	

Note: [a)] The output index is calculated by considering the yield reached by the farmers compared to the attainable yield for the corresponding age of the plantation, as published in technical manuals for pepper production. An index under 1 indicates that yield is below the prescribed value.
T-test and ANOVA test of significant differences of means:
*** Significant at 1% level; ** significant at 5% level * significant at 10% level.

The comparison of market segments and contractual arrangements indicates that especially poorer farmers with small acreages and limited farming experience prefer written or verbal contracts. Since they own more recently established plantations and are strongly dependent on pepper revenues, they have to rely on risk-minimizing marketing strategies (Magnusson and Ottoson, 1996). On the other hand, larger and more experienced farmers that maintain high-yielding pepper plantations are more likely to rely on spot market exchange as part of their risk diversification strategy. Pepper prices are slightly higher in the competitive market, and farmers without a contract were even able to negotiate a more attractive price.

3.7 Impact of contracts on pepper production systems

We have analyzed the relationships between the types of contract and their impact on input use and the implementation of soil conservation measures by pepper farmers. It is usually assumed that the availability of a contract enables farmers to invest more in crop and soil management practices, given the higher certainty regarding future returns. Moreover, contracts may compensate for failures in factor markets for land, input and information and thus make it possible to improve the efficiency of production systems.

Differences in input use, fixed investments and yields for each market segment are presented in Table 3.8. Since the development stage of the pepper plantation could influence input applications and yields, input and output are weighted for the age of the plantation.[13] Pepper yields are significantly lower for farmers with (written or verbal) agreements, even while these farmers—on an average—are somewhat better educated. On the other hand, the use of chemical fertilizers and labor is significantly higher for farmers involved in contractual exchange. In addition, fixed investments in pepper plantations are almost two times higher. The same holds for the larger number of soil conservation measures applied by pepper farmers with contracts. This indicates that contracts provide rather strong incentives for the intensification of pepper production systems, but do not necessarily lead to higher productivity. Given the fact that most farmers with contracts are operating smaller and more specialized fields, they rely far more on contract labor for pepper maintenance operations,

[13] The indices are calculated by dividing the real value of the input and output by a prescribed or estimated value for the corresponding age of the plantation. These values are published in technical manuals for pepper production (MAG, 1991). An index of less than 1 indicates that the value of the corresponding variable is below the prescribed value.

since family labor is partly involved in off-farm employment activities. The latter are required in order to compensate for an exclusive dependency of the household income on pepper revenues.

Table 3.8 Effects of contracts on production systems and market access

Variables	Monopsony market						Competitive market			
	Formal contract		Verbal agreement		No agreement		Verbal agreement		No agreement	
Pepper Yield (kg/ mz per year)	3.64		3.22		3.65		7.25		8.43	
Output per *mz* (index)	.80	**	.61	**	1.44	**	1.07	*	1.42	*
Value of chemical fertilizers ($/mz/year)	254		124		62.40		328		185	
Index input chemical fertilizers [a)]	1.34	**	.67	**	.33	**	1.69	*	1.37	*
Value of organic fertilizers ($/mz/year)	8.30		10.80		34.40		163	**	.00	**
Value of pesticides ($/mz/year)	38.30		170		136		179		80.50	
Index input pesticides [a)]	.18		.81		.63		.85		.38	
Total labor input (hrs/mz/week)	36.90		28.30		16.00		39.90		48.70	
Index labor input [a)]	1.91	**	1.16		.88	**	1.62		1.50	
Total family labor input (hrs/mz/week)	20.10		20.70		13.10		28.80		45.60	
Percentage of family labor (%)	.56		.69		.70		.79		.94	
Percentage of wage labor (%)	.44		.31		.30		.21		.06	
Value of initial investment (US$)	608	**	395		394	**	540	*	350	*
Number of soil conservation measures used by farmer	4.71	**	2.67	**	2.67		3.36	**	2.43	**
Access to land (1 = good)	.11	**	.27		.67	**	.47	**	.14	**
Access to input markets (1 = good)	.22	*	.20		.00	*	.40	*	.29	*
Access to information (1 = good)	.67	*	.27		.00	*	.53	*	.29	*

Note: a) The input index for fertilizer, pesticides and labor is calculated by dividing the value of the inputs used by the farmers by the value for the corresponding age of the plantation, as published in technical manuals for pepper production. An index less than 1 indicates that input use is below the prescribed value.
T-test and ANOVA test of significant differences of means: ** = Significant at 5% level ; * = Significant at 10% level

Access to inputs and information is better guaranteed for farmers operating under contracts, especially in the region where more competitive conditions prevail. Technical assistance services and credit facilities are, however, more available in the monopsony region. Moreover, the degree of farmers' organization is better developed in the regions with less market competition, presumably because farmers need to exercise countervailing power. We also notice that farmers without delivery contracts are more inclined to become members of farmers' organizations.

We can conclude that both contracts and market conditions could offer farmers the required incentives to intensify pepper production. Contracts are particularly important for guaranteeing farmers access to capital, inputs, technology and information, but do not lead to higher productivity or better prices. In fact, the reliance on contracts provided incentives for the transformation of pepper production systems from a traditionally rather low-intensity crop towards more labor- and capital-intensive operations. Farmers in the competitive markets prefer, however, to intensify only the use of variable inputs (especially fertilizers) and family labor, whereas farmers operating under monopsony market conditions are more inclined to make fixed investments and tend to rely far more on wage labor. The group of farmers without any contract maintains traditional production systems characterized by low levels of fixed investments and limited input applications.

We have analyzed in greater detail the implications of different types of contracts and the influence of market exchange conditions on pepper production systems. Production function analysis is used to disentangle the effects of contractual and institutional parameters on input efficiency and pepper yields (see Table 3.9). We estimated a pooled regression of a Cobb-Douglas production function with dummy variables for the existence of agreements and for the type of contract (written or verbal). In addition, the age of the pepper plantation, soil fertility and drainage conditions, and the education of farmer are included as relevant farm-household characteristics. The degree of competitiveness of the local market is included as a control parameter.

Table 3.9 Determinants of pepper yields (Log linear production function estimate)

Variables	Coefficient	Std. Error	Significance
(Constant)	4.908	1.101	***
Ln Area (*manzana*)	.496	.148	***
Ln Chemical Fertilizers ($/year)	.013	.058	
Ln Labor (hours/year)	.248	.131	*
Ln Organic fertilizers ($/year)	.079	.054	
Age of the plantation (years)	1.210	.191	***
Education level (1=secondary school)	.510	.202	**
Delivery agreement (1=yes; 0 = no)	-.632	.264	**
Type of contract (1=written; 0 = verbal)	-.096	.322	
Soil fertility (1=high, 0 n= low)	.345	.218	
Drainage (1=good; 0 = bad)	.910	.241	***
Market situation (1=competitive; 0 = monopsony)	.579	.246	**

N = 47 Adj. R^2 = 0.692

*** = significant at 1% level; ** = Significant at 5% level ; * = Significant at 10% level

Estimation results indicate that pepper yields are most dependent on land and labor inputs, and that production increases significantly on more mature plantations. In a similar vein, good drainage is considered the most important condition for reaching higher pepper yields. On the other hand, delivery agreements are negatively related to pepper yields, while no proof is found that written contracts modify this tendency. The direction of causality of this relationship is probably reverse, since more established pepper farmers with higher yields will be able to negotiate more favorable delivery conditions in the spot market. This illustrates also that—given the limited short-term yield effects derived from using more material inputs—improved access to credit and inputs provided by contracts is of minor importance to these producers. Far more relevant are the indirect market-related incentives towards enhanced investments and labor use for crop establishment and maintenance operations, respectively. This is confirmed by the fact that pepper yields are significantly higher under more competitive market conditions which favor a process of moderate intensification that guarantees high returns at relatively low costs to the more established pepper producers in the region.

3.8 Discussion and conclusions

We analyzed the structure and performance of pepper contracting schemes in the Northern region of Costa Rica in order to identify the effects of different types of contracts and market configurations on farmers' resource use and investment decisions. Particular attention is given to the incentives derived from contracts for the adjustment of production systems and livelihood strategies. The most important conclusions can be summarized as follows:

Contracts as insurance device

The analysis of market channel choice indicates that farmers require contracts especially in the early phase of the establishment process of perennial crops as a guarantee for their investment efforts. In subsequent phases and under more competitive market conditions, producers prefer verbal commitments to written contracts. Furthermore, in the absence of penalties, pepper farmers with delivery commitments may become disloyal to their buyer in markets with increased competition. Most farmers keep selling the major share of the harvest to their fixed buyer but deliver small volumes to competitors as well. Consequently, contracts fulfill rather different roles during the farm household life cycle and are shaped differently under various market conditions.

This analysis has revealed that farmers with investment constraints that are more specialized in pepper production are engaged in contractual arrangements with buyers. Moreover, younger and better-educated farmers with limited land endowment and investments in pepper prefer written contracts rather than verbal agreements. Farm households with nearly 40 percent of their income derived from non-agricultural activities follow a risk-management strategy to cope with liquidity constraints. Although this strategy might have negative effects on production efficiency, for low-income farmers it tends to be the preferred option for smoothing consumption (Key and Runsten, 1999). Therefore, these households opt for the insurance provided by a written contract before engaging in the production of specialized non-traditional crops. Contracts offer insurance against the uncertainties related with finding appropriate market outlets and against price fluctuations. Income-constrained farmers are willing to accept the conditions imposed by a written contract simply because they do not have enough sources of income to cope with market and price uncertainty, even when the price conditions stated in the contract are less favorable compared to those offered at the spot markets.

On the other hand, farmers without agreements are far less dependent on single agricultural activities. They derive income from other commercial crops that enable them to cope with uncertainties related to the pepper market. In summary, the more farmers rely on pepper production for their income generation, the more they need a stable contractual arrangement with a buyer.

Making investments in new pepper areas implies an increase in the farmer's asset-specificity. Asset-specificity refers to specialized investments for an almost unique purpose (Hobbs, 1996; Key and Runsten, 1999). These investments represent an additional source of uncertainty for low-income farmers, since pepper requires at least two years of maturation before the first harvest takes place. This also implies an increased dependency on market outlets and a reduction in farmer's bargaining power *vis-à-vis* the buyers. Farmers with more crop diversification would be able to maintain a better bargaining position *vis-à-vis* potential buyers (Rickson and Burch, 1996; Key and Runsten, 1999). Therefore, they can only accept the risk of not having a guaranteed outlet when they do not depend completely on pepper production. Notwithstanding, they make higher investments for the establishment of new areas of pepper, thus increasing their asset-specificity. Since they own more land and earn most of their income from other commercial crops, they are able to finance and partially

cross-subsidize the initial phases of pepper establishment. Hence, these farmers can refrain from the certainty of contractual arrangement to safeguard their investments in pepper without being locked into a bilateral delivery relationship.

Another interesting result of the analysis is that income diversification has a direct effect on contract choice. Income from other commercial crops provides farmers with bargaining power that enables them to refrain from contractual ties, whereas income derived from non-agricultural activities seemingly does not generate the same effect. A possible explanation is that the latter income is composed of several sources, ranging from non-agricultural wage labor to remittances from relatives outside the household. This income composition may restrict its use for production purposes. Conversely, income from other commercial crops is entirely under the farmer's control and can be applied according to his own criteria. In addition, off-farm activities restrict farmers' labor availability in critical periods and could thus reduce labor intensity required for critical crop management practices in pepper production.

In summary, the level and sources of income have a clear effect on farmer's contract choice and bargaining power. Income diversification enables farmers to increase their asset specificity in pepper crops, even without the insurance provided by contracts. Therefore, pepper companies prefer to offer contracts to less-endowed farmers, with some farming experience but limited income diversification. These farmers are likely to engage in contract farming due to their limited bargaining power. Farmers able to increase the asset base using their own resources may be less suitable partners for contractual regimes. Despite the fact that the enterprise operating in the monopsonistic market segment also maintains high asset specificity, it is able to buy from some farmers without any prior agreement, since the latter possess limited bargaining options for valuing their asset-specific investments (Key and Runsten, 1999).

Contracts as incentives

This analysis has shown that contracts provide an important incentive for more intensive input use, but also tend to induce a shift towards hiring wage labor to replace family labor. This only partly confirms the hypothesis that contracts improve the certainty for small-scale producers and hence increase their willingness to invest. The fact that mainly less-endowed farmers choose contracts points in the same direction. Contracts clearly improve access to

inputs and information, thus reducing existing market failures. Consequently, contracts could complement policies aiming at more efficient land-use systems. Even when farmers are equally informed about suitable land management technologies, those with contracts are likely to implement more soil conservation practices.

It has been argued that different types of contracts may have adverse effects on the adoption of soil conservation measures (Rickson and Burch, 1996). Short-term production goals imposed by the processing firms may restrain farmers from adopting soil conservation practices, which usually demand large amounts of labor time. Moreover, markets for specialized inputs and services are usually inaccessible to low-income farmers (Key and Runsten, 1999). In the pepper case, products such as organic fertilizers and calcium, not only contribute to maintaining good soil conditions but also help to prevent fungi attacks. Farmers facing budget constraints often cannot maintain the whole technical package (*i.e.* fertilizing regimes) designed for export crops and rely more on the exploitation of their soil nutrient stocks.

In the monopsonistic market segment, the buyer offers simple *resource providing contracts* focusing only on seedling provision and technical assistance, but without any other variable production inputs (*i.e.* fertilizer and pesticides). Therefore, resource-constrained farmers would look for the insurance of contracts before investing in disease prevention and soil maintenance practices that increase their asset specificity. Actually, the contract is functioning as a catalytic vehicle to entice these farmers towards risk-taking behavior. In the competitive market segment, one of the buyers offers a *resource-providing contract* that includes fertilizer and pesticide supply, resulting in higher use of biocides and soil maintenance inputs by contracting farmers. On the other hand, farmers with no agreement pay little or no attention to these practices. A possible explanation is that this category of farmers is younger, has less farming experience and more land availability. Even while they reach higher yields in pepper production, they consider the crop as a second best option from which they only derive some additional income while spending little time and limited investments for crop maintenance and soil conservation activities. Farmers without contracts thus sidestep the early non-productive phases of pepper production and use idle land with good soil nutrient stocks rather than investing in soil maintenance activities.

In summary, farmers with contracts are definitely investing more inputs and time in soil maintenance activities on their pepper plots. *Resource-providing contracts* in the competitive market have a stronger effect than simple *market specification* contracts in the monopsonistic segment. This confirms the literature regarding the importance of *resource-providing contracts* and vertical integration for sustainable agricultural intensification (Kuyvenhoven and Ruben, 2002). Budget-constrained farmers that intend to tailor their investment decisions in line with the designed technological package may substitute for their default in fertilizer use with additional labor investments in soil maintenance activities.

Farmers without agreements can still be efficient pepper producers, but maintain substantially lower investments for resource management. In the short run, the higher productivity makes them an attractive partner for the processing firm. However, since pepper is a semi-perennial crop with an expected life cycle of fifteen years only if adequate crop management practices are maintained, farmers without agreements that engage in pepper production as a complementary activity tend to reduce in-depth investments. For processing firms with high asset specificity, the best option tends to be through commitments with farmers using simple *market-specification contracts*. However, to encourage farmers to apply soil maintenance and conservation techniques, *resource-providing contracts* have a more direct effect on input use decisions encouraging a gradual substitution of soil maintenance products with chemical fertilizing regimes.

Contracts for market information

The effect of contracts under different market situations indicates that local monopsonies might generate rather perverse incentives for making fixed investments in pepper plantations compared to situations where competition between buyers exists. We have recorded yields per hectare that are substantially lower in the monopsony region, even when farmers use more inputs. Local monopsonies could favor a transition towards more capital-intensive production systems, especially when relying on *resource-providing contractual regimes* that (temporarily) reduce input costs. This points to close complementarities between the decisions on technology choice and the type of market organization.

Farmers with no contractual arrangements have less access to market information, use less credit and are more easily willing to deviate from the agreement with the buyer. Providing accurate information about the required amounts and desired quality characteristics is crucial

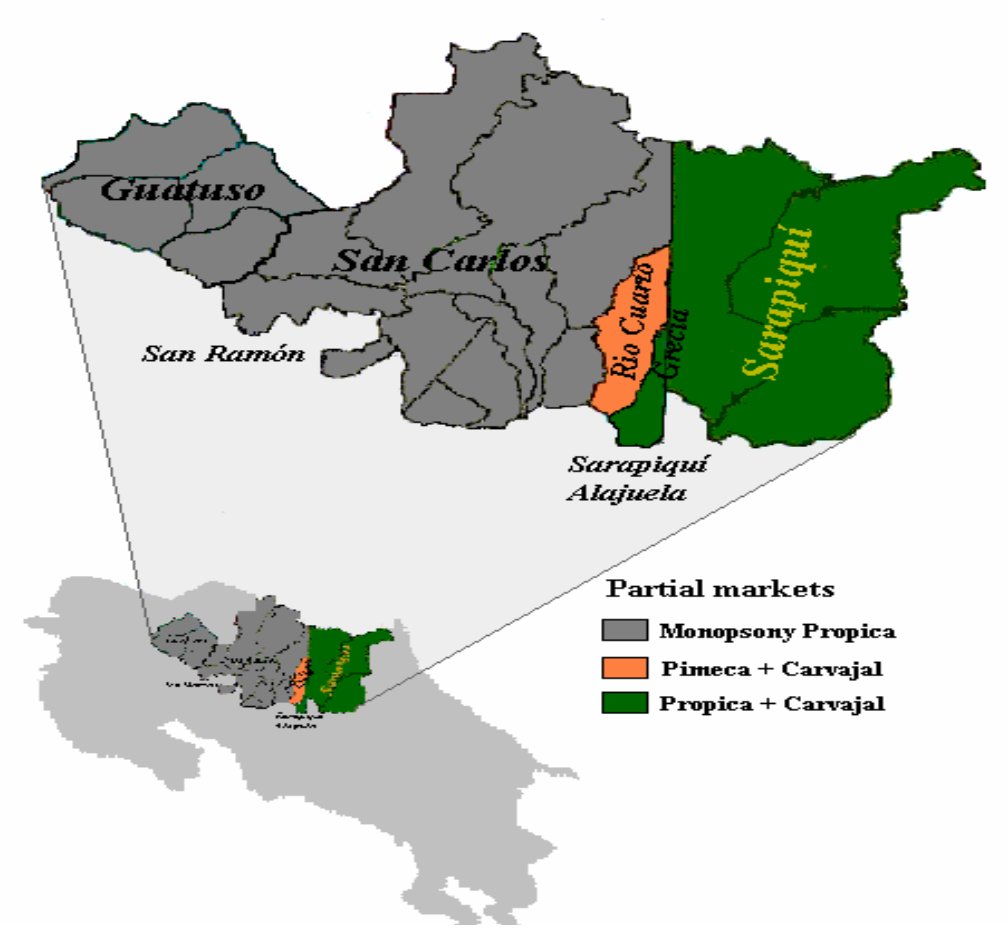
for efficient product coordination between farmers and buyers (Key and Runsten, 1999). Information regarding the structure of the market is also important to prevent false expectations and adverse selection problems. This is especially relevant for less-experienced farmers operating in the rather closed and specialized pepper market. Farmers producing pepper only as a diversification crop can accept the risks associated with missing market information. Hence, they will not allocate many resources to obtain this information on their own. On the other hand, farmers with contracts are usually better informed and more committed to the agreement with the buyer. *Resource-providing contracts* are likely to encourage input intensification, particularly in the competitive market segment. Similarly, contracting farmers are less likely to deviate from delivery arrangements, mainly because they are aware of their limited bargaining power *vis-à-vis* the buyer.

Although asymmetric information is always present between buyers and sellers in developing countries, contracts can provide an appropriate mechanism to cope with market information problems. However, the loyalty of farmers is likely to be more related to their lack of bargaining power rather than to the availability of market information. The fixed cost of obtaining accurate market information may be prohibitive for income-constrained farmers, and they are therefore fully dependent on the information provided by the processing firms.

Appendices

Appendix 3.1

Map of research area in northern Costa Rica: Huetar Norte and market segmentation



Appendix 3.2

Major technical characteristics of *Piper nigrum* L.

Scientific name	*Piper nigrum* L.
Origin	India
Life cycle	Perennial, 12 to15 years
Climate and soil requirements	Tropical humid zones, at altitudes below 1,000 m Rainfall no more than 2,500 mm, well distributed throughout the year. Annual average temperature: 20 to 30 °C Relative humidity: 60 to 93% Pepper plants have superficial root systems (20 to 25 cm), so soils should be fertile, loose, well drained, smooth, from alluvial origin, and pH 5.5 to 6.5.
Topography	Plots with slightly sloped land and natural drainage are preferred. Flat plots would require a drainage system and each plant should be placed in a high mound of soil.
Dissemination	Through seeds or cuttings. Cuttings are preferred because of better performance and should come from productive plants no older than 5 years.
Stakes	Pepper is a climbing plant, so it requires stakes for proper development. Stakes can be dead or alive. Nitrogen-fixing trees such as *Erythrina* are recommended as living stakes or poles.
Life cycle	While cleaning the plot and installing the stakes, pepper cuttings are first planted in plastic bags and kept in a shady environment in a pepper nursery until they are 25 to 30 cm tall. Later they can be transplanted in the field and should be continuously attached to the stakes, as the plants grow. The height of the plant should not exceed that of the stake. The plant takes 1.5 to 2 years until the first harvest and with good maintenance the production lifecycle is about 15 years.
Fertilizing	Good responses to Nitrogen and Potassium and somewhat to Phosphorus. 15:5:14 is a good proportion of these elements (same order as above). Micro-nutrients applied through the leaves are also important.
Control of diseases and pests	Combating diseases and pests is an important task that consumes about 40% of the total labor input, excluding harvesting. The root system is very susceptible to the attack of the two most important types of fungus: *Fusariun solani* and *Phytophtora polmivora*. The control of these fungi is mainly by means of preventive measures, such as having good drainage, applying organic matter, eliminating affected plants before the fungus spreads, disinfecting the soil, and using protective fungicides. Weed control is also important to prevent *Fusariun.*
Production	Harvesting takes place year-round after the second year, every two weeks. There is a clear production peak at the beginning of the summer, reaching yields 10 times higher than the production during the rest of the year. Yields vary with the age and state of the plantation. Under optimal conditions, expected yields are 1.6 tons/ha in the third year, 7.5 ton/ha in the fourth year, and 15 ton/ha in the fifth year. After the fifth year yields slowly stabilize to a maximum production in the eighth year.
Start-up costs	US$2,500/ha

Sources: Rojas Zúñiga, 1987; CONITTA, 1991; MAG, 1991; Rojas Zúñiga, 1994
Technical department of PROPICA S.A.

Chapter 4

Export contracts for non-traditional products: Chayote from Costa Rica*

4.1 Introduction

Diversification into new export products and contact with alternative international market outlets are important strategies for many developing countries to reduce their dependency on traditional agricultural crops. The Costa Rican government strongly supports the development of non-traditional export products with targeted incentives and fiscal measures enabling local producers to make the necessary investments for the establishment of new plantations. Private traders and processors are encouraged to ensure input provision and access to foreign markets under conditions offering sufficient security to local producers in order to enhance product quality and guarantee continuous supply.

Indigenous vegetables, like *chayote* (*Sechium edule* Sw. or vegetable pear) represent an increasing share of non-traditional exports from Costa Rica. Farmers' possibilities to become engaged in global agro-food chains depend on the relationships established with packers and (inter)national brokers. Farmers who are able to deliver better quality and stable amounts tend to become preferred suppliers. Harvesting the crop at an immature stage and quick delivery to exporters improve post-harvest shelf-life and quality, since storage affects the firmness, appearance, flavor and nutritional value (Marín-Thiele, 1997).

Contractual agreements may be helpful to reduce farmers' uncertainty and are intended to increase their loyalty towards the processor-exporter. While prices paid to the farmers are only slightly higher than those of the national market, other purchase conditions – like the terms of payment, the provision of credit for inputs and the frequency of collection – are equally or more important for the decisions regarding outlet choice (Hart and Holstrom, 1987). Farmers who deliver chayote to exporters make higher amounts for inputs and labor

* This chapter is largely based Sáenz and Ruben (2004), Export contracts for non-traditional products: Chayote from Costa Rica. *Journal on Chain and Network Science* (4) 2: 139-150.

use, but face delays before receiving their final payment. Therefore, specialization in chayote production is only a feasible option when delivery contracts provide sufficient certainty.
Loyalty may be seriously challenged when farmers offering a higher quality product can receive better conditions elsewhere. However, providing additional services (*i.e.* seed, credit and technical assistance) that enable farmers to improve their product quality at relatively low costs can be helpful to control such opportunistic behavior (Chiarelli *et al.*, 2002). Quality of production can also be reinforced through (mostly verbal) delivery agreements that guarantee frequent recollection and timely payment. Otherwise, farmers who deliver higher quality products are also more likely to exhibit loyal behavior towards exporters.

In this chapter we determine the critical factors that make farmers eligible for export delivery to traders-processors and we analyze the impact of contracts on quality performance and loyalty relations within the chayote supply chain. Specific research questions are defined as follows:

1) How organized is the supply chain for chayote (actors and tasks performed by each)?
2) What farm household characteristics determine market outlet choice?
3) Which farm households are engaged in (verbal) agreements with a processor/exporter?
4) What are the implications of such (verbal) contracts for product quality and loyalty?

We use an analytical framework based on the Structure-Conduct-Performance approach (SCP) (Bain, 1968; Martin, 1993). Data analysis is performed making use of factor analysis to identify the core dimensions of scale and experience. Robust parameter estimates from binary regressions are presented to examine the determinants of farmers' engagement in export production. Tobit and Logit models are used to examine the probability of contractual engagements between producers and exporters, and to analyze the key factors influencing quality performance and loyalty.

This chapter is structured in seven sections. In section 2 we describe the data collection process. In the third section we discuss the technical aspects of chayote production and the organization of production and marketing in Costa Rica. This is followed by an analysis of significant farm and household characteristics influencing the scale and experience of chayote farmers in Section 3. Then we estimate the parameters for engagement in export

markets and determine the factors underlying engagement in contractual delivery. Finally we review the factors that influence quality compliance and loyalty in export-oriented chayote chains. We conclude with some suggestions for further improving the integration of chayote marketing chains and networks.

4.2 Materials and methods

The analysis has been conducted in two parts. The first part describes the structure of the chayote supply chain, by providing a broad description of how the market and its actors are organized, and focusing on the general characteristics of the trade relations existing between producers and processors/exporters. The second part focuses on the analysis of the characteristics of farm households regarding contract and market choice, and the implications of these decisions for the quality of the product and loyalty in the trade relationship.

Field data were collected from chayote producers located in approximately fifteen villages in the valley of *Ujarrás* in central Costa Rica where 120 farmers were selected using a stratified sampling technique.[14] The total number of chayote producers consists of 450 farmers with an average yield of 80,000 kg/ha and a total production of 36,000 ton/year (SEPSA, 1993). From this group we subtracted 27 packers and exporters, leaving a group of 423 producers. We defined a sample size of 120 farmers to guarantee reliable results with a 90% confidence level and a five percent significance level. The selected sample frame consisted of 69% of the farmers in traditional private areas and 31% of the smallholders located in IDA settlements.[15]

According to data provided by the IDA, there are 131 chayote producers located in the settlements. In this stratum farmers were identified in the field and 37 selected randomly. On the other hand, in the traditional producers' stratum there is a lack of accurate records; therefore farmers were randomly selected in the field by dividing the total research area into twenty numbered equal segments. We randomly selected ten segments and subsequently the first farmer in each segment. With the help of this farmer, we used snowballing to select other farmers in the surroundings (at least 8 to 9 per segment). Maps of peasant settlements (collected from the Institute of Agrarian Development, IDA) and topographic maps from the

[14] We have applied this technique due to the separation of farmers in two categories: namely, traditional chayote producers and IDA settlers.
[15] The national rural development institute (*Instituto de Desarrollo Agrario*, IDA).

National Geographic Survey Institute were used to locate the segments in the field (map of the research area in Appendix 4.1).

Data collection from processors included a total population of 22 firms (five packers and exporters recently had quit their activity at the time of the survey). From this group, we visited seventeen processors (77.27% of the total) and applied guided interviews to obtain their impressions of the chayote activity.

For the farm-level interviews, a semi-structured questionnaire was used to gather information regarding relevant farm household characteristics (*e.g.* farm and family size, age, education, farming experience, distance from the market), main characteristics of chayote production systems (*e.g.* plot size, input use, labor intensity), institutional relationships (*e.g.* finance, input provision, technical assistance and bargaining) and marketing arrangements (*e.g.* market outlets, price, payment terms, rejection rate and loyalty with buyers) (see Table 4.1). A dummy variable was entered for the communities because during the fieldwork we observed notable differences between them; the dummy thus reflects the fixed effect of location. A map of communities can be found in Appendix 4.2, which shows how communities are located close together in the center of the research area. Moreover, two scaling indices were used, one reflecting the quality of the plot and the other with the amount of input. Table 4.2 shows the various estimation methods applied for the research questions defined.

Table 4.1: Selected variables of chayote producers

Farm household	Production	Institutions and credit	Marketing and loyalty
Farm	Chayote	Credit	Marketing
Community for chayote case (part of certain communities)	Total commodity area (in hectares)	Use of credit (yes/no)	Export (yes/no)
Located in IDA settlement (yes/no)	Total scale of production (in cajones per week)	Use of input credit (yes/no)	Percentage of export (percentage of total production)
Total farm area (in manzanas[16] for pepper and in hectares for chayote)	Productivity per hectare (in cajones for chayote)	Use of credit in the past (yes/no)	Involvement in verbal agreement (yes/no)
Plot quality (perception of drainage, erosion, topography and fertility)	Degree of land specialization (Commodity area/total area)	Willingness to take credit (yes/no)	Mean price (Mean price of all export buyers)
Household	Commodity principal activity (yes/no); % of income earned with the commodity		Mean term of payment (Mean term of all export buyers)
Household size (members in house)	Input intensity (index for quantities of inputs used)		Mean frequency of sale (mean frequency of all export buyers)
Age of head of household (in years)	Percentage of rejection (percentage of total production)		Number of processors (number of export buyers sold to at the same time)
Education of head of household (grades 1-6)			Kind of buyer (only packer/packer and exporter/both)
Chayote cultivated by relatives (yes/no)		Institutions	Collection on farm (yes/no)
Years on land (in years)		Access to land: sufficient (yes/no)	Possibility of negotiating (yes/no)
Experience in agriculture and with the commodity (in years)		Access to off-farm employment: possibility of finding off-farm employment (yes/no)	
Other crops (yes/no)		Access to input markets (fertilizer/pesticides)	
	Labor use	Possibility of buying desired inputs (yes/no)	Loyalty
Animal production (yes/no)	Total labor (in hours per month)	Information (yes/no)	Deviation (yes/no)
Off-farm activity (yes/no)	Hired/own labor (ratio of hired and own labor)	Technical assistance (yes/no)	Percentage stay (percentage of sales to previous buyer when offered better price)
Percentage of total income spent on family	Labor productivity (Labor hours per *cajón*)	Preference for organization (yes/no)	Paying more (additional sum to be paid in order to change)

[16] One hectare equals 10,000 m^2; a *manzana* equals 0.7 hectares and is a more common unit of area used by smallholders in Costa Rica. One *cajón* (*cajones*, pl.) equals 100 units on average.

Table 4.2: Research questions and analytical methods

Research question	Section in chapter	Variables	Analytical method	Expected outcome
Scale of production and experience	Market choice (4.4)	Characteristics of farms and households	Factor analysis	Core dimensions of scale and experience
What farm household characteristics determine outlet choice and in what proportion?	Market choice (4.4)	Factors, characteristics of farm and household, production, credit and marketing	Logistic regression	Variables influencing export market choice
			Tobit regression	Determinants of export share
Which farm households are engaged in verbal agreements with a processor/exporter?	Contract choice (4.5)	Factors, characteristics of farm and household, and marketing	Logistic regression	Variables influencing engagement in verbal agreements
What are the implications of verbal contracts for product quality and loyalty?	Implications for quality and loyalty (4.6)	Factors, characteristics of farm and household, production, and market and institutions	Tobit regressions	Determinants of product quality
			Logistic regression	Determinants of loyalty

4.3 Production and marketing of chayote

Chayote, a perennial vine with a pear-shaped fruit, is grown in mid-altitude areas having a high degree of humidity. Costa Rica has a leading position as a commercial producer and exporter of chayote. The production is located in the valley of *Ujarrás*, southeast of San José, the capital city. An area of approximately 450 ha is cultivated with chayote (Arze-Carrión, 1999). The production cycle lasts 14 months, but harvesting is a continuous process. Product quality is mainly determined by freshness, ripeness, weight and size, appearance, color and the absence of residues; post-harvest procedures (*e.g.* atmospheric management and ethylene treatment) influence fruit softening (Aung *et al.*, 1996).

There are six different varieties of chayote of which only one (*Tierno Quelite*) is exported (see Appendix 4.3 for a summary of technical characteristics). For export purposes, the chayote should not be totally ripe. It should be 5-15 cm long and uniformly pear-shaped, and weigh from 0.20 to 0.35 kg. It should have smooth shiny pale green skin, with no thorns or physical external damage (Saborio *et al.*, 1994). Technicians estimate the average rejection rate at about 14%, caused by inadequate post-harvest management. Genetic erosion, pathologies and entomological mismanagement are the main causes of post-harvest losses (Sáenz and Valverde, 1986; Marín-Thiele, 1997). Technicians and producers agree that the development of new higher yielding varieties that are resistant to common pests is a priority for the sector.

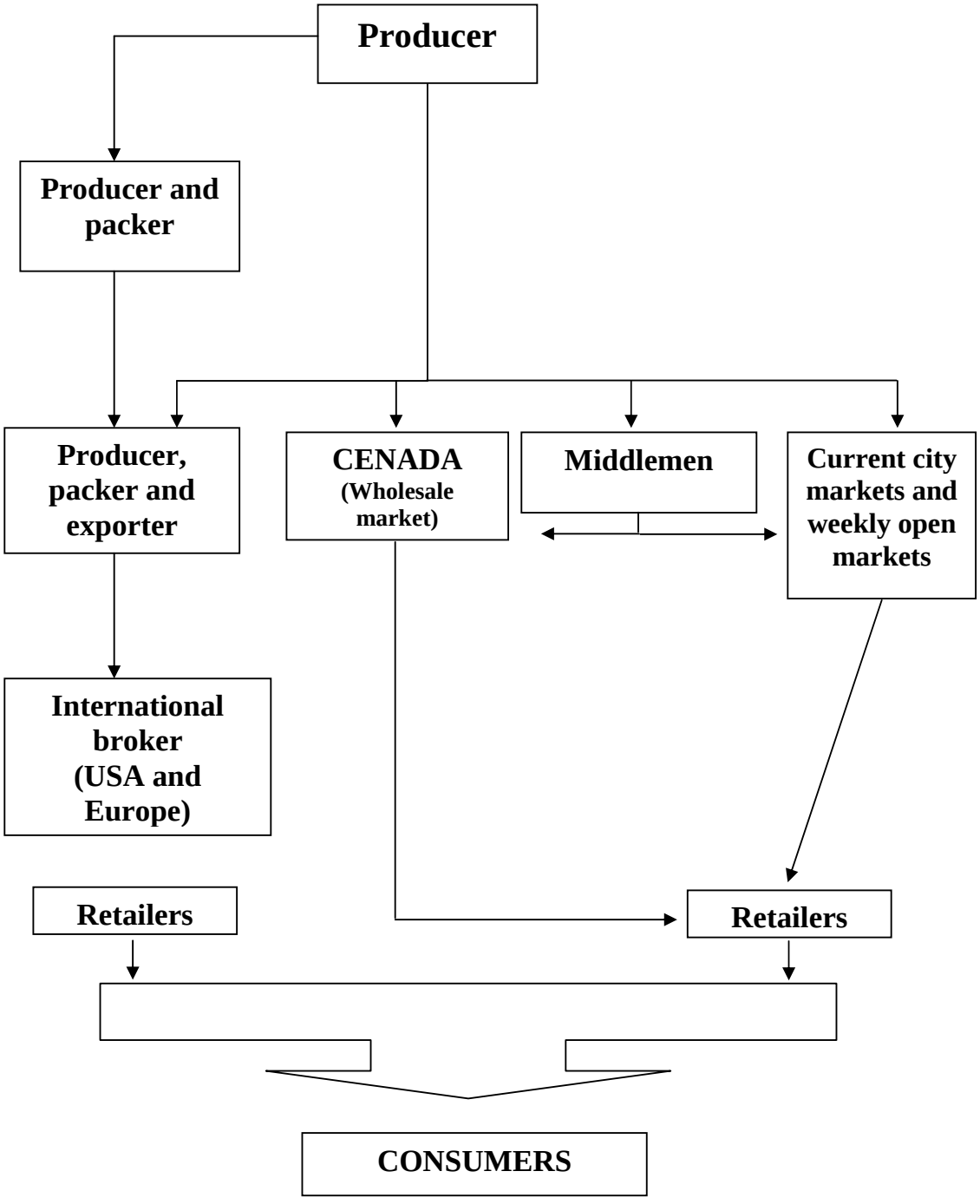
Chayote cultivation is highly labor-intensive, with labor representing approximately 70% of total production costs. Most farmers prefer to use family labor, whereas hired labor is used for incidental maintenance of plots or the trellis. However, it is estimated that about 2,750 persons work directly in chayote production, and 2,000 work as hired field laborers, or in transportation and processing facilities. Average farm size is around 3 ha. Intensive chayote cultivation is carried out on a trellis that consists of wooden posts connected by steel wires in a grid structure. The number of posts required and the distance between them will depend on the steepness of the plot. Chemical inputs such as solid and liquid fertilizers, insecticides, herbicides and fungicides are widely used. Most farmers rely on both organic and chemical fertilizers and prefer different varieties of products to prevent resistance of insects and pests. Chemical products that are most appropriate for chayote cultivation can only be obtained at specialized stores or through contacts with processors.

Figure 4.1 shows the structure of the supply chain for the chayote in Costa Rica, with two main branches (international and domestic market outlets); and four main stages (primary production and agro-processing, international market, national market, and retailers and consumers). Two rather different categories of producers can be distinguished: (1) traditional farmers with a long history of chayote cultivation for the domestic market, and (2) newly established smallholders located in settlements organized by the IDA. The latter type of producer usually possesses less capital and is therefore more dependent on credit provision, input supply and technical assistance. Notwithstanding their limited experience, these smallholders still have comparative advantages *vis-à-vis* larger outgrowers, since there are limited options for production mechanization and the crop requires large amounts of labor. While traditional farmers with larger plots have to rely on hired labor, smallholders can use family labor with the advantage of lower search and supervision costs. In addition, soil quality conditions in the settlements are more appropriate for chayote cultivation (higher fertility and better drainage) and the newly established farmers can rely on more advanced production technologies. About half of the farmers receive some kind of long or medium-term credit that is usually invested in farm equipment (transport, trellis, irrigation, etc.), while another quarter of the producers receive in-kind credit consisting of agro-chemicals to be paid back with the delivery of the harvest.

Since chayote is part of the popular diet, producers can easily sell the rejected chayote in the domestic market.[17] Although most producers are aware of the requirements in the export market, the absence of formal standards causes quality differences and endangers product uniformity. In addition, the number of producers has doubled since 1990 due to world's growing demand for chayote, and the Costa Rican government has supported the non-traditional agricultural sector with incentives in order reduce dependency on traditional export products. This has attracted many new, but less-skilled farmers, and has led to a seasonal oversupply of production, along with deficiencies in quality and uniformity. International phytosanitary controls are becoming stricter with respect to chemical residuals, but the enforcement of control is still limited, given the high costs for testing (CNRF, 1996). Still, containers of chayote are frequently rejected because chemical residues are detected.

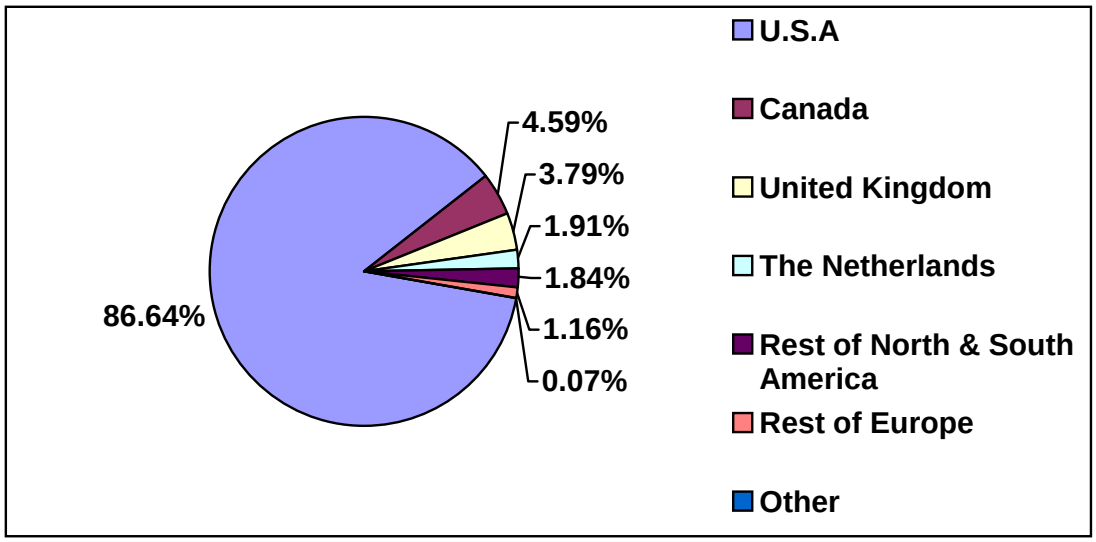
[17] There are two key moments for rejection: the first carried out by the farmer right at the farm (before sending the product to the processor), and the second performed by the processor at the plant. The rejected chayote is usually sold on the domestic market.

Figure 4.1: Structure of the chayote supply chain



Local market outlets include about 60 municipal wet markets (*Feria del agricultor*), retailers and the CENADA wholesale market where chayote represents around 17% of transactions. Local prices exhibit rather strong seasonal variation. Close to 80% of the chayote production is exported, and the main export markets are located in Northern America (86%), Europe (7%) and Canada (5%) (See Figure 4.2.).

Figure 4.2: Major destinations of chayote exported from Costa Rica



Source: Original, based on data from PROCOMER, 2000.

There are 30 registered processors in the study zone, but only 22 remained active at the moment of the survey. Eight firms were identified as producers/packers/exporters, dealing directly with at least five international brokers. The rest of the firms performed only production and packing operations. Most of these processors are family-owned companies that live in the research area, whereas only two exporters are considered formal companies with no family links in the zone. Some processors also operate their own plots producing fresh chayote (with an average size of 7.4 ha), but since this production is not enough to fully occupy the installed capacity, they purchase additional amounts of chayote from nearby producers. Most farmers deliver produce both to the local market and for exports. Processors are responsible for transportation from the plot to the processing plant (although many producers deliver to the factory), product selection, washing the fruit (using water to remove dirt and apply insecticides to protect the fruit for the upcoming trip), waxing, packing (each

chayote is put in an individual plastic bag, which is then placed in boxes of 25-30 units), and finally transportation to the harbor in refrigerated, sealed containers.

The demand for food in Costa Rica is highly diversified, even while there are only 14 products considered of key importance for national consumption. Chayote is one of them, since its consumption remains constant through the years (10.9 kg per capita/year), thus implying that demand is stable and keeps pace with the population. In addition, consumption is higher in densely populated areas. According to the National Bureau of Statistics in Costa Rica, the consumption of chayote is 27.12 and 18.45 grams/capita/year in urban and rural areas, respectively (INEC, 1999, 2001). Current chayote prices are higher in urban areas (2.84 Colones per unit) and somewhat lower in rural areas (1.93 Colones per unit).

The chayote supply chain operates in a rather fragmented way. The commodity moves from Costa Rica to the international markets without any value added abroad. Once the product is sold in target markets, wholesalers-importers (brokers) store and distribute the commodity to the retailers and set the purchase price for Costa Rican exporters. Retailers basically perform a distribution function and consumers purchase chayote in the same condition as it is packed by the exporter. The only food safety control is performed by the phytosanitary authorities in the country where the commodity is imported. Chayote suppliers cannot afford the investments required to introduce sophisticated food safety and quality control systems, and there is no official regulatory framework specifically for chayote in the importing countries. The most common standard is a list of prohibited or regulated chemical biocides.

The chayote chain does not have a clear strong leading agent, since there are no large retailers or branded manufactures involved in the design and promotion of chayote in international markets. In addition, the commodity has barely been industrialized and is mainly sold fresh. Importers only specify certain product parameters (color, shape, size, no damage). Their main strategic activity is linking overseas suppliers with ethnic niches in the target country. To remain participating in the supply chain, Costa Rican suppliers have to match brokers' product parameters. Trading is based on quality assessment and market knowledge of the broker. Hence, quality default is penalized via price rather than by exclusion from the market. These informal governing rules are enforced from exporters to packer and finally to producers in a backward sequence.

4.4 Market choice

The analysis regarding the engagement of chayote farmers in export markets is conducted at three levels. First, we have identified the relevant farm household characteristics influencing market orientation. Second, we have analyzed the key factors determining whether farmers are oriented to the export market. Third, we have searched for the factors affecting the share of chayote production delivered to processors-exporters.

4.4.1 Principal factors

Given the heterogeneity in farming systems and the diverse commercial orientation of the chayote producers, it is important to identify some common factors that structure the sample of producers. We used factor analysis to select the relevant variables that contribute to these common dimensions, thus reducing the farm-household characteristics into their main aspects. Variables with a high mutual correlation were excluded from the factor analysis to avoid multicollinearity. We were able to apply the Varimax rotation method (orthogonal), since a test using direct Oblimin rotation showed no indication that the extracted factors might be correlated to one another. This rotation procedure improves the interpretability of factors, since it maximizes the loading of each variable on the extracted factor, while minimizing the contributions to other factors (Field, 2000). Following Hair et al., (1998) and given our sample size, we take into consideration only significant factor loadings with values higher than 0.50.

Table 4.3 shows the rotated component matrix obtained from the analysis of farm household characteristics. Each column of numbers represents a separate factor or component. We obtained two factors containing loadings from eight variables. The larger the absolute value of the factor loading, the more important the variable is (Hair et al., 1998). Since a factor loading is a correlation between a specific variable and the factor, the square product of this loading represents the amount of the total variance accounted for by the variable in the factor.

Table 4.3 Rotated component matrix of farm household characteristics

Variable (unit of measurement in brackets)	Component 1 *Scale of production*	Component 2 *Experience*
Total labor use (hours per week)	**0.910**	0.151
Total area of chayote (hectares)	**0.889**	0.024
Labor ratio (hired/own labor in hours)	**0.896**	0.101
Production per week in boxes (box = 100 units)	**0.564**	-0.109
Age of head of household (years)	-0.132	**0.854**
Involvement in agriculture (years)	-0.022	**0.851**
Time owning the plot (years)	0.023	**0.823**
Period producing chayote (years)	0.232	**0.554**
Eigenvalues of the factors after rotation	2.830	2.483
% of explained variance	35.378	31.043
Cumulative %	35.378	66.421

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations.

We find that all variables have high positive loadings (above 0.50) on at least one factor. The two components selected account for 66.4 percent of the explained variance. The first component is composed of the production volume, the use of (own and hired) labor, and the cultivated area of chayote. In this component we have identified two farm characteristics: size and scale. Farm size usually refers to the total land area available by the farmer, whereas scale refers to the optimal economic combination of resources required for production (Ellis, 1988). As noted above, labor represents almost 70% of the chayote production costs, and the preference for using family labor thus restricts the optimal farm size.

The second component consists of the following variables: age of the head of household, years owning the plot, years of engagement in agriculture and years of producing chayote. All these variables show high positive loadings that account not only for knowledge in agriculture and chayote production, but also reflect the engagement in agricultural activities through the years. The highest loading values are for age of the head of household head and the tradition of engagement in agriculture. Hence, this component might be labeled as *experience*.

4.4.2 Export orientation

Although most farmers deliver to export markets, there is another segment of producers that only sell in the national market, while a third group is involved in both national and international markets. The latter producers rely on national outlets to sell the products that are

rejected for exports. We have analyzed the underlying factors for these differences in market outlet choice using a logistic regression model. The dependent variable is a dummy for export orientation of production that takes the value of one if farmers are delivering to the export market and takes the value of zero otherwise. Farm-household and marketing characteristics, together with the above-mentioned composite factors for scale and experience are used as dependent variables. Table 4.4 shows the results obtained in the analysis. The factor "scale of production" is related positively to export orientation. This was expected since export traders-processors prefer to receive large quantities of chayote in order to occupy their installed capacity effectively. The factor "experience" is also related positively to the choice for export markets. Farmers with a longer involvement in agricultural activities, more farming experience and a long-lasting settlement in the region started with chayote exports as a core economic activity. The first chayote exports had already begun in 1972, and thus these older farmers have become quite familiar with the international market.

Table 4.4 Variables influencing export market choice (Logistic regression)

Variables	B	Sign.	S.E.	Wald	Sign.
Constant	-0.664		4.453	0.022	0.882
Factors					
Factor Scale	5.478	***	2.077	6.954	0.008
Factor experience	1.210	*	0.701	2.979	0.084
Farm and household characteristics					
Household size (members)	-1.265	**	0.555	5.197	0.023
Quality of the plot (index) [a)]	27.830	***	9.953	7.818	0.005
Living in community (1=yes)	-12.370	***	4.024	9.448	0.002
Input use (index) [b)]	-2.242		1.418	2.498	0.114
Credit					
Credit use (colon)	-0.002	***	0.001	8.626	0.003
Input store credit (dummy)	10.585	***	4.029	6.901	0.009
Linkages					
Having an agreement (1=yes)	1.049		1.137	0.850	0.356
Negotiation possibilities (1=yes)	10.376	***	3.577	8.415	0.004
Preference for organization (1=yes)	-5.227	*	3.128	2.792	0.095

Note: *** significant at 1%; ** significant at 5 %; * significant at 10%.
Chi-squared: 56.10; $R^2_{(logit)}$: 0.65; Correct prediction: 94.4%.

a) Plot quality is defined as a composite index of drainage, soil erosion, fertility and topography.

b) Input use is defined as a composite index of chemical and organic fertilizers, herbicides, insecticides, seed and irrigation water.

We notice that farmers with plots located in IDA settlements outside the traditional communities have also become more oriented towards the export market. Given their reliance on family labor and the availability of high quality land, they are engaged in small-scale, intensive chayote cultivation, thus avoiding the usual imperfections in the market for hired labor (Ellis, 1988; Stiglitz, 1989). Another advantage is that since these plots are very suitable for chayote production and are less infected by soil-borne pests and diseases, they offer higher prospects for stable yields and high quality products. The plots in the settlements are located close to the exporters and packers' facilities to reduce transport costs.

The use of formal (bank) credit reduces the probability of export market choice, whereas the use of credit from input stores tends to increase the export orientation. Farmers producing for processors-exporters receive their payment several weeks after delivery.[18] Bank credit is an expensive source for covering this time lag. Input stores are more flexible and usually accept payment after some weeks. In addition, by accepting the export contract as collateral for borrowing, they guarantee timely access to chemical inputs and permit rapid responses to emerging diseases from pest attacks without requiring rigid bank processes.

Finally, farmers producing for the export market are barely interested in membership in producers' organizations, since most farmers' unions deal only with the government and have little influence on private transactions. However, when farmers make agreements with processors they are likely to become involved in export delivery. These farmers expect some real possibilities for negotiation regarding the delivery conditions. Since the chayote market is rather diversified and involves many different agents, the bargaining power of both parties is relatively equal and contracts are subject to negotiation (Wilson, 1986; Key and Runsten, 1999). Trust and loyalty are therefore important for developing stable partnerships.

4.4.3 Determinants of the export share

Farmers deliver different proportions of their total production to the processors/exporters. To identify which farm-household and market characteristics determine the share of the production devoted to exports, we have estimated a Tobit regression. Farmers who are not

[18] The fresh product is delivered on consignment to the exporter, who in turn sends the product abroad and waits for the final payment. Once the price is defined in the target market, the exporter proceeds to pay to packers and producers.

involved in exports are excluded from this analysis by truncating the sample at zero.[19] The results of the analysis are presented in table 4.5:

Table 4.5 Determinants of export share (Tobit regression with truncation at zero)

Variable	Coefficient	Sign.	Std. Error	z-Statistic	Prob.
Constant	69.102		12.481	5.536	0.000
Production					
Productivity	0.096	***	0.036	2.673	0.008
Input use (index)	0.079		0.095	0.835	0.404
Marketing conditions					
Verbal agreement (1=yes)	4.008		4.429	0.905	0.366
Product quality (% product accepted)	0.347	*	0.205	-1.695	0.090
Frequency of deliveries (visits/month)	-7.322	**	3.246	-2.256	0.024
Collection at farm (1=yes)	7.999		5.427	1.474	0.141
Collection price (colones/box)	0.008		0.006	1.274	0.203
Frequency attending open-markets	-8.430	***	2.667	-3.160	0.002
Others					
Located in settlement (1=yes)	7.186	*	3.754	1.914	0.056
Input store credit (1=yes)	-9.361	**	4.153	-2.254	0.024
Error Distribution					
SCALE:C(12)	17.290		1.253	13.802	0.000
R-squared	0.331		Log likelihood		-413.874
Adjusted R-squared	0.244		Avg. log likelihood		-4267
Jarque-Bera	4.52		Uncensored obs.		97

Note: *** significant at 1%; ** significant at 5 %; * significant at 10%.

We find that farm-level productivity and the quality of the products at the processor level are positively related to the relative export share. Whereas the scale of production proved to be decisive for the decision to export (see Table 4.4), the intensity of production and the quality of the product delivered to the processor are critical for the export share. The frequency of attending local open markets is related negatively to the export share, since farmers with high rejection rates are more likely to rely on the domestic market. Farmers living in the settlement areas are orienting a larger part of their production to the export market.

Farmers that take credit from input shops are devoting a smaller share of production to exports. We have noted above that farmers involved in exports tend to prefer informal and rapid delivery sources of credit (see Table 4.4). However, due to the usual delay in receiving export payments, full specialization is less likely and they are also forced to sell part of the

[19] The Jarque-Bera statistics indicate that the residuals of the obtained model are normally distributed.

produce to local outlets in order to maintain some liquidity. Surprisingly, delivery frequency is related negatively to the export share. A possible explanation is that deliveries with a larger time lag allow more time for preparation of the produce and quality selection. However, a more plausible explanation is that some producers allocate part of their production to the domestic market for two different reasons: to guarantee an alternative income source and to gain additional bargaining power. Since other options for improving their bargaining position (such as establishing a producers' organization or input control systems) are not available, farmers can only rely on market diversification as a protective device (Wilson, 1986). Therefore, when processors attempt to increase delivery frequency, producers may consider this a threat to their bargaining power, especially when the rejection rate at processing plants proves to be high.

4.5 Contract choice

Chayote producers oriented toward the export market are required to deliver high quality products at an established delivery frequency. Their production capacity should be fine-tuned with available resources, notably land, (family) labor and inputs. Export producers use more material inputs for chayote production and are likely to demand credit facilities in order to guarantee access to registered varieties and processing equipment. Contract farming can thus be a useful strategy to generate economies of scope and reduce marketing risk (Hayami and Otsuka, 1993). In addition, contractual arrangements reduce price uncertainty, thus enabling less-experienced farmers to engage in the production of non-traditional crops. Current export delivery contracts offer several benefits to producers, including access to market information, provision of technical assistance, access to specialized inputs and financial resources. At the same time, these facilities also allow traders to enforce better product quality.

In the chayote sector, although written or formal contracts are not used, verbal agreements between producers and processors are common practice. Agreements are made regardless of whether farmers are oriented fully or partially to the export market or only operate at the domestic market. In our sample, 75% of all producers hold a verbal agreement with their respective buyer, while only 25% are operating with no type of agreement at all. A preliminary T-test analysis indicates that farmers who are more involved in trade under verbal agreements are especially located in the IDA-settlements, possess smaller farms but with higher quality land, and have farmed their land for a shorter period of time. Although

these farmers are also engaged in other cropping activities, they usually devote a substantial share of their land to chayote. The contract thus seems helpful in decreasing uncertainty but does not result in full specialization in chayote cultivation.

To examine the determinants of engagement in verbal delivery agreements, we used a Logistic regression model. Selected farm and household variables, together with a number of variables reflecting the conditions under which the transactions take place are used as independent variables. The dependent variable is a dummy for having a verbal agreement with a buyer, with the value of one if farmers produce under verbal contracts and with the value of zero otherwise. Table 4.6 shows the results obtained in the analysis.

Table 4.6 Variables influencing engagement in verbal agreements (Logistic regression)

Variables	B	Sign.	S.E.	Wald	Sign.
Constant	-6.829		2.875	5.643	0.018
Factors					
Factor Scale	0.819	*	0.488	2.813	0.094
Factor experience	-0.556	*	0.316	3.094	0.079
Farm and household characteristics					
Educational level of head of household	1.096		0.715	2.350	0.125
Household size (members)	0.392	*	0.203	3.736	0.053
Quality of the plot (index)	2.337		1.652	2.000	0.157
Input use (index)	1.001		0.720	1.929	0.165
Marketing conditions					
Access to information (1=yes)	0.388		0.623	0.389	0.533
Producing only for domestic market (1=yes)	-2.142	**	1.019	4.420	0.036
Collection price (colon/box)	0.002	*	0.001	2.777	0.096
Delivery to processing plant (1=yes)	2.387	**	1.083	4.855	0.028
Input store credit (1=yes)	-0.465		0.662	0.493	0.483
Opportunistic behaviour (1=yes)	-1.137	*	0.608	3.500	0.061
Frequency of deliveries (visits/month)	0.303		0.559	0.293	0.588

Note: *** significant at 1%; ** significant at 5 %; * significant at 10%.
Chi-squared: 34.79. Psuedo $R^2_{(logit)}$: 0.29. Correct prediction: 78%.

The scale of production factor is positively related to engagement in verbal delivery agreements with a buyer. It was expected that farmers with a larger cultivated area maintain such contracts to guarantee access to market outlets. The factor experience shows, however, a negative relation to the existence of verbal agreements. This can be explained by the fact that the more established farmers no longer require an agreement and prefer to search for better prices at the last moment, selling at the farm gate or in the weekly open-markets. Hence,

older farmers try to maintain their bargaining power by diversifying their market outlets and income sources. Even when the more experienced farmers are orienting their sales to the international market, they are less inclined to engage into contractual delivery. Otherwise, younger and less-experienced farmers living usually in IDA settlements need the security of verbal agreements (Glover, 1987; Glover and Kusterer, 1990; Key and Runsten, 1999). This implies that agreements are a particularly useful device for enabling less-experienced farmers to become involved in production for the international market. In addition, processing firms usually prefer to contract producers with larger families for labor-intensive commodities like chayote (Key and Runsten, 1999).

Farmers that are not engaged in export trade usually resign from delivery agreements. Most of them sell their production directly to consumers in weekly open markets, or to middlemen at the farm gate. They negotiate on price and quantity at the moment of the delivery. However, farmers that maintain previous arrangements with buyers receive a better average price. Therefore, the delivery agreement is a good risk-reducing device for less-experienced farmers. This is further confirmed by the fact that farmers, who are responsible for the delivery of the produce to the plant, and thus incur in transportation costs, require a previous agreement. Finally, opportunism (i.e. selling products to other buyers when a better price is offered) is effectively controlled by the engagement in delivery contracts, since farmers prefer stable relations with their buyers in order to safeguard their investments.

4.6 Implications for quality and loyalty

This effectiveness of market and contract choice for the relationship between producers and traders/processors can be analyzed through the assessment of certain performance indicators (Bain, 1968). We have focused on the aspects of quality compliance and loyalty in export delivery as indicators of the effectiveness of the selected market and contract choice strategies.

For traders and processors, farmers' default on quality is one the most important problems in contract performance (Glover and Kusterer, 1990). From the producer's viewpoint, the difficulties in forecasting production and deliveries, together with limited access to information and technical assistance, tend to affect compliance with contracts and could easily induce distrust or disloyal behavior. Market imperfections due to coordination,

information and negotiation problems are major reasons for deviating from previous agreements or defaulting on quality requirements.

Default problems are usually caused by a lack of coordination in production and delivery. Glover (1987) points out three main sources of coordination problems: (1) producers fail to follow the processor's instructions, (2) the processor lacks operational and managerial capacities, and (3) exogenous reasons such as variable weather conditions. Regarding the first issue, chayote producers and processors have only verbal agreements on sale and purchase conditions. This type of agreement is in the category of procurement- or market-specification contracts where only rather general quality requirements, price and payment conditions and delivery rules are specified (Key and Runsten, 1999; Singh, 2002).[20] Hence, a detailed set of precise technical instructions for the producer is not available, and objective monitoring criteria for the processor are absent. With respect to the latter two causes of coordination failure, the irregular nature of fresh chayote production is affecting market supply and causes price variability. This irregular supply stems from climate hazards, the use of low-performing seeds, and the lack of organization in the sector. These are common problems in the production of export-oriented commodities in many developing countries (Key and Runsten, 1999). Technical assistance, whether provided by the government or by export firms, is critical for overcoming these problems. Since producers do not have proper storage facilities, certainty regarding recollection and/or continuous access to different market outlets is required to deal with supply and price variability throughout the year.

Efficient production also requires a fluent exchange of information between producers and processors regarding optimal production techniques, the characteristics of the produce required in the international market and the optimal timing of deliveries by the producer to the processor. When markets are missing in this type of information, adjustments may be delayed on the production side, and results in substandard quality and irregular deliveries (Key and Runsten, 1999). Ultimately, farmers may be inclined to distrust the processor and start deviating from the agreement. In fact, extreme conditions of asymmetric information regarding product quality can fully interrupt the trade between parties (Akerlof, 1970; Grosh, 1994).

[20] Fafchamps (2004) defines these arrangements as 'implicit' or 'incomplete' contracts offering rather flexible conditions as a way of sharing risk amongst agents.

Firms will try to cope with this by relying on three strategies: (1) changing to production management contracts, (2) contracting private technicians for internal monitoring, and (3) coordinating with public extension services. Delivering market information and providing technical assistance thus play important roles in diminishing the bottlenecks for agency coordination regarding timely delivery and quality performance.

Negotiations between producers and processors are useful to overcome coordination problems. The effectiveness of these negotiations depends on the bargaining power of both agents. A relatively competitive environment prevails in the Costa Rican chayote sector with many producers and a fair number of traders and processors. When there is no dominant agent, negotiations between the parties become more important. Relative bargaining power is mainly determined by asset specificity (Key and Runsten, 1999). For the producers, asset specificity is reflected in the amount of land devoted to chayote, the fixed investment in the trellis and other semi-permanent infrastructure. Given limited alternative use options, full specialization in chayote will not be attractive. For the processors, the investments in processing facilities are obviously asset-specific. Specific assets tend to reduce the existing margins for negotiation but are likely to have a positive impact on quality performance and loyal behavior.

4.6.1 Quality

The quality of the chayote is of major importance for access to export markets (see Table 4.5). Late harvesting and delivery delays affect the firmness and appearance of the crop. In addition, exposure to excessive rainfall and infestation by insects and fungus can harm the outside of the chayote. In order to prevent crop damage, frequent pest and disease control measures and the application of the appropriate kind of inputs play a critical role. Rough and improper handling can cause internal damage which is difficult to observe. Consequently, farmers who cannot afford to devote sufficient time and effort to careful product handling and management suffer higher rejection rates.

We have estimated the determinants of quality using a Tobit regression and have found that land quality and frequency of deliveries are the main factors responsible for reducing rejection (see Table 4.7). Surprisingly, specialization and experience with chayote production do not enhance quality. The availability of a delivery contract does not show any significant

direct effect on quality. There is, however, a close correlation between contracts and labor availability (see Table 47); this points to an indirect effect of contractual delivery on product quality. In addition, quality is improved when technical assistance and market information are provided by the processor.

Table 4.7 Determinants of quality (Tobit regression)

Variable	Coefficient	Sign.	Std. Error	z-Statistic	Prob.
Constant	92.554	***	21.566	4.292	0.000
Factors					
Factor Scale	4.114		2.940	-1.399	0.162
Factor experience	-5.003	**	2.520	1.985	0.047
Farm and household characteristics					
Total farm area (hectares)	-2.059	**	0.932	2.209	0.027
Quality of the plot (index)	52.409	***	18.123	-2.892	0.004
Chayote as main activity (1=yes)	-23.744	***	9.080	2.615	0.009
Input use (index)	0.022		0.123	-0.176	0.860
Educational level of head of household	5.282		3.224	-1.638	0.101
Marketing conditions					
Verbal agreement (1=yes)	8.363		6.046	-1.383	0.167
Frequency of deliveries (visits/month)	8.807	**	4.388	-2.007	0.045
Negotiation possibilities (1=yes)	2.864		4.655	-0.615	0.538
Access to information (1=yes)	-11.225	**	5.112	2.196	0.028
Number of buyers	4.783		3.861	-1.239	0.215
Frequency attending open-markets	-6.926	*	3.563	1.944	0.052
Assistance					
Technical assistance (1=yes)	12.825	**	6.486	-1.977	0.048
Input store credit (1=yes)	-16.916	***	5.171	3.271	0.001
Error Distribution					
SCALE:C(17)	21.497		1.669	12.883	0.000
R-squared	0.332		Log likelihood		-394.141
Adjusted R-squared	0.193		Avg. log likelihood		-4.193
Jarque-Bera	3.65		Uncensored obs.		86

Note: We have defined quality as the inverse of the share of rejection (= sum of the rejected amount of chayote reported at farm and processor's facility level). We excluded from the analysis 22 producers that only sell in the domestic market.
*** significant at 1%; ** significant at 5 %; * significant at 10%.

Traditional farmers that are more devoted to chayote production, with larger land areas (albeit of inferior quality), are defaulting the most on quality. Although they have more experience with the crop, their production systems are less tailored towards the quality requirements set by the international market. These farmers rely on input purchase from local stores instead of input provision by processors. Given their lower quality, they deliver more to local open

markets. The total available area of traditional farmers is substantially larger than that of farmers living in IDA settlements who became engaged in chayote cultivation more recently (mean total area for traditional and IDA farmers is 3.36 and 2.91 ha, respectively). Larger and more experienced producers are usually considered to be more receptive to adjusting their production systems to new technologies and accepting technical assistance (Feder and Umali, 1993). However, for labor-intensive crops like chayote, processors prefer contract farmers with limited endowments of land and larger families who can reduce their dependency on hired labor.

Marketing conditions and alternative outlets have a strong impact on bargaining power. More experienced farmers tend to prefer a high degree of independency and are therefore less likely to engage in an exclusive agreement with a processor that would obligate them to maintain a high frequency of delivery. Instead, they prefer to use the domestic market as an option to diversify their income and thus gain a certain amount of bargaining power vis-à-vis processors.

The negative impact of information on quality performance is surprising and seems to contradict the literature. A possible explanation can be found in the fact that information available to farmers refers particularly to prices, and far less to quality requirements. While price information has become transparent, information on quality is maintained strictly by the processors, thus gaining bargaining power vis-à-vis the producers (Grosh, 1994; Key and Runsten, 1999). Traditional farmers are better aware of this 'missing market' and respond by delivering the rejected produce to the domestic market. This can be qualified as a defensive coping strategy that makes trade relations less efficient and challenges market integration.

4.6.2 Loyalty

Markets for non-traditional crops in developing countries are often highly imperfect and transaction costs tend to be high. Long-term relationships reduce these costs while controlling opportunism and providing efficient resource allocation (Williamson, 1985). Apart from the economies of scale that are likely to result from contractual agreements, another benefit is the reduction of transaction costs for enhancing economic efficiency. Since contractual agreements in our study are mainly verbal and the enforcement of these informal contracts is difficult, loyalty is an important condition. Recent studies regarding the role of trust and

social capital indicate that networks of delivery relationships can reduce opportunistic behavior among the agents involved in trade (Fafchamps, 2004). These relationships are built up along several consecutive transactions and provide information on the agents' capabilities and their reactions to potential threats (Lyon, 2000). Loyalty in delivery arrangements is of mutual importance to both parties. The processor needs to be certain that the producer will continue to deliver, while the producer wants to have a guarantee that the processor will buy his products at an acceptable price and at the right moment. The contractual relationship thus ensures that the farmer will deliver a high quality product.

We have estimated the determinants for loyalty (defined as the willingness to maintain long-term supply relations) using Logit regression (see Table 4.8). Producers' decisions whether or not to sell (part of) the produce to another processor-exporter are strongly influenced by their engagement in contractual delivery. Producers that have become involved recently in chayote production (i.e. living in IDA settlements) and maintain a verbal agreement with processors exhibit considerably more loyalty. Loyalty is also substantially higher for those producers that are supported by technical assistance and receive credit.

Table 4.8 Determinants of loyalty (Logistic regression)

Variables	B	Sign.	S.E.	Wald	Sign.
Factors					
Factor Scale	-0.171		0.239	0.509	0.476
Farm and household characteristics					
Living in community (1=yes)	-0.522		0.495	1.113	0.291
Located in settlement (1=yes)	0.872	*	0.479	3.314	0.069
Input use (index)	0.574		0.550	1.087	0.297
Marketing conditions					
Verbal Agreement (1=yes)	1.417	**	0.634	4.993	0.025
Frequency of deliveries (visits/month)	0.638	**	0.323	3.906	0.048
Term of payment (mean)	-0.021		0.070	0.092	0.762
Product quality (% produce accepted)	0.024		0.026	0.835	0.361
Negotiation possibilities (1=yes)	-1.519	***	0.515	8.709	0.003
Assistance					
Access to information (1=yes)	0.868	*	0.519	2.797	0.094
Technical assistance (1=yes)	1.037	*	0.578	3.218	0.073
Use of credit (colones)	0.000	**	0.000	4.581	0.032

Note: *** significant at 1%; ** significant at 5 %; * significant at 10%.
Chi-squared: 32.79; $R^2_{(logit)}$: 0.23; Correct prediction: 74.3%.

Farmers with a contract are found to be more loyal to the contracting agent, since the contract provides the security of having a place where they can deliver and sell their production (Glover and Kusterer, 1990; Key and Runsten, 1999). Interestingly enough, loyalty proved to be fairly independent of the price; we found that producers with a contract will ask, on average, for a price adjustment of at least 25% before considering a shift to another buyer.

While the scale of production increases the probability that a farmer will produce for the international market, this variable has no influence on the tendency to deviate from a given agreement. Furthermore, while less experienced farmers search for the safety of agreements, experience has no effect on loyalty. Technical assistance, however, clearly reinforces loyalty and thus partially compensates for the lack of experience.

Farmers with plots located in IDA settlements are considered as 'newcomers' and tend to be more loyal to processors. This can be partly explained by the fact that the plots and houses in the settlements are located close together and social control tends to be rather strong. In addition, technical assistance services are easy to provide and coordination is required to prevent the spread of plant diseases. Technical assistance from processors also contributes to monitoring for preventing default. Hence, field technicians who control pests and diseases also have a dissuasive effect on potential deviation.

Market conditions are highly relevant for reinforcing loyalty. Access to (market and technical) information has a favorable impact on loyalty, since it enables farmers to a timely adjustment of farming practices and thus reduces the risk of product rejection at a later stage. Otherwise, farmers with limited negotiation possibilities are likely to be more loyal to the processor. Farmers who have little room for negotiations with buyers about price and other market conditions and maintain scarce bargaining power tend to stay with the buyer, fearing to lose opportunities for selling their produce.

4.7 Discussion and conclusions

Contracts provide an important device for improving security and enhancing the involvement of smallholders in international marketing chains. Farmers delivering under (in)formal contracts with processors/exporters have better access to credit, critical inputs and information, enabling them to benefit from economies of scale and scope. Contracts influence

farmers' production systems and household revenues in two different ways. In the first place, quality is improved as a result of better land use and more labor available for crop management and handling. This is mainly guaranteed through the selection of recently settled farmers with larger families as contractual partners. In the second place, loyalty is increased especially when these farmers can be ensured high delivery frequency. The latter is particularly important to maintain post-harvest quality and reduce rejection rates. Loyalty with processors/exporters requires contractual arrangements including provisions for technical assistance and market information as well as adequate facilities for timely product delivery and payment regimes.

Producers' preferences for a certain processor-exporter are determined by the price paid for their product, but non-price factors (such as access to credit, technical assistance and market information) appear to be equally or more important. In addition, producers are particularly interested in a high frequency of collection to maintain quality. Since chayote can be harvested year-round and storage can be damaging to the fruit, it is harvested several times a week. Therefore, it is of critical importance for farmers to be able to deliver their produce to the processor-exporter with a high frequency. High delivery frequency is favored by the size of the chayote area, the quality of the products and a location close to processors-exporters. Although contracts do not directly influence delivery frequency, the availability of input finance has a positive impact on the speed of collection. Apparently, the processor tries to reduce the recovery period of pre-financing through a more timely collection of the product. In a similar vein, processors may delay the final payment until the product has actually been exported, thus transferring the market risk towards producers. Such delayed payments for export transactions are a major constraint for further intensification of chayote production.

Prices appear to be positively related to export contracts, and these contracts in turn provide incentives for the intensification of chayote production systems. Producers with verbal agreements receive, on an average, about 25% higher prices, but also face higher risks of rejection (Hueth and Ligon, 1999). In this context, the existence of a contract improves the certainty for the producer, enabling investments in land improvements and better crop management. No direct relation was found, however, between contractual delivery and the quality of the produce, but a strong impact on loyalty was confirmed. Contracts are mainly offered to producers that already possess a comparative advantage for chayote production (i.e. better soils and more family labor). Product quality is further reinforced by institutional

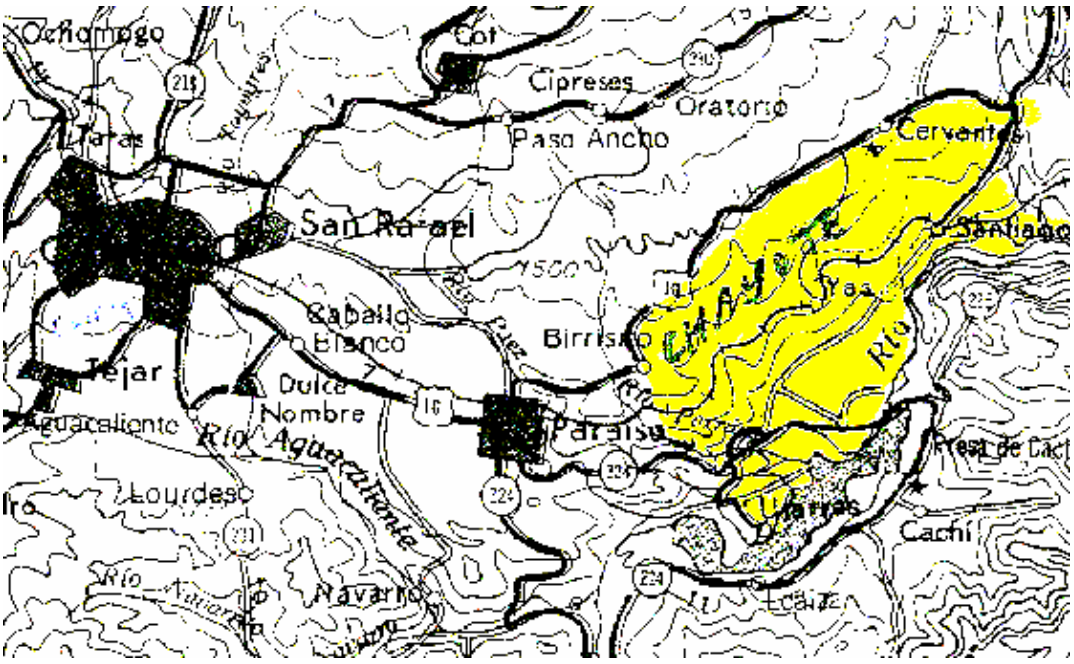
variables such as technical assistance and delivery frequency, and thus indirectly favored through the relationship with the processor.

Quality improvement starts at the farm-level and requires better input applications and higher labor intensity in production. Farmers endowed with the favorable natural and human resources are able to make additional investments once their cash-flow pattern is balanced. During this transition, full specialization in chayote production is usually not feasible, since returns from other crops or engagement in off-farm work are necessary for smoothing expenditures (Ruben and Sáenz, 2004). Preferred supplier arrangements that guarantee frequent collection and timely payment are therefore of critical importance. Additional support from packers and exporters concerning input financing and technical assistance contribute to enabling farmers to improve product quality. In turn, it is likely that producers will respond to this support with a high degree of loyalty.

Appendices

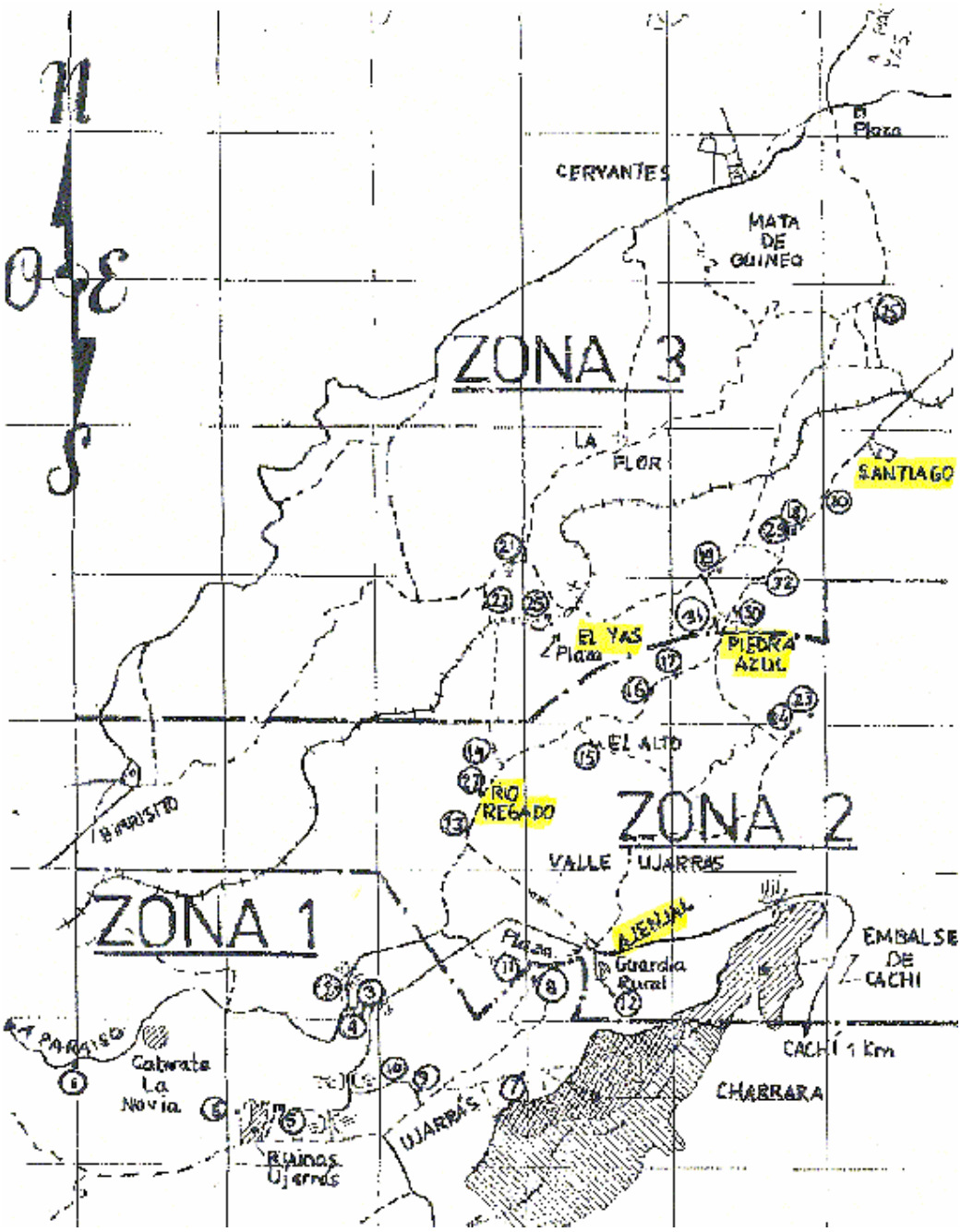
Appendix 4.1

Area where chayote is produced



Appendix 4.2

Map of communities



Note: The communities of Río Regado, Santiago, Piedra Azul, Ajenjal and el Yas (in yellow) are indicated with the value of one for the dummy variable communities. The circled numbers indicate the location of packers and packers/exporters.

Appendix 4.3

Major technical characteristics of *Sechium edule* SW.

Scientific name	*Sechium edule SW.* (Cucurbitacea family)
Origin	Meso-America (Mexico and Central America)
Varieties and commercial names	Six varieties: "Criollo Blanco," "Criollo Negro," "Criollo Verde," "Cocoro," "Mexicano," and "Tierno Quelite." The vegetable is known in France as *Christophine*, *Brionne*, *Chou-chou* and *Chouchoute*. In the United States of America and United Kingdom it is known as Chayote, Custard marrow, Vegetable pear, and Mirliton. In Latin America it is currently known as Chayote.
Life cycle	Annual, 14 months.
Climate and soil requirements	Chayote is cultivated preferably at an altitude of 800 to 1800 meters, with a temperature between 13 and 21 degrees Celsius. It requires a humidity of 80 to 85 percent and rainfall of 1500 to 2000 mm. Loose volcanic soils are preferred.
Topography	Plots can be located on either flat or quite steep land. In the latter case, a round mound would be required for each plant.
Dissemination	Through seeds. The indiscriminate use of seeds by farmers has led to cross-breading and loss of genetic material.
Infrastructure	The chayote is a climbing plant, thus requiring a trellis for proper development. Formerly the chayote was grown on the ground. Later, intensive cultivation required the use of a trellis that consists of wooden posts connected by steel wires in a grid-like structure at about 1.80 to 2 meters high. The distance between posts depends on the farmer's preferences and the steepness of the plot. At the bottom of each post one or more whole chayote fruits are planted. The plants then are directed up the wooden post onto the wires. Eventually the whole plantation is covered with a "shelter" composed of leaves beneath which the fruits grow. Start-up capital is therefore necessary for chayote production; the amount differs according to the materials used.
Irrigation	Irrigation may be required once or twice a week, depending on the temperature and soil structure.
Fertilizing, disease and pest control, and quality considerations	A major part of the production process is made up of chemical inputs. This includes fertilizers (both solid and liquid), insecticides, herbicides and fungicides. Most farmers use organic fertilizer along with chemical inputs. A large number of different inputs are available. The quality of the product is a significant aspect for export. This mainly implies no external damage or blemishes on the skin, and uniformity of size and color. Harvest and transport, and more importantly rain, insects and fungus, can damage the outside of the vegetable. To prevent this, application of insecticides and fungicides is of major importance. Farmers usually alternate these inputs to prevent insects and other pests developing resistance. Alternation of products also occurs due to shortage of financial means when either inferior brands or products are applied or no chemical inputs are used at all. If farmers cannot afford the necessary inputs, the quality of the product will decrease. This might push farmers into a so-called negative cycle in which fewer resources lead to less quality and so on. The chemical products used are not officially authorized for chayote production. This means that none of the chemicals currently available on the market have been tested and approved by public institutions, as an effective solution for a given disease. International phytosanitary controls are very strict with respect to chemical residues. However, the level of control is very low, since high costs are attached to this kind of testing. Still, containers of chayote are occasionally rejected due to chemical residues resulting either from a lack of information regarding the allowed residues or from the unwillingness of the farmers to use other products.
Production	Harvest is possible year round, with the peak in supply from August to December. Each production cycle lasts fourteen months, including nine months of harvest. Harvesting is done twice a week (in the research area, usually Mondays and Thursdays).
Labor	Labor represents approximately 70% of total production costs.

Sources: MAG, 1991; Saborío, 1994; Arze-Carrión, 1999; Ing. I. Alvarado-Valerio, personal communication

Chapter 5

Potential benefits of collective actions: a simulation approach for pepper contracts in Costa Rica

5.1 Introduction

Many rural poor farmers in developing countries face high transaction costs for trading their produce. These are difficult to overcome and tend to constrain in varying degrees their commercial activities (Upton, 1996; Meier, 1995; Sadoulet and de Janvry, 1995; de Janvry et al., 1991; Ellis, 1988; Stiglitz, 1985, 1989). Transaction costs include all cost of using the market (Coase in Hobbs, 1996) and they affect transactions between farmers and agro-processing firms, especially when product quality requirements and trust between trading partners are critical for reaching supply chain coordination (Key and Runsten, 1999). Transaction costs are partly endogenously-determined and household-specific, but also include exogenous factors that affect farm households' trade with other agents. Unbalanced bargaining power between market parties and a restricted monopsonistic market conditions for certain commodities are examples of such exogenous factors (Upton, 1996: Sadoulet and de Janvry, 1995; Ellis, 1988).

Several studies discussed how new hybrid organizations, like contract farming, emerge in response to transaction costs (Key and Runsten, 1999; Hayami and Otsuka, 1993; Ellis, 1988; Bardhan, 1980) and could lead to different levels of supply chain integration (Hobbs, 1996). However, the existence of a contractual relationship between small farmers and an agro-processing firm does not automatically guarantee that operations are optimally performed and that partners involved receive equal benefits.

Inequality in bargaining power between small farmers and agro-processing firms under monopsonistic market conditions may easily lead to negative effects of contracting for the farmers rather than yielding positive benefits for both parties (Wilson, 1986). The welfare distribution effects of contracts thus depend on the capacities and resources of the farmers with whom the agro-processor undersigns contracts (Warning and Key, 2002) as well as the physical-economic characteristics inherent to the commodity (Dorward, 2001). Moreover, the

distribution of power between parties and the level of asset-specificity they experience - given the degree of uncertainty in market exchange - are key determinants for stable contractual relations between them. Since institutions are not static but dynamic and evolve over time, a currently suitable contractual arrangement may change in response to a change in power distribution or in the organizational strategy of a party.

This chapter analyzes the dynamics of contracts in the pepper supply chain of Costa Rica. There are no spot markets for pepper and since 2001 only one processor buys fresh pepper from producers under defined quality conditions. Yet, rejection rates are in average of 10 percent of each delivery. This is a very sensitive issue for low-income farmers and one of the most common sources of distrust with the processor that tend to discourage the continuation of the relationships. Product rejection is mainly caused by two factors: (1) deficient transport conditions and (2) immature pepper included in the deliveries. Since most farmers act individually at the moment of the delivery, these two factors cause rejection rates that are partially out of their control.

Some authors have pointed out the importance of cooperative strategies in order to gain higher competitive advantage and/or better bargaining power (Dyer and Singh, 1998; Key and Runsten, 1999). We explore possible forms of collective action amongst farmers with the aim of increasing the quality of pepper by improving transport conditions and organizing monitoring at the point of collection. This could reduce rejection rates and increase the farmers' bargaining power. Yet, the costs of organizing collective action should be less than the potential benefits that results from a reduction of refused pepper and/or the received price premium. We compare different delivery scenarios searching for hybrid organizational forms, and assess the associated trade-off between governance costs and benefits that could optimize farmers' income and processors' profit.

We conducted the analysis for 19 farm-households from *El Roble* settlement; since this was the only group that started a peasant organization when market conditions changed from a competitive situation in the year 2000 to a monopsonistic market in the year 2001 (see Chapter 3). The remainder of the chapter is organized as follows: section 2 provides the theoretical framework regarding transaction costs and organizational strategies in a monopsonistic market, and explains how these concepts are operationized in the study case. In section 3 we characterize the local pepper market conditions in Costa Rica, followed in

Section 4 by a description the current contractual arrangement in the pepper supply chain according to the procedure suggested by Bogetoft and Olesen (2004). Section 5 provides the specification of the simulation model, followed by a discussion of the main results in Section 6. In section 7 we summarize the main policy conclusions.

5.2 Contract farming in a monopsonistic market

Transactions costs (TC) are the costs of using the market (Coase, 1937; Williamson, 1975; 1979), or the costs associated to the exchange of goods and services among economic agents when the neo-classical assumption of frictionless market is relaxed (Hobbs, 1996). The analysis of the effects of TC on the agricultural sector of developing countries is relevant, given the absence of a full set of markets that is assumed in standard exchange models (Meier, 1995; Stiglitz, 1985, 1989; Ellis, 1988). The impact of TC for smallholders in developing countries is even more important under restrictive market environments, where unequal bargaining power or monopsony conditions prevail. [21]

When a market fails for a specific good or service, either an alternative institution arises or the transaction simply does not occur (de Janvry *et al*., 1991). Different alternative market institutions represent a continuum of exchange options, ranging between pure spot markets and full vertical integration, each representing different degrees of supply chain integration (Hobbs, 1996).

Contract farming has been considered as a useful alternative market institution to cope with high TC. Under certain conditions, small farmers and agro-processing firms might agree on a contractual arrangement that might be preferred to spot markets or full vertical integration. Contracts imply a distribution of tasks and responsibilities at the first stage of the supply chain. They allow the processing firm to participate and even supervise the production process without owning the whole operation, while farmers maintain the formal control over the production process (Glover, 1987; Hobbs, 1996; Key and Runsten, 1999).

[21] The neo-classic theory defines a monopsony market as a situation with only one buyer and many competitive sellers. A monopsony does not exhibit an input demand function relating price and quantity. It just selects a point on its sellers' supply function where its profit is maximized (Henderson and Quandt, 1980).

Contracting implies higher transaction costs related to the search of information, the negotiation of contractual terms (i.e. price, quality, quantity, frequency, etc.) and the enforcement of compliance to the contract terms. For the agro-processing firm, the contract choice is based on its bargaining power and subject to bounded rationality (uncertainty), given the level of asset specificity[22] and the enforcement costs of maintaining a long-term trade relationship (Williamson, 1991; Key and Runsten, 1999; Dorward, 2001). A small-scale pepper producer is expected make a similar choice, after evaluating its own resource endowments, the specific TC for the farm- household and the competitive market conditions for trading (Hayami and Otsuka, 1993).

High asset specificity is likely to discourage processing firms from contracting. However, the firm may obtain a stronger bargaining position *vis-à-vis* smallholders when it operates in a monopsonic market, where producers are highly dispersed and disorganized, and asset-specificity for the producers is higher than for the firm (Key and Runsten, 1999).

Processing firms can induce crop specialization by farmers and gain bargaining power by applying a so-called "agribusiness normalization" strategy (Kusterer, 1982). This is based on a process where the firm promotes certain crops among farmers and encourages them to become involved in the activity (Glover, 1987). Written contracts with minimum guaranteed prices, high frequency in deliveries, short payment terms, technical assistance, input provision, and transport facilities are examples of advantages offered to producers under this "normalization" strategy. This type of promotional strategy is frequently used in developing countries, when the technical-economic characteristics of a commodity make it too risky for small farmers starting on their own (Key and Runsten, 1999). The firm thus transfers part of the asset-specificity towards smallholders and ties them up to specific activities.

Initial supportive measures usually only last for a short time period. Once the firm assures its provision of raw materials, it is tempted to change the initial rules by raising the quality standards and lowering procurement prices. The adjustment of trading conditions will become easier to apply for firms operating under monopsonic market conditions. Therefore, it is argued that "agribusiness normalization" is a typical step in the dynamic evolution of trade

[22] Asset specificity means high specialization of investments for a near-unique commercial purpose (Key and Runsten, 1999; Hobbs, 1996; Williamson, 1991).

relationship between smallholders and an agro-processing firm, which usually leads to more disadvantageous contractual conditions for farmers and tend to promote increasing discontent and distrust (Glover and Kusterer, 1990; Singh, 2002).

Welsh (1997) identified three policy options to protect small farmers in contract relationships with an uneven distribution of bargaining power, namely: (1) state intervention with exchange regulations; (2) promoting and increasing farmers' organization and bargaining power; and (3) creating competitive markets for farmers. In addition, Key and Runsten (1991) suggest that smallholders can increase their bargaining power by diversifying their sources of income, by owning more means of transport, and by adopting collective action, thereby strengthening their organization strength.

Collective action has not only been considered as a pathway for achieving a better bargaining position, but also contributes to creating market access. However, collective action among farmers is not always easy to achieve, mainly because of the heterogeneity of the farming population and the conflict between individual and collective interest. Often small farmers act individually in their trade relationship and tend to put their own interests before the organization's interest (Singh, 2002; Rickson and Burch, 1996; Glover, 1987). This is particularly true in cases where new settlers' communities emerge after the implementation of land reform programs. Moreover, changes in marketing conditions may stimulate the breach of contracts and/or simulate hold-up through collective action by one or both actors (Gow *et al.*, 2000).

Mainstream economics predicts that a buyer firm would resist the establishment of a producer association since it limits its influence on exchange conditions (Wilson, 1986; Key and Runsten, 1999). In an economy where transaction costs are ignored, a monopsonic processing firm would have full power to dictate contractual conditions (commodity price and quality standards) to maximize profits depending on its own cost structure and marginal product. In a group contract arrangement, the firm could loose these prerogatives because the new market arrangement has the characteristics of a bilateral monopoly. However, individual contracts are expensive to implement. Comparable to a spot market, individual contracts give rise to high search, monitoring and enforcement costs which make the contracts *costly, cumbersome, time-consuming and unpredictable* (Fafchamps, 2004, Pg 12). The level of these transaction

costs are determined by uncertainty (increase) and frequency (decrease) of the transactions and the amount of specific investments involved (increase) (Williamson in Ménard, 2005).

Uncertainty is important when the commodity is perishable with variable quality standards. Two important sources of uncertainty are opportunistic behavior of both producers and firm, and bounded rationality. Opportunistic behavior refers to the possibility of agents to act out of self-interest. Bounded rationality refers to the physically-limited capacity of agents to evaluate accurately all potential gains and losses from a given market decision, like a contractual choice (Simon, 1961). Due to bounded rationality, complete contracts do not exist; this usually encourages agents to act opportunistically and to take advantage of any situation that has not been specified in the contract. Producers will try to maximize their sales and thereby offer the entire harvested produce, disregarding the quality levels. Furthermore, farmers are found to easily breach individual contracts. Enforcement is problematic as the contracts are informal and small in quantity and therefore beyond the reach of the law. Moreover, even if the producers would be prosecuted for breaching a contract, they have limited assets that could be seized (*cf.* Fafchamps (2004) analysis of contracts by African traders).

The frequency of transactions is usually high for perishable products. Within a contractual relationship, transactions performed successfully and frequently build up reputation between parties and give confidence to repeat the business. Conversely, as transactions become less frequent, the incentive to act opportunistically and exploit informational asymmetries tends to increase (Hobbs, 1996). Moreover, when asset specificity is high both for the producers and the processor, the balance of bargaining power between parties may be affected, making the processor often less interested to become integrated with the production activities.

Williamson (1991) explained how trading agents search for the best mode of governance that fits the characteristics of the transaction in order to minimize transaction costs. Group contract may result in economies of scale for contracting and other transaction costs, as well as improving the product coordination to ensure a regular provision of fresh pepper with the desired quality characteristics (Singh, 2000; Glover, 1987). A group contract is considered as a hybrid governance arrangement that reduces transaction costs (Ménard, 2004; Allen and Lueck, 2005; Ménard, 2005). Efficiency gains from a group contract can also be explained from an agency theory view. A group contract can be considered as an efficient way to

govern the relationship between the principal (i.e. processor) and the agents (i.e. producers individually and/or as a farmers' association), because it reduces the conflicts of self-interest between the principal and the agent(s). In addition to scale economies in contracting costs, it is assumed that a group contract is helpful to overcome agency problems that result from the opportunistic behavior of both parties regarding quality default and deviation of the agreement (Eisenhardt, 1989). Thus, a group contract may limit the effects of the skewed bargaining power that results from the monopsonic market position of the processing firm (*cf.* cooperatives that have contractual purposes to deal with perceived market failures; see: Cook, 1995). Such bargaining cooperatives are described by Knoeber (1983) as collective organizations that contract with processors for the sale of members' crops. Furthermore, farmers' association may exhibit external economies, also described as passive collective efficiency (Nadvi in McDormick, 1999), forthcoming from improved access to market information and labor pooling in sorting, packaging, supervision and transport.

In summary, we can identify the following main processes that influence gross income and contract choice in a monopsonistic market setting, namely, 1) the market conditions that stimulate or not group contracts by one or both actors, 2) the level of TC that affects one or both parties' decisions regarding the type of the governance structure that is adopted (with implications for coordination costs, membership fees, uncertainty, frequency of transactions, and opportunistic behavior), 3) the technological improvements that may stimulate hold-up through collective actions by one or both actors, and 4) the procurement price resulting from the balance of bargaining power under a specific governance structure.

In the following we discuss the relevance of these aspects for the Costa Rican pepper market (Sections 3 and 4) and develop an empirical model that considers their impact on contractual choice (Sections 5 and 6).

5.3 Structure of the pepper market in Costa Rica

The pepper market in Costa Rica has been traditionally highly segmented, with three different processors operating at different scales of production and varying degrees of professional organization (see Chapter 3). These three processors are spatially oriented towards specific procurement zones and offer different contractual conditions to pepper producers. Pepper production is very decentralized and operated by smallholders because of the high labor requirements for crop management and due to continuous harvesting.

The oldest production area is *El Roble* settlement, where producers have grown pepper since the mid 1980s. Before the year 2000, pepper producers were dealing mostly with the largest processing firm in Costa Rica, called *Company A*.[23] The competitive market situation motovated this company to engage in contractual arrangements with stallholders to guarantee raw pepper supplies for three major reasons. Firstly, given the considerable investments in the processing plant, the company has to secure a sustainable flow of inputs. Secondly, given the limited number of farmers producing pepper (less than 80 producers) a spot market for pepper hardly exists in Costa Rica. Thirdly, full integration to procure raw pepper from own plantations is rather unlikely to be an option since it is far too expensive operating integrated pepper plantations.

Faced with a thin pepper market, *Company A* took initiatives towards introducing *agribusiness normalization* in the pepper sector. Actions taken by *Company A* included offering the producers a written contract which a guaranteed a minimum price in US Dollars. The company provided technical assistance as well as the possibility to acquire and pay pepper seedlings under a convenient lending arrangement. Transport costs from the settlement to the processing plant were entirely covered. Farmers were usually paid one week after each delivery and quality requirements were specified in the contract. Hence, *Company A* transferred asset-specificity to the farmers and linked them into the production and sale of pepper. Farmers became more specialized growers and were tied to *Company A* through the contracts. Although such support policies are usually limited in time (Glover, 1987; Singh, 2002), *Company A* exerted its monopsony power position to change the contract rules - once it had assured its provision of pepper - by raising the quality standards and lowering

[23] Not to disclose their identity, the names of the companies are not mentioned and changed into A and B throughout the chapter.

procurement prices. The *agribusiness normalization* of *Company A* thus resulted in more disadvantageous contractual conditions for the farmers; off course to their increasing discontent (Glover, 1987; Singh, 2002).

In 2000 a local entrepreneur who integrated production and processing of pepper in *El Roble*, set up a new *Company B* thereby challenging the monopsonistic power position of *Company A*. *Company B* bought at farm gate and paid cash at the moment of the purchase, providing farmers an extra 5% on top of *Company A's* purchase price. The pepper was bought in bulk with no restrictions on the applied production technology and the delivery quality. Many farmers preferred selling to *Company B* and started breaching their contracts with *Company A*. Facing irregular supply, the latter Company was forced to relax its quality requirements and to increase enforcement costs. Producers thus exerted their bargaining power and waited for the two buyers every week to negotiate on a convenient purchase price.[24]

About one year later, *Company B* finished its activities in the pepper market, which put *Company A* again in a monopsonic power position. *Company B* was a family-based enterprise, with limited assets and basic technologies for processing black pepper. It was poorly integrated into the domestic market for spices, also due to its restricted managerial and marketing skills. Not surprisingly, therefore, the company had to conclude its activities already after one year.

Early 2001 *Company A* changed all contract rules regarding payment conditions, technical assistance, transport facilities and collection place. The purchase price dropped significantly and the quality requirements became stricter. This caused large discontent amongst the producers. As a response, producers started to consider the establishment of a farmers' organization (Glover, 1987) in order to increase their bargaining power (Key and Runsten, 1999). Given the earlier experience with *Company B*, *Company A* redefined its organization strategy and looked for other contractual forms that allowed lower enforcement costs and higher stability in long-term deliveries. Hence, the firm also showed interest to promote collective action from its suppliers, rather than to continue with individual agreements.

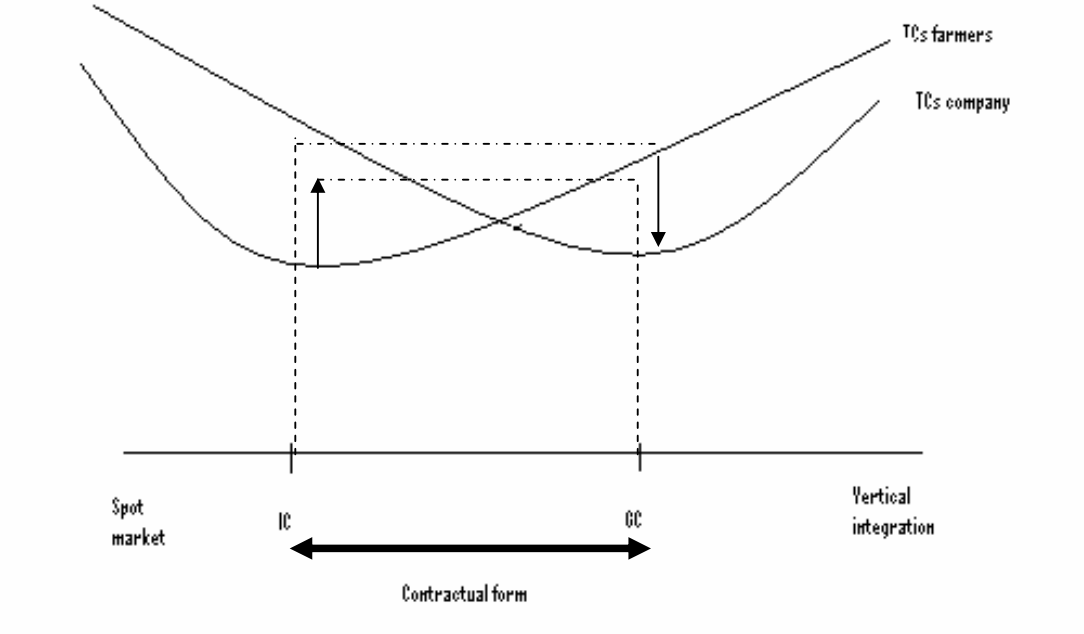
[24] A surprising fact is that most producers were partially or totally breaching the contract with *Company A* just because *Company B* paid ten Colones more per kilo of fresh pepper.

The dynamic relationship between the processor and the farmers is depicted in Figure 5.1. Spot markets and vertical integration are the two highly expensive options for both actors, since they require either the creation of a market (in the first case) or increase asset specificity (in the second case). In theory, there is a certain intermediate range where farmers and *Company A* can trade by individual contracts and/or by group contracts (area IC-OC marked with horizontal black arrow).

According to Figure 5.1, there may be trade-off involved between actors choosing either individual or group contract. We assume that the transaction costs for the farmers are lowest when the pepper is traded through individual informal contracts which closely resemble spot market trade. Transaction costs will increase when group contracts are made, since farmers need to organize themselves and institutionalize their organization. They furthermore have to undertake transport and supervision activities. For low-income producers, joining collective action may become expensive if the costs of organization are high or when market conditions suddenly changes. Farmers may be too risk-averse to subscribe the costs of collective actions and become tempted to hold up the group contract if local market conditions are subject to changes.

At the processor's side, we can assume that the transaction costs are lower in a group contract compared to individual contracts. There are a limited number of pepper producers, scattered throughout peasant settlements that are poorly-endowed with gravel roads. Therefore, fewer contracts require less effort to search and contact the farmers, and thus reduce the negotiation and monitoring costs of each individual arrangement. Moreover, the level of asset specificity makes the firm to procure more regular and increasing amounts of fresh pepper throughout the year. One single group contract may indeed be a better scenario for the processing firm to assure the required deliveries of pepper, while improving also product coordination and reducing opportunistic behavior of farmers. These are good reasons for a monoposonic firm to share some of its bargaining power with a group of organized farmers.

Figure 5.1 Comparison of transaction costs under alternative governance regimes (adapted from Dorward, 2001)



In summary, group contracts are likely to become feasible arrangements if:

(a) at the farmers' side: the increase in the costs of organization (including costs related to the organization of the collection of fresh pepper at a gathering point, quality supervision, transport and supervision costs, and membership fees for farmers' organization) do not exceed the expected benefits from lower rejection rates of fresh pepper in group contracts;

(b) at the processor's side: a better organized and regular flow of fresh pepper resulting from group contracts reduces the opportunistic behavior of the farmers and guarantees full occupation of the processing facilities.

The cost of implementing an organization (for the farmers) and the cost of dealing with a farmers' organization (for the firm) vis-à-vis the gains obtained by each party are central issue for the anakysis in the remainder of this chapter. One or both actors may switch between individual and group contracts when market conditions change, when the costs of organizing and coordinating collective actions become higher than the benefits, when uncertainty increases due to adjustments in the amount and the frequency of deliveries, and when the balance of market power between agents is changing. Our main hypothesis is that a bilateral monopoly can be sustained only if the gains for the contracting partiess are higher than the costs for organizing collective action.

5.4 Agents' profiles and contractual arrangements

In this section we characterize the activities of the main agents involved in the pepper sector (after 2000), followed by a summary of the contractual delivery arrangements, using the indicators outlined by Bogetoft and Olessen (2004). This description of key-actors and contract conditions represents the basis for the stylized contract simulation model presented in Section 5.5.

5.4.1 The Processor

Core business

Company A is the only processor of pepper and hot pepper in Costa Rica supplying to both the national and international markets. The firm is specialized in the production of white pepper, which requires a more expensive process. All produce is sold under a contractual arrangement to a North American food processor based in Costa Rica. The firm also produces black pepper for national consumption that is sold to small local food processors and retailers. In sum, 90 percent of the production is white pepper of high quality for industrial use and 10 percent is black pepper for direct consumption.

Contracts

Written contracts proved to be administratively expensive and not enforceable during a competitive market situation. Therefore, the firm now implements simple verbal agreements, but shows certain interest in a group contract.

Size

The firm operates with seven persons and temporally contracts at least three more people for services such as the transportation of raw materials. The processing facility covers approximately 12,000 m^2. Operation costs amount US$ 3,000 per month.[25] Grading the fresh pepper and packing are the most expensive operations.

Ownership

The firm is totally operated with national capital, owned by one single entrepreneur.

5.4.2 The Producers

Target group

In reaction to the abrupt change in market conditions, a small group of the most experienced farmers from *El Roble* settlement started a group named APROPISA S.A. (*Asociación de Productores de Pimienta de Sarapiquí S.A.*), which operated as a producer association with 19 members at the time of doing our field research. This producer organization basically registers individual deliveries of pepper from each member and distributes the payments received from *Company A*[26] accordingly. APROPISA S.A. charges ten Colones per kilo delivered as a membership fee. *Company A* considers APROPISA S.A. as a potential partner to improve product coordination and quality. The farmers' organization aims at improving the delivery and reception conditions at the collecting point, increasing quality monitoring of the deliveries and improving transport conditions.

Total production and specialization level

The selected 19 producers from *El Roble* settlement devote on average 1.32 manzanas (mz)[27] to pepper, from which 0.73 mz are in production and 0.59 mz are not yet in production. Producers devote on average 4.5 percent of their available land to pepper. Further increase in the area of pepper depends on labor availability, available capital for investment and the farmers' confidence in the market conditions. These producers have additional income

[25] Cost in Colones of 2001 are 975,000 = US$3,000 (at exchange rate US$ 1 = 325 Colones). These are general operational cost and do not include the purchase of fresh pepper.
[26] The pepper from each member is weighted and manually recorded in individual cards before being delivered to *Company A*.
[27] 1 manzana equals 7.000 m^2 or 0.7 ha.

sources apart from pepper, although 8 farmers report that 40 percent or more of their income depends on this crop. The remaining 11 farmers derive less than 40 percent of their income from pepper. Other income sources include animal husbandry and non-agricultural activities.

5.4.3 Quality considerations

Pepper is harvested the day before the collecting date.[28] Like any other fresh product, bunches of pepper should be processed as quickly as possible before the quality degrades. Only mature bunches should be delivered. Inexperienced pickers may increase the proportion of immature bunches and thus increase the rejection rate. Transportation conditions from the plot to the collecting point and from there to the processor plant also affect the quality of bunches. Once the delivered pepper is weighted and recorded for each farmer at the collection point, bags suffer from being piled up to the truck. The quality of pepper is affected most in the first uploaded bags that support the weight from the others on top. The truck has an open-air freight compartment with no cover. After leaving *El Roble* the truck driver stops in another settlement to collect more pepper before continuing the three-hour journey to the *Company A* processing facility. During that time, the bags are exposed to sunshine or rain. The producers have no influence at all over transport conditions.

For the producers, availability and skills of pepper pickers, and the packing and transportation conditions of pepper are the most important determinants for quality. The quality of the fresh pepper is also very important for *Company A*., since 90 percent of the production is white pepper for industrial use, which requires top quality grains. The industrial yield for processing white pepper is also higher than for black pepper[29], which means that the firm not only needs pepper bunches of high quality but also large amounts of them.

[28] However, some farmers may start two days earlier due to shortages of hired labor. Bunches are stored in bags under small shelters during this time.

[29] 4.2 kg of fresh pepper is required for obtaining 1 kilo of white pepper, while 3 kg is needed for 1 kg of black pepper.

5.4.4 Contractual regimes

Selection of producers and contract conditions

Company A continuously motivates farmers to produce pepper and encourages new farmers to set up pepper plantations. Basically, any producer interested to grow pepper is welcomed by the firm. Beginners with no experience are provided with technical assistance and seedlings. The farmers are charged 10 Colones per kg of accepted pepper for technical assistance. Seedlings are the only input provided by the firm under a written contract. The other contract conditions are fixed in a verbal agreement, such as the frequency of collection of pepper (usually every two weeks), the terms of payment (at the time of next collection), the transport costs (10 Colones per kg delivered) and the quality requirements.

Duration

The verbal agreements have no specific expiration date. A pepper plant takes two years before a first harvest can be done, and hereafter continuously produces during the next 15 years if appropriate care and maintenance id provided. Since the firm needs to maintain all producers engaged in this life cycle, a specific expiring date of the contract is not convenient. On the contrary, the firm encourages producers to keep renovating their older pepper plants. The written contract formally expires at the fifteenth year.

Processor's tasks

The processor assumes the following tasks:

- Provision of seedlings, technical assistance and transportation of fresh pepper (Costs charged to the farmers)
- Delivery of seedlings
- Coordination of transport for fresh pepper and technical assistance
- Selection of pepper
- Sending individual payments by cheques
- Processing white and black pepper

Producer's tasks

The producers are in charge of the following tasks:

- Taking care of plantation, hereby following the instructions of the technician

- Harvesting only mature bunches
- Packing bunches of pepper in clean bags free of waste
- Taking the bags to the collection point on the agreed delivering date

Enforcement and monitoring

Company A enforces the contracts by notifying the farmers that they will terminate buying their pepper when they deviate from the agreement. However, this mechanism is rather weak since the firm is totally dependent on every single active producer delivering pepper. Therefore, the company's technicians monitor the amount of pepper on the fields during the whole season.

5.5 Modeling framework for analyzing contract choice

5.5.1 Conceptual framework

We developed a non-linear integer simulation model to assess which contractual arrangements could maximize the processor's and/or farmers' gross income. The model is inspired by the modeling approach proposed by Dorward (2001). The sum of the gross incomes of the farmers and processor is maximized, taking into account their relative market power and risk preferences. [30]

In the model, individual farmers (*sellers*) deliver pepper to one single monopsonic processor (*buyer*). Mature pepper plants are harvested throughout the year, yet with a clear harvesting peak resulting in two marketing seasons (s): low-supply (March to November) and high supply (December to February). The contractual forms (k) are ether individual contracts (IC) or group contracts (GC). The processor and farmers may exhibit low or high opportunistic behavior (j) with defined probabilities of occurrence and associated expected loss. Higher probabilities for a given party behaving opportunistically *vis-a-vis* the other party are assumed in case individual contracts are chosen. Conversely, probabilities of behaving opportunistic are lower under group contracts. It is expected that rejection rates and supervision costs are increasing under high opportunistic behavior of farmer and processor.

[30] Gross income is defined as value of sales less value of variable and fixed costs, not including labor, capital and land costs.

We also assume that the firm's production costs are lower under group contracts, since fresh pepper is of better quality, requiring lower supervision costs when opportunistic behavior is limited.

The model calculates the income levels of the farmers and the firm with the quantity of transacted pepper as endogenous variable. Furthermore, risk behavior is modeled using a Target MOTAD approach (Tauer, 1983). In such a model, income deviations below a target income should be smaller than defined parameters (λ*'s*) for farmers and firm that reflect their respective risk aversion. Low levels of both λ*'s* indicate that the buyer or seller is risk-averse regarding such income deviations.

We developed five delivery scenarios where we identify hybrid organizational forms and the associated trade-off between governance costs and benefits that optimize the contracting parties' incomes (Table 5.1).

Table 5.1 Analytical setting for the dynamics of contracts in the pepper supply chain

Scenarios runs	Section	Changing variables and parameters
Changes of market conditions	Changing governance structure with selling price of fresh pepper (5.6.2)	Procurement price of fresh pepper
Effects of transaction costs	Coordination costs and selling prices of fresh pepper (5.6.3)	Firm's coordination costs, under three different procurement prices Farmers' coordination costs under three different procurement prices
Effects of risk averseness	Risk aversion of farmers (5.6.4)	Level of risk-averseness of farmers
Technological change	Technology improvement (5.6.5)	Industrial yields of the firm Production of fresh pepper at plot level Production costs at plot level
Procurement price setting and bargaining power	Seasonal contracts and endogenous pricing (5.6.6)	Bargaining power and contract choice

5.5.2 Data

The model uses data derived from previous research on markets and contracts for smallholder pepper producers in Costa Rica (see Chapter 3). Data were gathered in 2000 and 2001 from a farmers' survey and in-depth interviews with processors and employees of involved governmental institutions. Because the identity and number of the producers were unknown at the beginning of the research, we implemented a non-random sampling method, called 'snow ball' method (Babbie 1992).[31] We selected the *El Roble* settlement because it is the oldest pepper producing area and the main production zone in Costa Rica. In this settlement, we can find most skilled pepper producers and it is the only area with a tradition in producers' organizations.

El Roble settlement is located in the monopsony market area, under *Company* A's influence (see appendix 3.1). Maps of the farmers' settlement (collected from the Institute of Agrarian Development) and topographic maps from the National Geographic Institute were used to locate the plots where pepper is produced. Leading pepper farmers were identified first and interviewed. Hereafter, they provided information on the location of other farmers.

5.5.3 Model specification

In the model, we consider two market conditions (*s*): low and high supply seasons; two contract arrangements (*k*): individual and group contracts (IC and GC, respectively); and parties may display a low or high opportunistic behavior (*j*): low-opp and high-opp, respectively. The model specification is as follows (see appendixes 5.1, 5.2a and 5.2b for the GAMS codes):

Objective function:

$$Max \quad A = \sum_{kjs} w_{kj} B_{kjs} pb_{kjs} + \sum_{kjs} (1 - w_{kj}) S_{kjs} ps_{kjs} \qquad (1)$$

[31] We identified 75 active pepper producers and successfully interviewed 50 (65%), of which 19 from *El Roble* settlement.

Gross Income calculation:

$$B_{kjs} = X_{kjs}(1-refuse_{kjs})/indy)\,frp - X_{kjs}(1-refuse_{kjs})(F^{*}_{kjs} + premium_{k} + fpc_{ks}/indy + ft_{ks} + fg_{ks}) - ff_{ks}, \quad \forall k, j \tag{2}$$

$$S_{kjs} = X_{kjs}(1-refuse_{kjs})(F^{*}_{kjs} + premium_{k}) - X_{kjs}(ppc_{ks} + pg_{kjs} + pt_{kjs} + pts_{kjs} + pmf_{k}) - pf_{ks}, \quad \forall k, j \tag{3}$$

Minimum expected gross income requirements per season:

$$\sum_{kj} B_{kjs}\, pb_{kjs} \geq rb_{s}, \quad \forall s \tag{4}$$

$$\sum_{kj} S_{kjs}\, ps_{kjs} \geq rs_{s}, \quad \forall s \tag{5}$$

Target MOTAD part:

$$\sum_{s} (B_{kjs} + Zb^{-}_{kjs}) \geq b^{*}, \quad \forall k, j \tag{6}$$

$$\sum_{s} (S_{kjs} + Zs^{-}_{kjs}) \geq s^{*}, \quad \forall k, j \tag{7}$$

$$\sum_{kjs} pb_{kjs} Zb^{-}_{kjs} = \lambda_{buyer} \tag{8}$$

$$\sum_{kjs} ps_{kjs} Zs^{-}_{kjs} = \lambda_{seller} \tag{9}$$

Capacity restriction:

$$\sum_{kj} X_{kjs} \leq cap^{*} qs_{s}, \quad \forall s \tag{10}$$

Binary part of the model:

$$X_{kjs} \geq m^{*} Y_{kjs}, \quad \forall k, j, s \tag{11}$$

$$\sum_{kj} Y_{kjs} \leq 1, \quad \forall s \tag{12}$$

In the objective function (1), the sum of the gross income of processor and farmers is maximized. This is expressed as the expected income of processor (B) and farmers (S) multiplied by their bargaining power. The *w* is defined as a measure of bargaining power of the processor with respect to the farmers with a value ranging from 0 to 1 ($0 \leq w \leq 1$). When individual contracts are set up ($w = 1$), monopsonistic market conditions prevail as the firm (buyer) has full market power (*i.e.* the buying price for fresh pepper is set according to the value of its marginal product), subject to minimum income requirements and risk considerations of the other party. In the case of collective action, a bilateral monopoly emerges, *i.e.* one buyer and one group of sellers. In this case, it is useful to consider three sub-cases where the price of pepper will be the result of negotiations between the buyer (processing firm) and the seller (group of farmers). The first three scenarios consist of two extreme cases: (1) a monopoly where the farmers' group would have all market power ($w = 0$) and (2) a monopsony (buyer firm has all market power, $w = 1$), and one intermediate case of (3) joint profit maximization ($w = 0.5$) (Henderson & Quandt, 1980) as a possible, but not necessary outcome, of the negotiation process. The parameters pb_{kjs} and ps_{kjs} indicate the probability for a given party (processor or farmers) of meeting other party's opportunistic behavior (*j*), under a certain contractual arrangement (*k*) and market condition (*s*). Probabilities sum up to one for each market condition (*s*). The probability for farmers behaving opportunistically is higher when the processor chooses individual contracts and lowers when group contracts are preferred. The probability for the processor behaving opportunistically is higher when farmers choose individual contracts and lower when they prefer group contracts.

Equations (2) and (3) define the endogenously determined income of the processor and farmers, respectively, under contractual arrangement (*k*), opportunistic behavior (*j*) and season (*s*), by taking into account that:

- X_{kjs}: the endogenously determined volume of fresh pepper traded;
- *refuse*: Rejection rate which is defined at four different levels: 9% (IC and low-opp), 15% (IC and high-opp), 1% (GC and low-opp), and 5% (GC and high-opp);
- *indy:* the industrial yield (defined by the processor as 4.20 kg of fresh pepper to produce 1 kg of processed white pepper);
- frp_{ks}: processor's price for white pepper, equal to $8 per kg. This is the highest selling price reported by the processor in the year 2000. Selling prices may vary every semester, depending on the negotiations with the processor's main client (a

North American food processor based in Costa Rica). This niche market arrangement is relatively isolated from the world pepper market;

- $F^*_{k,j,s}$: Purchase price of fresh pepper for the processor and the farmers, fixed for the first four scenarios and endogenously determined in the model in the fifth scenario;
- $premium_k$ is a quality premium paid as an incentive for good quality pepper in the group contract;
- fpc_{kjs} and ppc_{ks}: the production costs for the processor and the farmers, respectively. The processor reported different production costs per kg of white pepper under k and j. The farmers survey estimated average production costs at \$0.17 per kg of fresh pepper;
- fg_{ks}, ft_{ks}, pg_{ks}, pt_{ks}, pts_{ks} and pmf_k: organization costs when individual and group contracts are chosen; fg_{ks} and ft_{ks} are the coordination and transport costs for the processor per kg of fresh pepper under k and s; pg_{kjs} is the cost for farmers to organize supervision at the collection point (estimated at \$0.107 per kg of fresh pepper for the supervision by 3 people during 3 hours at each delivery in low supply season; and \$0.025 per kg for supervision by 3 people during 6 hours at each delivery in high supply season); pt_{kjs} is the cost of transportation from *El Roble* to the processor's processing facility (estimated at \$0.0204 per kg of fresh pepper in a 2.5 ton truck); pts_{kjs} are the costs of supervising the transportation (estimated at \$0.024 per kg of fresh, given a processor's low opportunistic behavior; and \$0.0032 per kg under processor's high opportunistic behavior[32,33]), and pmf_k introduces a membership fee when group contracts are chosen;
- ff_{ks} and pf_{ks}: fixed costs for the processor and the farmers when they trade pepper respectively. For the farmers, this is the minimum cost for delivering and refers to the value of working time and the time needed for delivery at the collection point. For the processor, we consider half of the monthly administrative costs for the management of pepper processing.

[32] We estimated the cost of one person traveling in the truck on every delivering, spending six hours for the trip and supervision at the processor's facility gate under processor's low opportunistic behavior, and eight hours under processor's high opportunistic behavior.

[33] Governance and transport supervision costs are calculated taking into account the minimum labor cost for an agricultural worker, which was about US\$1 per hour at the time of this research.

Taking into account long term contractual stability too, the processor and the farmers should at least receive a minimum income that is attractive enough to remain involved in pepper cultivation. These minimum income constraints are operative in the monopoly, monopsony and joint profit maximization cases, in order to prevent non-stable long term solutions. Equations (4) and (5) express that the expected gross income of processor and farmers should be larger than a reservation income which is equal to what they could have earned in an alternative activity in both seasons of the year. For the processor (*rb*) this is defined as half of the target income, namely US$19,400, equally divided over both seasons. For the farmers (*rs*) it is defined as the average income obtained from other agricultural activities (commercial crops, livestock production and off-farm employment) amounting to $17,570, alos divided over the two seasons.

The variables Zb^{-}_{kjs} and Zs^{-}_{kjs} in equations (6) to (9) determine the value of the deviation in income below the target income. The expected shortfall from the target is calculated. The acceptable level of shortfall from target is given by λ_{buyer} and λ_{seller} for the processor and farmers, respectively. These variables are introduced to enable the model to account for risk behavior. For the processor, the target income (b^*) is set at $38,000 in the base run, which is the annual fixed costs to operate the plant processing pepper. For the farmers' group, target income (s^*) is the lowest income they reported to be willing to accept before quitting to produce pepper, calculated at $27,412 per year from survey data.

Equation (10) refers to the limitations in production, namely that the amount of fresh pepper traded in a season should be lower than a maximum of what can be transacted per season (30,000 kg, the production in 2000) multiplied by a capacity factor (*cap*) to allow for production increases.

Finally, constraints (11) and (12) are added to make the model integer, so that only one contract arrangement per season is selected. Thus, the model does not foresee the scenario where farmers trade part of the produce individually and the rest in a group contract. This set of equations was programmed in GAMS (appendix 5.1). The results are shown and discussed in the next section. A summary of the base parameters can be found in Appendix 5.3a and 5.3b.

5.6 Model results

We argue that a bilateral monopoly can be sustained only if the gains for the farmers adopting this governance structure are higher the costs of organizing collective action. Therefore, in the first scenario we show the base run situation with the optimum governance structure, given the set of current market conditions and transaction cost. In the second scenario we look for different procurement prices that make it feasible for farmers to offset the costs of the bilateral monopoly. The third scenario shows the effects of coordination costs on the selection of the governance structure, under a three different prices regimes. This is followed by a fourth scenario where farmers perceive as risky the collective action under certain crop cycle production. In the fifth scenario we analyze how technology improvements can make feasible or not the bilateral monopoly for a given party. Finally, the sixth scenario shows how the level of market power determines the procurement price.

5.6.1 Initial situation (base run)

The base run considers a selling price of $0.89 per kg where the situation that *w* is equal to 0.5 in the case of group contracts and one for individual contracts. It is argued that in the case of individual contracts, the processor has most of the bargaining power, while farmers are price takers. Conversely, when *w* is equal to 0.5 the market power is shared between the processor and a collective of farmers, in a bilateral monopoly. Producers have only one market to sell and the processing firm has only one partner to procure from. We use this level of *w* for the next five run scenarios when GC is selected, since it reflects a possible intermediate case of negotiation, while the limiting cases are too cumbersome to included for each run.

The results of the base-run predict that farmers will opt for group contracts with low opportunistic behavior in both the low supply and high supply season. At the price of $0.89 per kg, the firm should earn $39,997 in the low supply season and $42,251 in the high supply season. The farmers' income as a group totals $33,060 in the low supply season and $38,322

in the high supply season. In each season a total of 60,000 kg fresh pepper is traded[34]. The average income per farmer per year equals $3,757.

5.6.2 Changing governance structure with selling price of fresh pepper

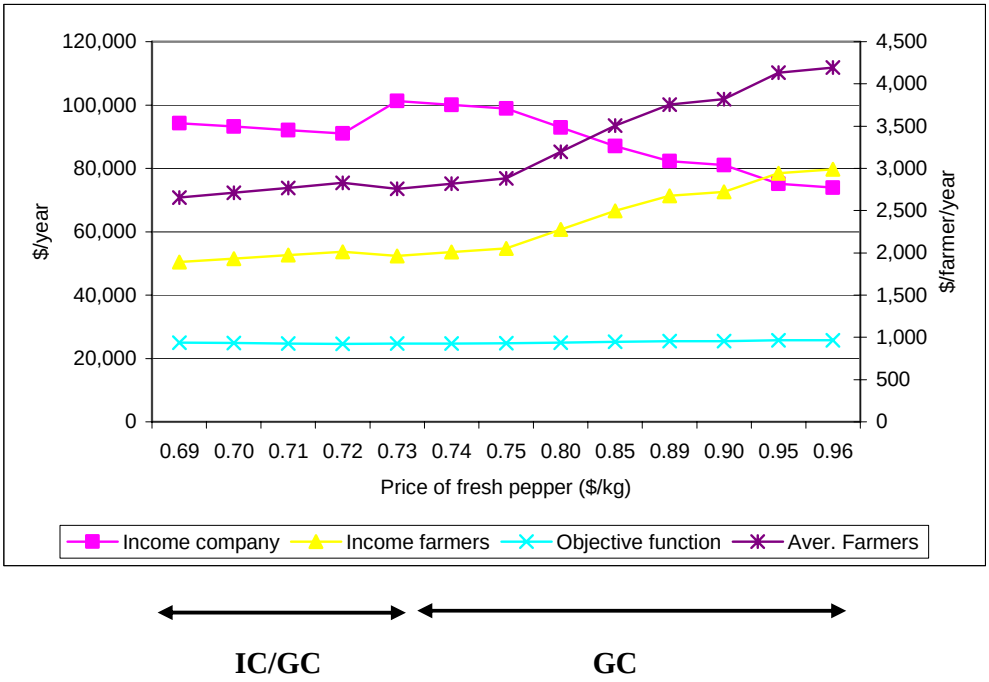
In this scenario we show the effects of the contracting parties' income on the adopted governance structure. We identified under which prices the governance structure can change for certain supply season, making feasible or not the bilateral monopoly for the farmers.

The model becomes unfeasible when the price of fresh pepper (Fb_{kjs}) drops below $0.69 per kg. This suggests that the farmers withdraw from trading at this price, because at this price farmers do not obtain the desired minimum income to stay in the activity. Their income from selling pepper is then lower than the opportunity cost of income. Figure 5.2 shows how the income of the firm and farmers changes with increasing selling prices of pepper. At selling prices below $0.73, the model predicts that farmers prefer to deal with individual contracts, under high opportunistic behavior (IC), during the low supply season; and with group contracts, under low opportunistic behavior (GC), during the high supply season. At higher prices, the model predicts that group contracts under low opportunistic behavior will prevail in both seasons. The objective function shows a relatively stable trend, with small increments through the period of analysis.

Figure 5.2 shows that income of the processor is decreasing up to the price where it switches to GC ($0.73 per kg), while the income of farmers slightly increases. This suggests that the processing firm is affected when IC are chosen during the low season, and that any increment of the purchase price below $0.73 per kg of fresh pepper only contributes to worsen off the firm's earnings. This can be explained by the fact that under a selling price of $0.73 per kg, the gains for farmers from organizing the collection and transport of the pepper during the low season are not high enough to offset the costs.

[34] According to technicians from *Company A* 60,000 kg of fresh pepper is the expected maximum amount of pepper, possible to produce by farmers, with the current technology level.

Figure 5.2 Effects of changing price of pepper on expected income levels



Note: the objective function is the income of the processing firm and the farmers group on the left Y-axis. Income of average per farmer per year is on the right Y-axis.

The model predicts that the best scenario for the processing firm is at the purchase price of $0.73 per kg, which is the switching point to GC for both seasons. The processor earns its maximum income while sharing its bargaining power with a group of farmers, who earn one of their lowest incomes (although still higher than the income earned at $0.69 per kg). It is interesting to note that the bilateral monopoly is attractive for the farmers only at $0.75 per kg or higher. Under this governance structure, the income of the farmers group increases with 10 percent when the firm pays 5 cents more per kg (inside the range of procurement prices $0.75 to $0.85 per kg). The processor's income drops by 6 percent. Above the base run price ($0.89 per kg), collective actions prevail for the both seasons, with continuing increments of farmers' income and reductions of processor's income, nearly in the same proportion. In general, the firm's income drops when moving from seasonal individuals contracts to group contracts, up to the price of $0.73 per kg. Farmers' income continually increases as they move towards higher selling prices under group contracts only after the selling price of $0.74

per kg. The best scenario for the firm is keep paying no more than $0.73 per kg and promotes collective actions among farmers.

5.6.3 Coordination costs and selling prices of fresh pepper

In this scenario we demonstrate how high transaction costs can make a bilateral monopoly unattractive for a given party, and thereby affect the parties' income. The model accounts for the transaction costs of both the farmer and processor. For establishing a group contract, the farmers face governance costs and a membership fee as well as transport and supervision costs, which are all defined in dollar per kg of fresh pepper traded. The processor needs to account for coordination costs, which are higher for individual contracts than for a group contract in the base run situation. Dealing with each farmer individually multiplies the costs to negotiate, administer and monitor all arrangements.

We consider several options, namely changing the costs of the governance structure for the processor and the group of farmers, and the cost of the membership for the group. Results are given in Table 5.2 (for the processor) and Table 5.3 (for farmers) under three price conditions, namely the base-run price ($0.89 per kg), the price when the governance structure shifts to group contracts for both seasons ($0.73 per kg), and the price when individual contracts are chosen for the low supply season ($0.72 per kg).

In Table 5.2 we simulate the effects of two governance options with different coordination costs for the firm, at three different price regimes. The first run attributes coordination costs for individual contracts, but not for group contracts. In the second run we consider the case when group contracts are expensive to coordinate for the firm, while individual contracts have cero costs. In Table 5.3 we simulate the effects of changing levels of farmers' coordination costs and membership fees. In total, four runs are presented for three selling prices of fresh pepper.

Table 5.2 Processing firm's coordination costs at different purchase prices W = 1 when IC and 0.5 when GC

1) Base run price at $0.89 per kg of fresh pepper

Runs	Firm's coordination costs ($ per kg of fresh pepper)				Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective Function
	IC		GC							
	Low supply	High supply	Low supply	High supply	Low supply	High supply	($/year)	($/year)	($/year)	
Base run	0.035	0.024	0.031	0,020	GC.low-opp	GC.low-opp	82,248	71,382	3,757	25,463
Run 1	0.035	0.024	0.000	0,000	GC.low-opp	GC.low-opp	85,278	71,382	3,757	25,947
Run 2	0.000	0.000	0.031	0,020	GC.low-opp	GC.low-opp	82,248	71,382	3,757	25,463

2) Price at $0.73 per kg of fresh pepper

Runs	Firm's coordination costs ($ per kg of fresh pepper)				Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective Function
	IC		GC							
	Low supply	High supply	Low supply	High supply	Low supply	High supply	($/year)	($/year)	($/year)	
Base run	0.035	0.024	0.031	0.020	GC.low-opp	GC.low-opp	101,256	52,374	2,757	24,702
Run 1	0.035	0.024	0.000	0.000	GC.low-opp	GC.low-opp	104,286	52,374	2,757	25,187
Run 2	0.000	0.000	0.031	0.020	IC.high-opp	GC.low-opp	91,656	54,822	2,885	25,018

3) Price at $0.72 per kg of fresh pepper

Runs	Firm's coordination costs ($ per kg of fresh pepper)				Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective Function
	IC		GC							
	Low supply	High supply	Low supply	High supply	Low supply	High supply	($/year)	($/year)	($/year)	
Base run	0.035	0.024	0.031	0.020	IC.high-opp	GC.low-opp	90,975	53,718	2,827	24,586
Run 1	0.035	0.024	0.000	0.000	IC.high-opp	GC.low-opp	92,163	53,718	2,827	24,776
Run 2	0.000	0.000	0.031	0.020	IC.high-opp	GC.low-opp	92,760	53,718	2,827	25,157

Table 5.3 Farmers' coordination costs at different selling prices **W = 1 when IC and 0.5 when GC**

1) Base run price at $0.89 per kg of fresh pepper

Runs	Farmer's coordination costs ($ per kg of fresh pepper)		Membership fee for GC	Governance structure		Income	Income	Average income	Objective
	GC in low supply season	GC in high supply season	($ per kg of fresh pepper)	Low supply	High supply	Firm	Farmers	per farmer	function
Base run	0.1070	0.0250	0.0330	GC.low-opp	GC.low-opp	82,248	71,382	3,757	25,463
Run 1	0.0000	0.0000	0.0000	GC.low-opp	GC.low-opp	82,248	83,262	4,382	27,839
Run 2	0.0535	0.0125	0.0165	GC.low-opp	GC.low-opp	82,248	77,322	4,070	26,651
Run 3	0.2140	0.0500	0.0660	GC.low-opp	GC.low-opp	82,248	59,502	3,132	23,087
Run 4	0.0535	0.0500	0.0660	GC.low-opp	GC.low-opp	82,248	69,132	3,639	25,013

2) Price at $0.73 per kg of fresh pepper

Runs	Farmer's coordination costs ($ per kg of fresh pepper)		Membership fee for GC	Governance structure		Income	Income	Average income	Objective
	GC in low supply season	GC in high supply season	($ per kg of fresh pepper)	Low supply	High supply	Firm	Farmers	per farmer	function
Base run	0.1070	0.0250	0.0330	GC.low-opp	GC.low-opp	101,256	52,374	2,757	24,702
Run 1	0.0000	0.0000	0.0000	GC.low-opp	GC.low-opp	101,256	64,254	3,382	27,078
Run 2	0.0535	0.0125	0.0165	GC.low-opp	GC.low-opp	101,256	58,314	3,069	25,890
Run 3	0.2140	0.0500	0.0660	IC.high-opp	GC.low-opp	89,871	51,342	2,702	23,751
Run 4	0.0535	0.0500	0.0660	GC.low-opp	GC.low-opp	101,256	50,124	2,638	24,252

3) Price at $0.72 per kg of fresh pepper

Runs	Farmer's coordination costs ($ per kg of fresh pepper)		Membership fee for GC	Governance structure		Income	Income	Average income	Objective
	GC in low supply season	GC in high supply season	($ per kg of fresh pepper)	Low supply	High supply	Firm	Farmers	per farmer	function
Base run	0.1070	0.0250	0.0330	IC.high-opp	GC.low-opp	90,975	53,718	2,827	24,586
Run 1	0.0000	0.0000	0.0000	GC.low-opp	GC.low-opp	102,444	63,066	3,319	27,031
Run 2	0.0535	0.0125	0.0165	GC.low-opp	GC.low-opp	102,444	57,126	3,007	25,843
Run 3	0.2140	0.0500	0.0660	IC.high-opp	GC.low-opp	90,975	50,238	2,644	23,890
Run 4	0.0535	0.0500	0.0660	GC.low-opp	GC.low-opp	102,444	48,936	2,576	24,205

Model runs at the price of $0.89 per kg show that the changes in the coordination costs of the firm and the farmers' group do not change the contract choice. Yet, when coordination costs are zero for group contracts, it obviously would positively affect the firm's realized income. Similarly, the income of the farmers' group is negatively affected when costs are increased. At a price of $0.73 per kg, when coordination costs of collective action become too expensive with respect to individual contracts, there is a shift in the governance structure for the low supply season, from GC to IC, for the processor and for the farmers, respectively. It is interesting to note that the processor's income is more affected by changes in the costs of coordinating collective actions. At purchase prices above $0.73 per kg, the firm earns more income when the costs of GC are cero or close to cero. On the other hand, changes in the coordination costs for the firm at price of $0.72 per kg do not produce changes in the governance structure, simply because this price is into the range of prices where collective actions are unattractive for farmers during the low supply season. Conversely, when coordination costs and membership fee for farmers drop by the half of the costs in the base run situation (or even lower up to cero), then, GC become feasible for both seasons (Runs 1 and 2).

Increased transaction costs for the farmers when closing a group contract, affects the choice for the governance structure in a similar way. The model forecasts that farmers breach the group contract when it becomes too expensive. Increasing the coordination costs and/or membership fees makes the model switch to individual contracts while the income of the farmers decreases.

5.6.4 Risk aversion of farmers

In this scenario we show how different levels of risk averseness in farmers affect their selection of governance structure to deal with the processor. The Target MOTAD is a safety first model. It is designed to estimate feasible production plans which insure a minimum income level. Parametrizing the λ in equation (9) enables us to evaluate the risk-averseness of the farmers. For modeling that the group of farmers is risk-averse we started with low levels of λ_{seller}. Increasing λ_{seller} will reflect the reaction of a farmers' group that is less concerned about survival. Table 5.4 shows the results.

At a price of $0.73 per kg and with farmers' accepted shortfall from the target income (λ) of $25,095, the model anticipates that the farmers will prefer group contracts for both seasons (base + run 1). This governance structure remains the same with less risk-averse farmers (run 4). Yet reducing the expected shortfall (λ below 18,000), thus assuming that farmers are less willing to take risks on any deviations of their income to the target income changes their choice in contract structure. The model predicts that more risk-averse farmers (runs 2 and 3) would go for group contracts in the high season and individual contracts in the low season. This would indicate that farmers drop the group contract in low supply seasons and get back to it when supply is high. The model runs show that the contractual choice is sensitive to the risk-averseness of the farmers. Risk-averse farmers seem to be distrustful to assume the costs of the bilateral monopoly when pepper supply is low, while group contracting seems to be a good risk coping strategy, only when levels of supply are higher. The model becomes infeasible at very low levels of λ (lower than 10,000).

Table 5.4 Comparing different levels of risk aversion (Selling price of pepper $0.73 per kg and w=0.5 in GC)

Runs	Λ	Governance structure		Income processor ($/year)	Income farmers ($/year)	Average income per farmer ($/year/farmer)	Objective function
		Low Season	High season				
Base run	25,095	GC	GC	101,256	52,374	2,757	24,702
Run 1	18,000	GC	GC	101,256	52,374	2,757	24,702
Run 2	12,548	IC	GC	89,871	54,822	2,885	24,447
Run 3	10,000	IC	GC	89,871	54,822	2,885	24,447
Run 4	50,190	GC	GC	101,256	52,374	2,757	24,702

5.6.5 Technology improvement

This scenario shows how under different procurement prices, technology improvement either by the processor or by the farmers could lead to changes in the governance structure and income levels. Pepper is produced in Costa Rica with a relatively low technology package. Despite the fact that *Company A* owns the best processing facility; it still has a relatively inefficient industrial yield. The processing firm needs 4.2 kg of fresh pepper in order to make one kilo of white pepper, which represents an industrial yield of 24%. According to literature (Purseglove, 1968; Nair, 2004), yields can be increased in 1 percent, where 25% is possible for a current processing operation and 27% would be possible under very good processing conditions, but optimistic. Notwithstanding, the market characteristics for pepper and the risk associated to the opportunistic behavior of farmers, it will be risky for the firm to increase its level of asset-specificity. Similarly, the production system for pepper is characterized by the use of a low-input package and a resistant but low-productive plant variety (*Balankota*). Substituting the *Balankota* plant by a higher-productive variety represents a loss of asset-specificity that farmers cannot afford. Therefore, an intermediate solution for farmers is to increase yields by applying more cultural measures at plot level, using more family labor reducing external input costs.

The model accounts for technology constrains for both the processor and the farmers. Raising the production yields, plus a reduction in farmers' production costs, is expected to have a positive effect on farmers' and processors' income, and may have an effect on the selected governance structure. To test our hypothesis, we introduce changes the industrial yield (*indy*) in two capacity use scenarios (namely at 25% and 27%) and with three different prices per kg ($0.89, $0.73 and $0.72); see Table 5.5.

Table 5.5 Technology improvements at different procurement prices ($/kg of fresh pepper)
W = 1 when IC and 0.5 when GC

1) Improvement of industrial yields (base run price = $0.89)

Runs	Industrial yields *(indy)*	Percentage	Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective function
			Low supply	High supply				
Base run	4.2	24%	GC.low-opp	GC.low-opp	82,248	71,382	3,757	25,463
Run 1	4.0	25%	GC.low-opp	GC.low-opp	92,078	71,382	3,757	27,035
Run 2	3.7	27%	GC.low-opp	GC.low-opp	108,814	71,382	3,757	29,713

2) Improvement of industrial yields (base run price = $0.73)

Runs	Industrial yields *(indy)*	Percentage	Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective function
			Low supply	High supply				
Base run	4.2	24%	GC.low-opp	GC.low-opp	101,256	52,374	2,757	24,702
Run 1	4.0	25%	IC.high-opp	GC.low-opp	98,793	54,822	2,885	26,515
Run 2	3.7	27%	IC.high-opp	IC.high-opp	100,053	52,350	2,755	30,213

3) Improvement of industrial yields (base run price = $0.72)

Runs	Industrial yields *(indy)*	Percentage	Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective function
			Low supply	High supply				
Base run	4.2	24%	IC.high-opp	GC.low-opp	90,975	53,718	2,827	24,586
Run 1	4.0	25%	IC.high-opp	GC.low-opp	99,897	53,718	2,827	26,655
Run 2	3.7	27%	IC.high-opp	IC.high-opp	101,073	51,330	2,702	30,540

At a price of $ 0.89 per kg, the firm can progressively earn higher incomes as it improves the industrial yield, without changing the governance structure. On the other hand, the group of farmers maintains their income level. The firm can thus improve its income by becoming more efficient and not by paying lower procurement prices. A more conflicting situation appears at a procurement price of $0.73 per kg, when a simple one percent improvement of industrial yields leads to a breach of collective actions during the low supply season, affecting both the firm's revenues (negatively) and farmers' incomes (positively). The model shows how sensitive the governance structure is for shifting the price. With the most optimistic yield improvement, the firm partially recovers its original income, while collective action appears not attractive for the farmers in any season. Similarly, at a procurement price of $0.72 per kg, a one percent improvement in the industrial yield does not change the governance structure, but improves the processor's income. However, a 27 percent improvement of industrial yield would allow the firm to gain a higher income, while the farmers' income deteriorates and collective actions are abandoned.

In general, the bilateral monopoly can be sustained with higher incomes for the contracting parties only at higher procurement prices (above $0.73), where the costs of collective actions can be offset by the farmers, while the firm's income increases due to its own technical efficiency. An alternative strategy for the firm is to improve industrial yields at lower procurement prices. This strategy would be negative for the farmers' income but not for the firm's, and obviously this is a good strategy for a firm that wants to discourage a bilateral monopoly and prefers individual contracts.

Farmers can produce more pepper by simply increasing the crop area. A higher production of pepper at plot level leads to a progressively increasing incomes for the farmers and the processing firm, with no changes in the governance structure, at procurement prices of $0.89 and $ 0.73 per kg (see Appendix 5.4). More interesting is the fact that at $0.72 per kg, a raise of 30% in the total production of pepper makes attractive the collective action during the low supply season. This outcome shows that the bilateral monopoly is also feasible for farmers if they sell more fresh pepper at lower procurement prices. Therefore, if the firm follows the previous breaching collective action strategy, the group of farmer can respond by raising yields and selling more fresh pepper. Hence, they can afford the cost of the bilateral monopoly and gain a higher income.

Finally, reduction of on-farm production costs with 24 and 35 percent only leads to higher farmers' income, with the same governance structure; at procurement prices of $0.89 and $0.73 per kg (see Appendix 5.5)[35]. Notwithstanding, at lower procurement price the farmers can follow a similar strategy to sustain the bilateral monopoly by reducing their production costs. In general, if the firm wants to encourage individual contracts by applying lower procurement prices, farmers have two options, namely (a) accept that they cannot afford the bilateral monopoly at lower selling prices, or (b) sustain the bilateral monopoly, thereby gaining some bargaining power by increasing production volumes or reducing production costs.

5.6.6 Seasonal contracts and endogenous pricing

In this last scenario we endogenously calculated the selling price of fresh pepper as a result of three different levels of bargaining power between the processor and the farmers. Therefore, the model is run under three distinct forms of group contract: (A) a monopsony of the processor; (B) joint profit maximization between the processor and the farmers' association; and (C) a monopoly of farmers' association, considering the parameters for market power (w) at values 1, 0.5 and 0, respectively (see sections 5.5.1 and 5.5.3). In case of individual contracts, a monopsonistic situation prevails and the firm holds all bargaining power.

As in the previous scenarios, a maximal amount of 60,000 kg of fresh pepper will be transacted for each season. Table 5.6 shows the endogenously calculated price at which fresh pepper is traded and the contract choice for the three runs. All prices are above the minimum price accepted by the producers, before they shift from pepper to another economic activity. According to field data collected in the year 2,000, the reported minimum price was on average $0.523/ kg of fresh pepper.

[35] Farmers can reduce production cost if they collectively buy certain input at wholesaler prices or if they collectively perform some field labors.

Table 5.6 Price and governance structure in three runs

Run #	Market form	Market power[1] w	Contract Structure[2]	Behaviour[3]	Price of fresh pepper ($/kg) Low season	High season
In case of individual contracts between one buyer and several sellers						
A	Monopsony	1	IC	Low-opp		
A	Monopsony	1	IC	High-opp		
B	Monopsony	1	IC	Low-opp		
B	Monopsony	1	IC	High-opp	0.681	
C	Monopsony	1	IC	Low-opp		
C	Monopsony	1	IC	High-opp		
In case of a group contract between one buyer and one group of sellers						
A	Monopsony	1	GC	Low-opp	0.729	0.632
A	Monopsony	1	GC	High-opp		
B	Joint profit maximization	0.5	GC	Low-opp		1.062
B	Joint profit maximization	0.5	GC	High-opp		
C	Monopoly	0	GC	Low-opp	0.967	1.062
C	Monopoly	0	GC	High-opp		

[1] w=1: In case of IC, monopsony; in case of GC, monopsony as a limiting case
w=0: GC only, monopoly as a limiting case
w=0.5 GC only, joint profit maximization as a possible outcome of negotiation process

[2] IC: Individual contract, GC: Group contract

[3] Behavior: Low-opp: low opportunistic behavior of either the seller and/or the buyer
High-opp: high opportunistic behavior of either the seller and/or the buyer

Table 5.7 shows the income levels that would be reached if the firm and farmers opt for the contract structure as proposed by the model above. It is clear that the firms' gains are the highest when it has a monopsonistic power and lowest in a monopoly situation, while for farmers the opposite holds.

Table 5.7 Income levels of processor and farmers in three runs

Run #	Market form	Market power[1] w	Contract Structure[2]	Behaviour[3]	Realized income ($/year) Firm	Farmers' total	Average per farmer
In case of individual contracts between one buyer and several sellers							
A	Monopsony	1	IC	Low-opp			
A	Monopsony	1	IC	High-opp			
B	Monopsony	1	IC	Low-opp			
B	Monopsony	1	IC	High-opp	40,618	23,502	1,237
C	Monopsony	1	IC	Low-opp			
C	Monopsony	1	IC	High-opp			
In case of a group contract between one buyer and one group of sellers							
A	Monopsony	1	GC	Low-opp	107,140	46,490	2,447
A	Monopsony	1	GC	High-opp			
B	Joint profit maximization	0.5	GC	Low-opp	31,012	48,560	2,451
B	Joint profit maximization	0.5	GC	High-opp			
C	Monopoly	0	GC	Low-opp	67,425	86,205	4,537
C	Monopoly	0	GC	High-opp			
Total incomes under each run							
A					107,140	46,490	2,447
B					72,630	70,062	3,687
C					67,425	86,205	4,537

Note: 1, 2 and 3: see Table 5.5

The model predicts that, given the parameters defined above, both firm and farmers as a group could benefit from developing a group contract in the limited cases (i.e. runs with monopsony (A) and monopoly (C)). Although in a monopsony the processor has all bargaining power to keep the price of the fresh pepper low, the model, nevertheless predicts that the gross income of the processor is maximized when the fresh pepper is procured in a group contract instead of a multiple set of smaller individual contracts.

In the other extreme case (C), when farmers are given all the bargaining power, a group contract is chosen at a higher selling price of pepper in both seasons. The gross income of the farmers is maximized at these higher prices. In this situation the costs of organizing a farmers' association and the costs to organize a group contract are lower than the expected benefits (mainly due to lower rejection rate).

Limited case runs of monopsony (A) and monopoly (C) show the same outcome, namely that group contracts with low opportunistic behavior yield the highest gross incomes for the firm and the farmers. The highest income levels for the firm and the lowest for the farmers are reached in the monopsony run (A), while the opposite is shown in a monopoly (C).

Under joint profit maximization run (B), as a possible but not necessary outcome, it seems more rewarding for the processor to procure pepper through a group contract during the high season (at a price which is substantially higher than in monopsonistic run), and through individual contracts during the low season. In the latter case, the model predicts that the most optimal situation is reached at lower procurement prices than those paid in group contracts, and therefore being more favorable for the firm. The price paid to the farmers would be $0.681/kg of fresh pepper, nevertheless, still above the average minimum price accepted by the farmers ($0.523/kg of fresh pepper). The model shows that the gains for the firm to organize a group contract (lower contract and transaction costs) are foregone by the loss in bargaining power which would result in a higher input price. The firm has enough bargaining power in the model to shift the contract choice into its favor.

The firm can maximize its income by acting opportunistically and exerting its monopsonic power through individual contracts. Yet, it does so by paying a price which guarantees the farmers a minimal income, and without taking them to the point that they might shift from pepper to another economic activity. The rationale behind this behavior can be explained by the fact that the firm wants to assure a constant supply of fresh pepper and by the low frequency of transactions. As explained before, both uncertainty and frequency of transaction are determinants of transaction costs; and the level of transaction costs influences to a large extend the selected governance structure between trading parties (Williamson, 2003).

The firm invested significantly in specific assets, more in particular in a processing plant and personnel, and it depends on farmers' loyalty, providing a constant flow of fresh pepper. During the low production season, however, the delivery of fresh pepper is irregular (every 2 to 3 weeks instead of the weekly supply during the high season). In this case the firm may not accept the risk that farmers refuse harvesting pepper and turn to other activities, which explains why the price of pepper reaches acceptable levels for the individual farmers. Farmers also have some room for negotiation. Yet, it may not convince them to establish an association and bulk the produce. The model shows that the gains for the firm of a lower procurement price are more important than the potential gains for the farmers of a higher selling price and a decrease of transaction costs. The transaction costs are high due the less frequent deliveries in the low season which encourages the agents to behave opportunistically. The reduction of these transaction costs that would result from a group contract is not sufficient to conduce to a collective action.

Conversely, the model predicts a group contract during the high season. This finding is in line with theory, namely that as the frequency of transaction increases, the risk on opportunistic behavior decreases (Hobbs, 1996). Stable relationships are more easily maintained with frequent and repeated transactions, where agents are able to build up reputation, loyalty and confidence. Or in other words, it is worthwhile for the firm to enter into a group contract in order to economize on transaction costs.

Finally, one could argue that a similar reasoning applies to the low-supply market situation in the first scenario (A), as the firm faces similar low supply and uncertainty. Yet, in the monopsonistic situation the objective function maximizes the gross income of the firm as a sum of the returns in the low and high season. The income of the farmers is not considered, since we assumed that they have no or very limited bargaining power (although the firm seeks the farmers' loyalty, by earning an acceptable procurement price in order to earn a minimum required income; see above). In this case, the firm is likely to exert its bargaining power to reach a group contract in the high-supply season at a lower price of fresh pepper than in the low-supply season.

5.7 Discussion and conclusions

The model scenarios presented in this chapter simulate the effects of collective action under initial monopsonic market conditions[36]. The model results indicate that low procurement prices of fresh pepper can make the farmers breach the group contract, even between different seasons in the year. It is furthermore shows that group contracts are only rational when higher prices prevail. To justify the group contracts, the costs of organizing collection and transport and the membership fee should be lower than the gains reached from the lower rejection rates. Furthermore, group contracting can be beneficial for risk-averse farmers in either the low or high season.

[36] As soon as all farmers, in a specific location, form a group or a cartel, the market condition changes to a bilateral monopoly.

Although the processor has monopsonic power, it needs to secure the procurement of pepper. As monopsonists it has the largest bargaining power. Yet, it is expected that the processor will have to pay more for fresh pepper if the processing volumes are increased: 'the price which a monopsonists must pay is generally an increasing function of the quantity it purchases' (Henderson and Quandt, 1980). It is therefore important for the processor to have a sustainable and trustful relationship with the farmers.

When group contracts are agreed upon and farmers organize themselves, a bilateral monopolistic situation arises. Henderson and Quandt (1980) identify three general outcomes that are possible: (1) one of the partners dominates and forces the others to accept price and/or quantity decisions; (2) trading partners reach an understanding and cooperate; and (3) trading does not take place as the market mechanisms break down. The difference between the first two options for the case of pepper relies on the differentials of bargaining power. Farmers may hold-up the group contract if the price offered by the processor is too low (processor is then the price taker).

For farmers and the processor reaching a sustainable arrangement, the processor needs to apply a price range in which group contracts are honored. In this self-enforcing range, the farmers would not be likely to hold-up deliveries through collective actions, or in other words, they will not change their minds and break up group's activities (see also Gow *et al.*, 2000; Cocks and Gow, 2003). It can become costly for the company having to change its procurement regimes every season, especially given the services that go along each contract.

If the price is too low, or the organization costs are too high, the farmers may prefer individual contracts, even if the rejection rates are high. At higher prices, they have an incentive to organize the collection and transport of the pepper through the group. The model shows that *Company A* should not overuse its bargaining power beyond the self-enforcing range as the farmers might easily breach the contracts.

We also simulated what type of governance structure is chosen when the selling price is endogenously established in the model and the income of the processing firm and the farmers is maximized. This analysis demonstrates that under certain conditions the incomes of the monopsonic processing firm and the farmers' association are jointly maximized by a group contract, enforced by low opportunistic behavior from both agents. The model shows that the

processing firm is better-off dealing with a group contract instead of a multiple set of smaller individual contracts when farmers show low opportunistic behavior; even in the monopsonistic market situation.

The extreme situations – (illustrated in Runs A and C as limiting case solutions in Section 5.6.6) are very unlikely to provide stable solutions. We would not expect a processor to behave as a total monopsonist that exerts all its bargaining power for its own benefit, since it faces high uncertainty regarding farmers' response which is costly to monitor. Although farmers tend to be loyal to the processor, even if their negotiation power is limited, they might be forced out of pepper production if the price is considered too low. They could earn a better living in alternative activities. This will become critical to the firm as it needs a continuous and stable flow to operate and generate returns to its investments. Otherwise, pepper producers can form an organization in order to confront the monopsony. However, they are very far away from exerting a full monopolistic power due to their resource limitations. Hence, we conclude that joint profit maximization run (i.e. run B) could be a possible and may be a preferred solution. The results of the model show that the firm maximises its gross income in individual contracts; yet, it may not fully exploit the farmers and pay them an acceptable price in order to enforce farmers' loyalty (Key and Runsten, 1999).

The latter outcome is important in the sense that collective action might be needed only under certain market conditions, but not all the time. Given the importance of contract farming and collective action as forceful mechanisms to mitigate transaction reduced transaction costs, improving coordination and bargaining power balance between the contracting parties, it can be expected that farmers will look for the implementation of such mixed institutions all the time. However, certain changes in market conditions may stimulate to breach the contract and/or holding up the collective action by one or both actors (Gow *et al.*, 2000).

The model forecasts a breach of the group contract under conditions of low supply of fresh pepper just because it becomes too expensive or unattractive. However, if the production remains stable throughout the year, with regular weekly supplies and limited season variation, group contracts will be preferred all the time. Notwithstanding, pepper production in Costa Rica is done by producers with a low technology and input package, and using a resistant but low-productive plant variety (*Balankota*). Therefore, two notably different production

seasons are maintained, with unbalanced amounts of fresh pepper and irregular supplies from distinct categories of producers that exhibit a rather varied dynamics of their production systems (Ruben and Sáenz, 2005).

For the future development of pepper production in Costa Rica, an increase in productivity and stabilization of production throughout the year is required, with the aim of increasing (and especially stabilizing) the frequency of transactions, to improve the trust between actors, encourage low opportunistic behavior, and thereby strengthening the prospects for vertical integration between the parties. This goal would require a re-conversion of current production systems, by progressively substituting the traditional low-yielding pepper plants with high-productive varieties that require higher input applications. Yet, this re-conversion may be too risky and expensive for low-income producers. Therefore, the firm might start by providing assistance to farmers to enable them to increase the productivity of the current variety. This can be done by changing the present market-specification contract for a production-management contract. Otherwise, under irregular supply through the year seasonal contracts will be still the best scenario.

The basic model could be used furthermore to simulate several alternative scenarios, not analyzed in the present chapter. We could envision what would happen if a third party enters into the pepper market, leading to an adjustment in the self-enforcing range beyond the selling price. In a similar vein, the modeling framework could be applied for estimating the costs and benefits of vertical integration, namely: (a) if farmers integrate marketing and/or processing activities into their internal activities, and (b) if the company starts to engage itself into pepper production. One could also think of simulating the impact of improved pepper production technologies for production volume and quality compliance.

Some limitations of the model need to be acknowledged. The current model design only accounts for an increase in farmers' income under group contracts. Yet, we could consider other benefits derived from farmers' organization that might be introduced into the model, such as input cost-sharing, technological spillovers, labor pooling and improved access to information (McDormick, 1999). Finally, some other shortcomings of the model deserve attention. First, the model would benefit from a more precise estimation of the transaction costs for both the farmers and the company under different contractual arrangements. In particular, a better specification of the pure transaction costs would increase the precision of

the model. Second, we did not account for transaction costs of institutionalizing the farmers' organization itself. These costs might decrease the opportunistic behavior of individuals in the group, since these sunk costs are lost when the group dissolves and turns back to individual contracts. Third, we did not take into account the seasonal variation in prices. Finally, we disregarded the potential benefits of interlocking contracts forthcoming from the delivery of plant material and the provision of technical assistance by the company.

Appendices

Appendix 5.1

Model Specification in GAMS Code

```
$TITLE A cooperation strategy for pepper suppliers under monopsony or bilateral monopoly market conditions
* F. Sáenz-Segura, R.A. Schipper & M. DHease. (September 2005)

$ONTEXT

 In this model individual farmers sell pepper to one single monopsonistic buyer
 Pepper is harvested through the year in two seasons: low season (nine months)
 and high season (three months). Average rejection rate is high and bargaining
 power in the firm's side is higher than farmers'. Transaction costs related to
 transport conditions of fresh pepper and quality monitoring at the delivering
 point play an important role in the rejection rate. This situation led to
 farmers to look for collective action to cope with the rejection rate and gain
 bargaining power. Two market forms are simulated: monopsony and bilateral monopoly.
 The model is used to simulate the trade-off between governance costs and market performance.
 Trust relations and price stability are considered to be critical factors.

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$OFFTEXT

*---------------------------------------------------------------------------
* Declaration of SETS
*---------------------------------------------------------------------------

SETS
s       market conditions
j       opportunistic behavior
k       contractual form
;

*---------------------------------------------------------------------------
* Definition of SETS
*---------------------------------------------------------------------------

SETS
s       market conditions
        / low-supply  low supply season due to unfavorable climatic conditions (April to December)?
          high-supply high supply season due to favorable climatic conditions (January to March)? /
j       opportunistic behavior
        / low-opp     low-probability that buyer (pepper processor) or seller (farmer) changes contract form
          high-opp    high probability that buyer (pepper processor) or seller (farmer) changes contract form /
k       contractual form
        / IC          individual contract between buyer (pepper processor) and each seller (farmer)
          GC          group contract between buyer (pepper processor) and group of sellers (farmers)/
;

*---------------------------------------------------------------------------
* Declaration of parameters
*---------------------------------------------------------------------------

PARAMETERS
W(k,j)          Measure of market power of buyer according to contractual arrangement k and opportunistic behavior j of seller
lambdab         Max acceptable weighted sums of deviations below buyers target income
lambdas         Max acceptable weighted sums of deviations below sellers target income
*Fstar          Base price at which fresh pepper is traded under normal conditions (US$ per kilo of fresh pepper)
Jbstar          Target income of buyer (US$ at year)
Jsstar          Target income of seller (US$ at year)
Rb              Reservation income per year that buyer could gain in alternative activities (US$)
Rs              Reservation income per year that seller could gain in alternative activities (US$)
Rb_s(s)         Reservation income per season s that buyer could gain in alternative activities (US$)
Rs_s(s)         Reservation income per season s that seller could gain in alternative activities (US$)
* Fs(k,j,s)    Selling price of fresh pepper (US$ per kilo of fresh pepper)
Ppc(k,s)        Farmers' production costs of pepper under k and s (US$ per kg of fresh pepper)
Pg (k,j,s)      Farmers' governance costs under k j and s (US$ per kg of fresh pepper)
Pt (k,j,s)      Farmers' transport costs under k j and s (US$ per kg of fresh pepper)
Pts (k,j,s)     Transport supervision costs under k j and s (US$ per kg of fresh pepper)
Pmf (k)         Membership fee for farmers' organization (US$ per kilo of fresh pepper delivered)
Pf (k,s)        Farmers' fixed costs under k and s (US$ at year)
Frp             Reselling price for the firm under k and s (US$ per kilo of processed pepper)
*Fb(k,j,s)      Buying price of fresh pepper (US$ per kilo of fresh pepper)
Fpc(k,j,s)      Firm's production costs of pepper under k j and s (US$ per kilo of processed pepper)
Ft(k,s)         Firm's transportation costs of fresh pepper under k and s (US$ per kilo of fresh pepper)
Fg (k,s)        Firm's coordination costs of pepper under k and s (US$ per kilo of fresh pepper)
Ff (k,s)        Firm's fixed costs of pepper under k and s (US$ per year)
Refuse (k,j,s) Refuse rate of fresh pepper at plant level under k j and s (%)
Indy            Industrial yields for pepper
Cap_fact        Capacity factor to change produced and transacted volume of pepper
Q_s(s)          Total volume of fresh pepper transacted around the year 2000 under s in kg per year
Pb(k,j,s)       Probability for the buyer of farmer' behavior j in case of k and s (Pb(j\ks))
```

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Ps(k,j,s)      Probability for the seller of firm's behavior j in case of k and s (Ps(j\ks))
dFb(k,j,s)     Change of buying price at which pepper is traded under k j and s (US$ per kilo of fresh pepper)
dFs(k,j,s)     Change of selling price at which pepper is traded under k j and s (US$ per kilo of fresh pepper)
Premium (k)    Premium price paid by the firm in US$ per kilo of fresh pepper
M_large(s)     Just a large number equal to total volume of fresh pepper produced and transacted per season s;

*---------------------------------------------------------------------------
* Declaration and definition of variables
*---------------------------------------------------------------------------

POSITIVE VARIABLES
v_X(k,j,s)     volume of fresh pepper transacted under k j and s in kg of fresh pepper
v_Zb(k,j,s)    actual sums of deviation of income of buyer in US$
v_Zs(k,j,s)    actual sums of deviation of income of farmers in US$
v_Price(k,j,s) price of fresh pepper paid by buyer to farmers under k j and s in US$ per kg of fresh pepper
;

FREE VARIABLES
v_A            objective function of buyer and seller utility and bargaining power
v_Jb_js(k,j,s) income of buyer under k j and s in US$
v_Js_js(k,j,s) income of farmers under k j and s in US$
;

BINARY VARIABLES
v_Y(k,j,s)     binary marketing choice variables related to vX(k j s)
;

*---------------------------------------------------------------------------
* Declaration of equations
*---------------------------------------------------------------------------

EQUATIONS

* The model consists of 12 equations divided into six parts (A to F)

* A. Objective
e_objective           objective function (1)

* B. Income calculation
e_inc_kjs_b(k,j,s)    endogenously determined income for buyer under k j and s in US$ (2)
e_inc_kjs_s(k,j,s)    endogenously determined income for farmers under k j and s in US$ (3)

* C. Minimum income   requirements to stay in 'business'
e_inc_constr_b(s)     minimum income constraint for buyer per season (v_Jb_js(kjs)) in US$ (4)
e_inc_constr_s(s)     minimum income constraint for farmers per season (v_Js_js(kjs)) in US$ (5)

* D. Target MOTAD part of model
e_devincome_b(k,j)    buyer's income deviation (Zb) from target income in US$ (6)
e_devincome_s(k,j)    farmers' income deviation (Zs) from target income in US$ (7)
e_dif_income_b        difference between acceptable (lambdab) and actual (Zb) sums of deviations of income (vJb_js) below
target income (Jb*) in US$ (8)
e_dif_income_s        difference between acceptable (lambdas) and actual (Zs) sums of deviations of income (vJs_js) below
target income (Js*) in US$ (9)

* E. Capacity restriction
e_transaction(s)      quantity of commodity fresh pepper transacted in each season in kg (10)

* F. Binary part of model to force single contract types per season
e_binary(k,j,s)       marketed quantities smaller than binary variables times 'just a large number' (11)
e_sum_binary(s)       sum of binary variables smaller than one per season (12)
;

*---------------------------------------------------------------------------
* Definition of equations
*---------------------------------------------------------------------------

* The model consists of 12 equations divided into six parts (A to F)

* A. Objective

* objective function (1)
e_objective..
         v_A       =E= SUM ((k,j,s), W(k,j)     * v_Jb_js(k,j,s) * Pb(k,j,s))
                    + SUM ((k,j,s), (1-W(k,j)) * v_Js_js(k,j,s) * Ps(k,j,s)) ;

* B. Income calculation

* endogenously determined income for buyer under k j and s in US$ (2)
e_inc_kjs_b(k,j,s)..
         v_Jb_js(k,j,s)
                   =E= v_X(k,j,s) * ((1- Refuse(k,j,s)) / Indy) * Frp
                    - v_X(k,j,s) * (1- Refuse(k,j,s)) * (v_Price(k,j,s) + Premium(k)
                    + Fpc(k,j,s)/Indy + Ft(k,s)   + Fg(k,s))- Ff(k,s)  ;

* endogenously determined income for farmers under k j and s in US$ (3)
e_inc_kjs_s(k,j,s)..
         v_Js_js(k,j,s)
                   =E= v_X(k,j,s) * (1- Refuse(k,j,s)) * (v_Price(k,j,s) + Premium(k))
                    - v_X(k,j,s) * (Ppc(k,s) + Pg(k,j,s) + Pt(k,j,s) + Pts(k,j,s)
                    + Pmf(k))- Pf(k,s) ;

* C. Minimum income requirements to stay in 'business'

* income constraint for buyer per season (v_Jb_js(kjs)) in US$ (4)
e_inc_constr_b(s)..
         SUM((k,j), v_Jb_js(k,j,s) * Pb(k,j,s)) =G= Rb_s(s) ;

* income constraint for farmers per season (v_Js_js(kjs)) in US$ (5)
e_inc_constr_s(s)..
         SUM((k,j), v_Js_js(k,j,s) * Ps(k,j,s)) =G= Rs_s(s) ;
```

```
* D. Target MOTAD part of model

* buyer's income deviation (Zb) from target income in US$ (6)
e_devincome_b(k,j)..
         SUM(s, v_Jb_js(k,j,s) + v_Zb(k,j,s))
                  =G= Jbstar  ;

* farmers' income deviation (Zs) from target income in US$ (7)
e_devincome_s(k,j)..
         SUM(s, v_Js_js(k,j,s) + v_Zs(k,j,s))
                  =G= Jsstar  ;

* difference between acceptable (lambdab) and actual (Zb) sums of deviations of income (vJb_js)
below target income (Jb*) in US$ (8)
e_dif_income_b..
         SUM((k,j,s), v_Zb(k,j,s) * Pb(k,j,s))
                  =E= lambdab ;

* difference between acceptable (lambdas) and actual (Zs) sums of deviations of income (vJs_js)
below target income (Js*) in US$ (9)
e_dif_income_s..
         SUM((k,j,s), v_Zs(k,j,s) * Ps(k,j,s))
                  =E= lambdas ;

* E. Capacity restriction

* quantity of commodity fresh pepper transacted in each season in kg (10)
e_transaction(s)..
         SUM ((k,j), v_X(k,j,s)) =L= Cap_fact * Q_s(s) ;

* F. Binary part of the model to force single contract types per season

* marketed quantities smaller than binary variables times 'just a large number' (11)
e_binary(k,j,s)..
         v_X(k,j,s) =L= M_large(s) * v_Y(k,j,s) ;

* sum of binary variables smaller than one per season (12)
e_sum_binary(s)..
         SUM((k,j), v_Y(k,j,s)) =L= 1 ;

*---------------------------------------------------------------------------
* Declaration of parameters
*---------------------------------------------------------------------------

SCALAR

lambdab  max acceptable weighted sums of deviations below buyers target income
         / 87981 /
lambdas  max acceptable weighted sums of deviations below sellers target income
         / 25095 /
*Fstar    base price at which fresh pepper was traded under normal conditions around 2000 (US$ per kilo)
*         / 0.89 /
Jbstar   target income of buyer (US$ at year)
         / 38800 /
Jsstar   target income of seller (US$ at year)
         / 27412 /
Rb       reservation income that buyer could gain in alternative activities
         / 19400 /
Rs       reservation income that seller could gain in alternative activities
         / 17570 /
Indy     Industrial yields of pepper (4.2 kilos of fresh pepper make 1 kilo of white pepper)
         / 4.20 /
Frp      Reselling price of the firm under k and s (US$ per kilo)
         / 8 /
Cap_fact Capacity factor to change processed and transacted volume of pepper
         / 2 /
;

PARAMETER

Q_s(s)                   Total volume of fresh pepper transacted around 2000 under s in kg per year
 /low-supply  30000
  high-supply 30000/

Premium(k)               Premium price paid by the firm in US$ per kilo of fresh pepper
 / IC  0
   GC  0.02 /

* Earlier 0.00 in all cases; by the way, when set at 0.05 some 'solving' problems occur as well as
* it results in 'opposite' contracts.

Pmf(k)                   Membership fee for farmers'organization (US$ per kilo of fresh pepper delivered)

/ IC  0
  GC  0.033 /
;

TABLE
W(k,j)                   Measure of market power of buyer according to contractual arrangement k
                         and opportunistic behaviour j of seller
                         low-opp             high-opp
* Monopsony:
IC                       1                   1
* Bilateral monopoly with 3 sub-cases:
* 'Monopsony'
*GC                      1                   1
* 'Joint profit maximization'
GC                       0.5                 0.5
* 'Monopoly'
*GC                      0                   0
;
```

```
$ONTEXT
In case of monopsonic market conditions (thus under contractual arrangements of IC,
contracts with individual farmers), w=1 means that the buyer has full market power,
i.e., he can set the buying price for fresh pepper according to the value of its marginal product,
in this way maximizing his profit (= margin between value of sales and production and transaction costs)
(Henderson & Quandt, 1980: 191). Other values of w (i.e., 0 =< w < 1), are not relevant
as full market power of buyer is the main characteristic of a monopsony.

In case of a bilateral monopoly (thus under contractual arrangements of GC, a contract between
one group of farmers and one buyer), it is useful to consider three sub-cases, as the price of pepper
will be the result of negotiations between the buyer (processor of fresh pepper) and the seller
(group of farmers), and can not be simulated with the present model. The three cases are two limiting cases,
w=1 (monopsony) and w=0 (monopoly), and an in-between case w=0.5 (joint profit maximization)
(Henderson & Quandt, 1980: 223-226). Taking into account long term contractual stability too,
than in the w=1 case (monopsony of buyer), the farmers as group should at least receive a margin (income)
that is attractive enough to stay in the pepper cultivating business. This is built into the current model
(required minimum income constraint for buyer; e_inc_constraint_b(s)). In the w=0 case (monopoly
of group of farmers), the buyer should at least have a profit (= margin between value of sales
and production and transaction costs) that is attractive enough to stay in the pepper processing business.
This is also built into the current model (required minimum income constraint for seller; e_inc_constraint_b(s)).
These minimum income constraints are also operative in the w=0.5 case of joint profit maximization, in order
to prevent non-stable long term solutions.
$OFFTEXT

TABLE   Ppc(k,s)        Farmers' production costs of pepper under k and s (US$ per kg of fresh pepper)
                         low-supply          high-supply
IC                       0.17                0.17
GC                       0.17                0.17
;

TABLE   Pg(k,j,s)       Farmers' governance costs under k j and s (US$ per kg of fresh pepper)
                         low-supply          high-supply
IC .low-opp              0                   0
IC .high-opp             0                   0
GC .low-opp              0.107               0.025
GC .high-opp             0.107               0.025
;

TABLE   Pt(k,j,s)       Farmers' transport costs under k j and s (US$ per kg of fresh pepper)
                         low-supply          high-supply
IC .low-opp              0                   0
IC .high-opp             0                   0
GC .low-opp              0.0204              0.0204
GC .high-opp             0.0204              0.0204
;

TABLE   Pts(k,j,s)      Transport supervision costs under k j and s (US$ per kg of fresh pepper)
                         low-supply          high-supply
IC .low-opp              0                   0
IC .high-opp             0                   0
GC .low-opp              0.0024              0.0024
GC .high-opp             0.0032              0.0032
;

TABLE   Pf(k,s)         Farmers' fixed costs under k and s (US$ at year)
                         low-supply          high-supply
IC                       1026                684
GC                       1026                684
;

TABLE   Fpc(k,j,s)      Firm's production costs of pepper under k j and s (US$ per kg of processed pepper)
                         low-supply          high-supply
IC .low-opp              1.2                 1.2
IC .high-opp             1.4                 1.4
GC .low-opp              1.05                1.05
GC .high-opp             1.25                1.25
;

TABLE   Ft(k,s)         Firm's transportation costs of fresh pepper under k and s (US$ per kilo of fresh pepper)
                         low-supply          high-supply
IC                       0.012               0.012
GC                       0                   0
;

* Reasoning: Colon 10 price difference in 2000 would give $ 0.0308 (exchange rate Colon 325 per $ 1),
* but of Colon 10 only Colon 4 for transport, which means $ 0.0123, rounded to $ 0.012.

TABLE   Fg(k,s)         Firm's coordination costs of pepper under k and s (US$ per kg of fresh pepper)
                         low-supply          high-supply
IC                       0.035               0.024
GC                       0.031               0.020
;

TABLE   Ff(k,s)         Firm's fixed costs of pepper under k and s (US$ at year)
                         low-supply          high-supply
IC                       2400                800
GC                       2400                800
;

TABLE   Refuse(k,j,s)   Refuse rate of fresh pepper at plant level under k and s (%)
                         low-supply          high-supply
IC .low-opp              0.0943              0.0943
IC .high-opp             0.15                0.15
GC .low-opp              0.01                0.01
GC .high-opp             0.0471              0.0471
;
```

```
TABLE    Pb(k,j,s)      Probability for the buyer of farmer' behaviour j in case of k and s (Pb(j\ks))
                         low-supply          high-supply
IC .low-opp              0.18                0.18
IC .high-opp             0.32                0.32
GC .low-opp              0.32                0.32
GC .high-opp             0.18                0.18
;

TABLE    Ps(k,j,s)      Probability for the farmers of firm's behaviour j in case of k and  (Ps(j\ks))
                         low-supply          high-supply
IC .low-opp              0.1                 0.1
IC .high-opp             0.4                 0.4
GC .low-opp              0.4                 0.4
GC .high-opp             0.1                 0.1
;

*---------------------------------------------------------------------
*        Calculation of parameters from other parameters
*---------------------------------------------------------------------

*Calculation of required minimum incomes per season

* buyer
Rb_s("low-supply")  = 0.5 * Rb ;
Rb_s("high-supply") = 0.5 * Rb ;
* seller (farmers)
Rs_s("low-supply")  = 0.5 * Rs ;
Rs_s("high-supply") = 0.5 * Rs ;

* When set to 0.5 (low-supply) and 0.5 (high-supply) INIT-NEXT problems occurs: no integer solution obtained using DICOPT
* Earlier: 0.75 (low-supply) and 0.25 (high-supply), no INIT-NEXT problem (and DICOPT integer solution is under optimal
* NLP solution.
* When set to 0.501 (low-supply) and 0.499 (high-supply), no INIT-NEXT problem, but DICOPT integer solution
* is under non-optimal NLP solution.

* Calculation of M_large(s)
M_LARGE(s) =        Cap_fact * Q_s(s) ;

*---------------------------------------------------------------------
* Initial values of variables
*---------------------------------------------------------------------

v_X.L(k,j,"low-supply") = 60000 ;
v_X.L(k,j,"high-supply") = 60000 ;
v_Price.Fx(k,j,s) = 0.89 ;
*Note: v_Price(k,j,s) is only fixed for the first five scenarios, but variable for the sixth scenario
*v_Price.L(k,j,s) = 0.89 ;
*v_Price.UP(k,j,s) = Frp/Indy ;
*v_Price.LO(k,j,s) = 0.2 * Frp/Indy ;
* 0.2
*---------------------------------------------------------------------
* Model statement
*---------------------------------------------------------------------

MODEL   transaction /all/ ;

*---------------------------------------------------------------------
* Solve statements
*---------------------------------------------------------------------
OPTION LIMROW = 8 ;
OPTION ITERLIM = 1000000 ;

OPTION NLP=MINOS ;
OPTION MIP=BDMLP ;
OPTION RMINLP=CONOPT2 ;
OPTION MINLP=DICOPT ;

*
* solve relaxed (RMINLP) model
*
SOLVE  transaction using RMINLP maximizing v_A ;
ABORT$(transaction.modelstat > 2.5) "Relaxed model could not be solved" ;
*
* solve NON-relaxed (MINLP) model
*
SOLVE  transaction using MINLP maximizing v_A ;

*---------------------------------------------------------------------
* After optimisation calculations, using the results op the optimal solution
*---------------------------------------------------------------------

VARIABLE
v_Jb               expected income per year of buyer in US$
v_Js               expected income per year of farmers in US$
;

v_Jb.L             = SUM ((k,j,s), v_Jb_js.L(k,j,s) * Pb(k,j,s)) ;

v_Js.L             = SUM ((k,j,s), v_Js_js.L(k,j,s) * Ps(k,j,s)) ;


PARAMETER
Use_mark(k,j,s)    use of marketing channal
Income_buyer       realised income of buyer per year in US $
Income_farmers     realised income of farmers per year in US $
Inc_exp_indv       average expected income per farmer per year in US $
Inc_indv           average realised income per farmer per year in US $
GM_b(k,j,s)        buyers gross margin related to variable costs per kg (of fresh pepper) in US$
Margin_kg_b(k,j,s) margin per kg of buyer in US $
GM_s(k,j,s)        farmers gross margin related to variable costs per kg (of fresh pepper) in US$
Margin_kg_s(k,j,s) margin per kg of farmer in US $
;
```

```
Use_mark(k,j,s)    = v_X.L(k,j,s) / (Cap_fact * Q_s(s)) ;

Income_buyer       = SUM((k,j,s), v_Jb_js.L(k,j,s) * Use_mark(k,j,s)) ;

Income_farmers     = SUM((k,j,s), v_Js_js.L(k,j,s) * Use_mark(k,j,s)) ;

Inc_exp_indv       = v_Js.L / 19 ;
Inc_indv           = Income_farmers /19 ;

GM_b(k,j,s)        = ((1- Refuse(k,j,s)) / Indy) * Frp
                     - (1- Refuse(k,j,s)) * (v_Price.L(k,j,s) + Fpc(k,j,s)/Indy + Fg(k,s)) ;

Margin_kg_b(k,j,s) = ((1- Refuse(k,j,s)) / Indy) * Frp
                     - (1- Refuse(k,j,s)) * (v_Price.L(k,j,s) + Fpc(k,j,s)/Indy + Fg(k,s))
                     - (Ff(k,s) / v_X.L(k,j,s))$(v_X.L(k,j,s) GT 0)
                     - (Ff(k,s) / (Cap_fact * Q_s(s)))$(v_X.L(k,j,s) EQ 0) ;

GM_s(k,j,s)        = (1- Refuse(k,j,s)) * v_Price.L(k,j,s)
                     - (Ppc(k,s) + Pg(k,j,s) + Pt(k,j,s) + Pts(k,j,s) + Pmf(k)) ;

Margin_kg_s(k,j,s) = (1- Refuse(k,j,s)) * v_Price.L(k,j,s)
                     - (Ppc(k,s) + Pg(k,j,s) + Pt(k,j,s) + Pts(k,j,s) + Pmf(k))
                     - (Pf(k,s) / v_X.L(k,j,s))$(v_X.L(k,j,s) GT 0)
                     - (Pf(k,s) / (Cap_fact * Q_s(s)))$(v_X.L(k,j,s) EQ 0) ;



*---------------------------------------------------------------------------
* Display of variables
*---------------------------------------------------------------------------

DISPLAY
v_A.L,
v_Jb_js.L
v_Zb.L
v_Js_js.L
v_Zs.L
v_X.L
v_Price.L
v_Y.L
;

DISPLAY
v_Jb.L
v_Js.L
Use_mark
Income_buyer
Income_farmers
Inc_exp_indv
Inc_indv
GM_b
Margin_kg_b
GM_s
Margin_kg_s
;
```

Appendix 5.2a

Variables of the GAMS model

GAMS code	Meaning	Measure unit
1) Positive variables		
v_X(k,j,s)	Volume of fresh pepper transacted under k j and s	Kg of fresh pepper
v_Zb(k,j,s)	Actual sums of deviation of income of the buyer (processing firm)	US Dollars
v_Zs(k,j,s)	Actual sums of deviation of income of the sellers (farmers)	US Dollars
v_Price(k,j,s)	Price of fresh pepper paid by buyer to farmers under k j and s (only for the fifth run)	US Dollars per kg of fresh pepper
2) Free variables		
v_A	Objective function of buyer and seller utility and bargaining power	US Dollars?
v_Jb_js(k,j,s)	Income of buyer under k j and s	US Dollars
v_Js_js(k,j,s)	Income of seller under k j and s	US Dollars
3) Binary variables		
v_Y(k,j,s)	Binary marketing choice variables related to vX(k j s)	Integer value

k = contractual forms: individual contract between the processing firm and each farmer (IC) and group contract between the processing firm and a group of farmers (GC)
j = opportunistic behavior: low (low –opp) or high (high –opp) probability that the processing firm or the farmers change contract form
s = market conditions: low (low-supply) or high (high-supply) supply season due to unfavorable climatic conditions (March to November for low-supply and December to January for high-supply)

Appendix 5.2b

Parameters of the GAMS model

GAMS code	Meaning	Measure unit
w (k,j)	Measure of market power of the buyer according to k and j of the sellers	W = 1 when IC and can be 0, 0.5 and 1 when GC
lambdab	Maximum acceptable weighted sums of deviations below buyers target income	Integer value
lambdas	Maximum acceptable weighted sums of deviations below sellers target income	Integer value
jbstar	Target income of the buyer	US Dollars at year
jsstar	Target income of the sellers	US Dollars at year
rb	Reservation income per year that the buyer could gain in alternative activities	US Dollars at year
rs	Reservation income per year that the sellers could gain in alternative activities	US Dollars at year
rb_s (s)	Reservation income per season s that the buyer could gain in alternative activities	US Dollars per season
rs_s (s)	Reservation income per season s that the sellers could gain in alternative activities	US Dollars per season
ppc (k,s)	Farmers' production costs of pepper under k and s	US Dollars per kg of fresh pepper
pg (k,j,s)	Farmers' governance costs under k j and s	US Dollars per kg of fresh pepper
pt (k,j,s)	Farmers' transport costs under k j and s	US Dollars per kg of fresh pepper
pts (k,j,s)	Transport supervision costs under k j and s	US Dollars per kg of fresh pepper
pmf (k)	Membership fee for farmers' organization	US Dollars per kg of delivered fresh pepper
pf (k,s)	Farmers' fixed costs under k and s	US Dollars at year
frp	Reselling price for the firm under k and s	US Dollars per kg of processed fresh pepper
fpc (k,j,s)	Firm's production costs of pepper under k j and s	US Dollars per kg of processed fresh pepper
ft (k,s)	Firm's transportation costs of fresh pepper under k and s	US Dollars per kg of fresh pepper
fg (k,s)	Firm's coordination costs of pepper under k and s	US Dollars per kg of fresh pepper
ff (k,s)	Firm's fixed costs of pepper under k and s	US Dollars at year
refuse (k,j,s)	Refuse rate of fresh pepper at plant level under k j and s	Percentage
indy	Industrial yields for pepper	Kilos
cap_fact	Capacity factor to change produced and transacted volume of pepper	Integer value
q_s(s)	Total volume of fresh pepper transacted around the year 2000 under s	Kilos at year
pb (k,j,s)	Probability for the buyer of farmer' behavior j in case of k and s	Fraction (pb(j\ks))
ps (k,j,s)	Probability for the sellers of firm's behavior j in case of k and s	Fraction (ps(j\ks))
dfb (k,j,s)	Change of buying price at which pepper is traded under k j and s	US Dollars per kg of fresh pepper
dfs (k,j,s)	Change of selling price at which pepper is traded under k j and s	US Dollars per kg of fresh pepper
premium (k)	Premium price paid by the firm	US Dollars per kg of fresh pepper
m_large (s)	Just a large number equal to total volume of fresh pepper produced and transacted per season s	

Appendix 5.3a

Farmers' input information for the base run

Farmers' characteristics and constraints:		
λ		25,095
Target income (Jsstar) in US$:		27,412
Reservation income (Rs) in US$:		17,570
Base selling price for fresh pepper (F^*) in US$ per kg		0.89
Pmf (k) Membership fee for farmers'organization (US$ pero kilo of delivered fresh pepper)		
IC		0
GC		0.033
ppc (k,s) Farmers' production costs (US$ per kg of fresh pepper):		
	Low-supply	High-supply
IC	0.17	0.17
GC	0.17	0.17
pg (k,j,s) Farmers' governance costs (US$ per kg of fresh pepper):		
	Low-supply	High-supply
IC and processor's low-opportunistic behavior	0	0
IC and processor's high-opportunistic behavior	0	0
GC and processor's low-opportunistic behavior	0.107	0.025
GC and processor's high-opportunistic behavior	0.107	0.025
pt (k,j,s) Farmers' transport costs (US$ per kg of fresh pepper):		
	Low-supply	High-supply
IC and processor's low-opportunistic behavior	0	0
IC and processor's high-opportunistic behavior	0	0
GC and processor's low-opportunistic behavior	0.0204	0.024
GC and processor's high-opportunistic behavior	0.0204	0.024
pts (k,j,s) Transport supervision costs (US$ per kg of fresh pepper):		
	Low-supply	High-supply
IC and processor's low-opportunistic behavior	0	0
IC and processor's high-opportunistic behavior	0	0
GC and processor's low-opportunistic behavior	0.0024	0.0024
GC and processor's high-opportunistic behavior	0.0032	0.0032
pf (k,s) Farmers' fixed costs (US$ at year)		
	Low-supply	High-supply
IC	1,026	684
GC	1,026	684
Ps (k,j,s) Probability for the farmers of processor's behavior j:		
	Low-supply	High-supply
IC and processor's low-opportunistic behavior	0.1	0.1
IC and processor's high-opportunistic behavior	0.4	0.4
GC and processor's low-opportunistic behavior	0.4	0.4
GC and processor's high-opportunistic behavior	0.1	0.1

Appendix 5.3b

Processor's input information for the model

Processor's characteristics and constraints:		
λ		87,981
Target income (Jbstar) in $:		38,000
Reservation income (Rb) in $:		19,400
Base purchase price for fresh pepper (F^*) in $ per kg		0.89
Reselling price for processed pepper (Frp) in $ per kg		8
Industrial yield of pepper (kg)		4.20:1
fpc (k,j,s) Processor's production costs (US$ per kg of porcessed pepper):		
	Low-supply	High-supply
IC and farmers' low-opportunistic behavior	1.2	1.2
IC and farmers' high-opportunistic behavior	1.4	1.4
GC and farmers' low-opportunistic behavior	1.05	1.05
GC and farmers' high-opportunistic behavior	1.25	1.25
ft (k,s) Processor's transportation costs (US$ per kg of fresh pepper):		
	Low-supply	High-supply
IC	0.012	0.012
GC	0.	0.
fg (k,s) Processor's coordination costs (US$ per kg of fresh pepper):		
	Low-supply	High-supply
IC	0.035	0.024
GC	0.031	0.020
ff (k,s) Processor's fixed costs (US$ at year):		
	Low-supply	High-supply
IC	2400	800
GC	2400	800
fb (k,j,s) Probability for the processor of farmers' behavior j:		
	Low-supply	High-supply
IC and farmers' low-opportunistic behavior	0.18	0.18
IC and farmers' high-opportunistic behavior	0.32	0.32
GC and farmers' low-opportunistic behavior	0.32	0.32
GC and farmers' high-opportunistic behavior	0.18	0.18

Appendix 5.4

Increase of production of fresh pepper at plot level (kg per year)
w = 1 when IC and 0.5 when GC

1) Improvement of production at base run price of US$0.89 per kg

Runs	Production *Q(s)*	Percentage	Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective function
			Low supply	High supply				
Base run	30,000		GC.low-opp	GC.low-opp	82,248	71,382	3,757	25,463
Run 1	39,000	30%	GC.low-opp	GC.low-opp	107,883	93,310	4,911	33,950
Run 2	40,500	35%	GC.low-opp	GC.low-opp	112,155	96,964	5,103	35,364
Run 3	42,000	40%	GC.low-opp	GC.low-opp	116,428	100,619	5,296	36,779

2) Improvement of production at price of $0.73 per kg

Runs	Production *Q(s)*	Percentage	Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective function
			Low supply	High supply				
Base run	30,000		GC.low-opp	GC.low-opp	101,256	52,374	2,757	24,702
Run 1	39,000	30%	GC.low-opp	GC.low-opp	132,593	68,599	3,610	32,961
Run 2	40,500	35%	GC.low-opp	GC.low-opp	137,816	71,303	3,753	34,338
Run 3	42,000	40%	GC.low-opp	GC.low-opp	143,039	74,008	3,895	35,714

3) Improvement of production at price of $0.72 per kg

Runs	Production *Q(s)*	Percentage	Governance structure		Income Firm	Income Farmers	Average income per farmer	Objective function
			Low supply	High supply				
Base run	30,000		IC.high-opp	GC.low-opp	90,975	53,718	2,827	24,586
Run 1	39,000	30%	GC.low-opp	GC.low-opp	134,138	67,055	3,529	32,899
Run 2	40,500	35%	GC.low-opp	GC.low-opp	139,420	69,700	3,668	34,274
Run 3	42,000	40%	GC.low-opp	GC.low-opp	144,702	72,344	3,808	35,648

Appendix 5.5

Reduction of production costs at plot level (US$ per kg of fresh pepper)
w = 1 when IC and 0.5 when GC

1) Reduction of production costs at base run price of US$0.89 per kg

Runs	Production costs *ppc(k,j,s)*	Percentage	Governance structure Low supply	Governance structure High supply	Income Firm	Income Farmers	Average income per farmer	Objective function
Base run	0.17		GC.low-opp	GC.low-opp	82,248	71,382	3,757	25,463
Run 1	0.13	-24%	GC.low-opp	GC.low-opp	82,248	76,182	4,010	26,423
Run 2	0.11	-35%	GC.low-opp	GC.low-opp	82,248	78,582	4,136	26,903

2) Reduction of production costs at price of US$0.73 per kg

Runs	Production costs *ppc(k,j,s)*	Percentage	Governance structure Low supply	Governance structure High supply	Income Firm	Income Farmers	Average income per farmer	Objective function
Base run	0.17		GC.low-opp	GC.low-opp	101,256	52,374	2,757	24,702
Run 1	0.13	-24%	GC.low-opp	GC.low-opp	101,256	57,174	3,009	25,662
Run 2	0.11	-35%	GC.low-opp	GC.low-opp	101,256	59,574	3,135	26,142

3) Reduction of production costs at price = $0.72)

Runs	Production costs *ppc(k,j,s)*	Percentage	Governance structure Low supply	Governance structure High supply	Income Firm	Income Farmers	Average income per farmer	Objective function
Base run	0.17		IC.high-opp	GC.low-opp	90,975	53,718	2,827	24,586
Run 1	0.13	-24%	GC.low-opp	GC.low-opp	102,444	55,986	2,947	25,615
Run 2	0.11	-35%	GC.low-opp	GC.low-opp	102,444	58,386	3,073	26,095

Chapter 6

Contracts meeting challenges in the chain

Earlier literature on contract farming and outgrower arrangements has been fairly pessimistic about the prospects for involving smallholders into more advanced markets. In this thesis, we have challenged this viewpoint by making a detailed assessment of two typical supply chains of non-traditional products in Costa Rica. Making use of new institutional economics approaches has enabled us to identify how contracts have different function in particular market settings and for specific types of producers. Instead of focusing only on price and value arrangements, more attention is given here to the non-price aspects and the life-cycle dimension of contracts during different stages of market development.

This concluding chapter provides the opportunity to synthesize our major findings (section 6.1) and draw some conclusions regarding the usefulness of the new institutional economics framework for analyzing contract choice and supply chain cooperation (section 6.2). Below we will discuss the most appropriate roles of public and private agents for reinforcing efficient, equitable and sustainable supply chain (Section 6.3).

6.1 The role of contracts

The main research question addressed in this thesis (see Chapter 1) can be recapitulated as follows:

1. How are the agri-food supply chains for the selected two commodities currently organized?
2. What type of farmers and processing firms participate in contract farming, and what market failures are motivating them to engage in these contractual relations?
3. Can contracts be considered as a suitable mechanism for implementing efficient exchange relationships between agro-processing firms and farm households?
4. What characteristics should both parties (the firm and the farmer) exhibit in order to assure that contract farming becomes a feasible institution for enforcing loyalty, transparency and information sharing?

We have summarized the results derived from the analysis of supply chains for the pepper and chayote case studies by focusing on differences in *the characteristics of the commodities* as well as *the types of farm households* and the derived *implications* for *market configuration* and *contract choice* (see Table 6.1). This comparison enables us to yield insights on the endogenous character of the selected contractual arrangements (Escobal *et al.*, 2000) and draw pertinent conclusions regarding the efficiency and equity effects of supply chain cooperation.

Characteristics of the commodities

Both case studies refer to non-traditional, labor intensive crops with almost continuous harvest throughout the year, which make them suitable for small-scale production. The technology and production systems are simple and fairly homogenous. At the time of the research, we found strong but rather old varieties of plants in both cases, and there was almost no ongoing private or public research for the improvement of production systems. Timely harvesting and recollection determine quality to a large extend. In both supply chains, commodities are transacted fresh from producers to the next step in the chain, namely the processor. The supply chains differ, however, in the state and destinations that the commodities follow downstream the chain. Pepper is basically processed and transformed according to the requirements of the domestic food-industry market, whereas fresh chayote continues with little added-value to retailers and consumers, since options for storing or industrializing chayote are absent.

An important source of differentiation between both supply chains is related to the technical characteristics of the crop, which have influenced the farmers' level of asset specificity and uncertainty. The chayote product cycle lasts 14 months and the crop becomes productive after the fifth month. Although the infrastructure is expensive, it represents only 30 percent of total production costs. It can eventually be used in other climbing cash crops or left unused for a certain period of time. This allows producers to adjust their plans and easily quit cultivating if necessary. Conversely, the pepper product cycle ranges between 12 to 15 years and the plantation starts to deliver production after its third year. These characteristics bind producers and discourage them from abandoning the activity, since the establishment of the crop requires investing a great deal of effort. Consequently, pepper producers can only start cultivating if they have an appropriate relationship with a helpful partner (*i.e.*, a resource-

providing processor that agrees to purchase pepper) and/or when they can be certain that there are enough processors willing to buy the fresh pepper.

Producers' characteristics

Farm households characterized by different socio-economic conditions and production systems are involved in both supply chains. Pepper producers are located in small settlements, scattered throughout the northern region of Costa Rica. Depending on their location, they operate under monopsony and competitive market conditions.

Farmers in the monopsony market segment are usually younger than those in the competitive segment and have a higher degree of specialization in pepper, but their pepper plantations have been established more recently. Therefore, they can devote less working hours to their pepper plots. Since their plantations are in the early stages of the crop, their income from pepper is lower than the competitive segment, and they need alternative income sources. The use of contracts is more frequent in the monopsony region, where farmers are also more likely to receive credit and technical assistance. Farmers' organizations are more active in this region to compensate for the processor's monopsony power. The mean price for pepper delivered fresh is lower, thus indicating the effect of the monopsony situation. Since the payback time for the initial investment in the plantation is two or three years, this group of farmers can be described as farmers in the risky start-up phase of their plantation.

Conversely, farmers involved in the competitive market usually operate larger but more degraded plots. They have mature plantations that are more productive but also require more labor. This category of farmers is less dependent on contractual relations with processors and requires less technical assistance and credit. Since they obtain a better price than in the monopsony region, their prospects for expanding pepper production are significantly greater, since farmers expect to be able reach higher returns from land and labor under the conditions of open competition. These farmers can be characterized as self-confident producers that have already passed the risky initial phase of establishing the crop. The fact that their plantations are now in the productive stage, in addition to the competitive market environment and market expansion, provides them opportunities to develop bargaining power vis-à-vis the processors.

Table 6.1 Comparison of the supply chains

Characteristics	Pepper (*Piper nigrum* L.)		Chayote (*Sechium edule* Sw.)	
Commodities	Perennial tree (12-15 years); commodity is traded in fresh bunches; quality depends on maturity at harvest. Visual quality inspection. Value added in processing (white pepper requires higher quality).		Semi-perennial vegetable crop (14 months), susceptible to plant diseases and quality degradation. Inspection of appearance based on uniformity. Trade with little added-value (only washing, grading and packaging).	
Farmers	Small number of farmers (75), spatially distributed in - traditional communities - peasant settlements		Large number of farmers (500) with different farm size (scale) and experience: - traditional producers - newcomers	
Market outlets	Domestic niche market; target market is domestic food processing sector. Two distinct market segments: - monopsony - competitive.		Competitive (and growing) market, with domestic and international outlets. No dominant operator; open competition between 14 processors; eight processors linked to international brokers.	
Product-market combination	Monoposony segment	Competitive Segment	Traditional producers	Newcomer Producers
	Young farmers. Smaller plots. Higher quality land. Young plantations. More specialized. Low labor use. Low pepper yields. More use of contracts + tech assistance + input credit. More active in organizations.	Older farmers. Larger farm size. Degraded land. Mature plantations. More diversified. Higher labor use. High pepper yields. Less use of contracts+ tech assistance + input credit. Less organized.	Larger plots. More working capital. More experience in chayote production. Higher use of hired labor. Internal input provision.	Smaller plots (but higher quality). Capital constraints Less experience. Reliance on family labor. More dependency of technical assistance, credit provision and input supply.
Contracts	Monoposony	Competitive	Traditional	Newcomers
Written arrangements➔ (*resource providing*)	Price adjusted with inflation + seedling supply + technical assistance. Farmers agree to deliver in a long term relationship. Promisory note as guarantee against breaching contracts.	None		
Verbal agreements (*resource providing*) ➔	Seedling supply + tech assist. Farmers agree to deliver.	Seedling supply + tech assist. Farmers agree to deliver.		
Verbal agreements➔ (*market specification*)	None.	Provision of a market outlet. Farmers do not agree to deliver.	Provision of a market outlet. Farmers agree to deliver.	
No agreements➔	No commitments on either side.	No commitments on either side.		

Producers in the chayote sector are spatially concentrated in one single valley. According to their socio-economic characteristics, we have classified these farmers in two categories: traditional producers and newly established producers. Income diversification was very limited amongst both groups of farmers (only some horticultural production was found providing additional income during the non-productive period of chayote) and therefore the availability of either family or hired labor determines the optimal farm size for both types of producers. Traditional farmers have a long history of chayote production and well established family roots in the area. They have more working capital of their own and larger plots, for which they use wage labor, especially for the harvest (labor input use represents 70 percent of total production costs). The second category—'newcomers'—is composed of farmers in peasant settlements organized by the governmental rural development institute (IDA). These producers usually have less capital and are therefore more dependent on credit provision, input supply and technical assistance. Notwithstanding their limited experience, these smallholders still enjoy some advantages in comparison to larger outgrowers, since there are limited options for mechanization of production and the crop requires large amounts of labor. Therefore, smallholders can use family labor with the advantage of lower search and supervision costs. In addition, the soil quality conditions in the settlements (higher fertility and better drainage) are more appropriate for chayote cultivation and the newly established farmers can rely on more advanced production technologies.

Despite the above classification, we have detected a large heterogeneity in production systems and socio-economic characteristics amongst chayote producers. Factor analysis proved to be helpful to identify two common components that structure our sample of producers, namely scale of production and experience. For the first component, size and scale are identified as significant farm-household characteristics clearly related to production output. The experience component consists mainly of each farmer's personal characteristics which reflect his skills as a producer.

Market organization

Both supply chains exhibit a different type organization in terms of outlets and agents. The pepper supply chain is characterized as a closed niche market, whereas the chayote chain operates in a more competitive market environment. There are no spot markets in the pepper supply chain and only a limited number of producers (75) deal with very few processors (1-3). Depending on the area of influence of each of the processors, two different market

segments can be distinguished: a monopsony region and a competitive region. After the year 2000, only one processor remained, making the supply chain even shorter and more uniform, and shifting definitely towards a monopsony market. In the context of a rather stagnant market, producer organization for reinforcing bargaining power becomes increasingly relevant.

Conversely, the chayote supply chain involves more producers (500) and processors (14), operating in a rather competitive environment, with two well-defined outlets, namely the international and the domestic market. However, we found only eight processors dealing with at least five international brokers in the target markets. This implies that producers and processors have to pass their production through a reduced number of exporters if they want access to international market outlets. Given the large volume of the domestic (and growing regional) market, chayote trade is likely to expand in the near future, and more producers may be willing to enter the market.

Contract choice

The processors active in both supply chains operate at different scales of production and rely on different contractual mechanisms. They use varying degrees of vertical integration with primary producers and also have a different amount of confidence in forward integration throughout the chain. These two factors influence the level of processors' bargaining power and determine their sourcing strategy by offering farmers diverse types of contractual arrangements.

In the monopsonist market segment for pepper we found that the largest and most enterprise-oriented processing firm had fully specialized in the production of white pepper and originally declined from any backward integration with the primary production. The company only sells white pepper to one large food processor in Costa Rica, for which quality of fresh pepper turned out to be a key issue. In this segment, both written contracts and verbal agreements are used to guarantee timely delivery and full capacity utilization. On the contrary, in the competitive market segment we found three companies competing, using only verbal agreements with producers. Two of them have specialized in the production of black pepper, which has less stringent quality standards for fresh pepper. Consequently, both companies showed a lower scale of operation compared to their competitor that operates at

the higher quality segment while maintaining strong backward integration with primary production.

Enforcement of contracts was reported by processors to be ineffective, especially in the competitive market segment. In fact, the proportion of defaults on contracts turned out to be quite high: 40 percent of the farmers interviewed operating under a delivery agreement were disloyal. This outcome is in line with findings from the literature (see: Glover & Kusterer, 1990; Grosh, 1994; Key & Runsten, 1999). Farmers are tempted to default on their contracts in markets with a sudden rise of competition and prices. It also confirms certain weaknesses for processors to enforce contracts and points to the importance of maintaining a high degree of confidence with the farmers, thus reinforcing the mutual dependence existing between producers and agro-processors. Each needs the other to guarantee to deliver on future occasions.

The essential difference between the contracts provided by the companies refers to product and process specifications, the type of guarantees used for enforcing delivery, price-determination procedures, and whether instantaneous or delayed payments are preferred. Written contracts provided by the chayote monopsony firm are defined as *resource-providing* arrangements including input delivery (*i.e.* seedlings) and technical assistance. These contracts closely resemble *quasi-vertical integration* based on long-term co-investment activities (Hobbs, 1996) and offer farmers an inexpensive, low-risk way to acquire inputs and technical assistance. However, the associated risk for farmers with written contracts is being tied up by the firm in a long-term relationship, with the consequent loss of bargaining power. Moreover, farmers have to sign a promissory note for the value of seedlings that has to be paid if they default the contract. Verbal agreements offered by the companies operating in the competitive market segment can be also defined as *resource-providing* contracts, since they include input provision and free technical assistance. For the company, resource provision is part of a backward integration strategy used to supplement the raw material delivery to the processing plant. On the other hand, verbal agreements provided by both companies are strictly *market-specification* contracts limited to provisions regarding price, delivery time and quantity. The latter types of arrangements refrain from any involvement in the production process and are limited to simple product delivery specifications. In practice, we found producers selling their pepper to any of these buyers with no previous delivery agreement.

Therefore, the farmers' decision to opt for a specific agreement mainly depends on their individual needs and preferences.

Most of the chayote processors are companies owned by families residing in the area. We have only included two export companies with no family links in the zone. Some processors also operate their own plots producing fresh chayote, but this production is not enough to occupy the installed capacity completely, so they purchase additional amounts of chayote from nearby producers. Processors perform several tasks to match international brokers' parameters, taking care of the transport from the plot to the processing plant, product selection, washing the chayote, waxing and bagging it individually, packing it in boxes, and transporting the boxes to the harbor in refrigerated and sealed containers.

We have found that almost all chayote processors only offered farmers verbal agreements, which can be defined as strictly *market-specification* contracts. In general, farmers with these verbal agreements obtained access to information, input supply, credit and even technical assistance, with certain effects on product quality and loyalty. Given the shorter production cycle and the relative homogeneity of the produce, these contracts suffice for linking producers in the supply chain.

Further perspectives

The comparative analysis of the pepper and chayote supply chains provides an opportunity to address the future perspectives for expansion in both sectors. Pepper can be produced in Costa Rica at relatively low prices and there is still some unsatisfied domestic demand. Moreover, there is a potential for export, but local production is still insufficient for processors to offset the export costs. Conversely, chayote is already a well-positioned commodity in ethnic markets in United States, Canada and Europe, and Costa Rica appears in international records as the main export country. Besides, since this vegetable is a staple of the Costa Rican diet, it is sold in the domestic market with no need for advertising.

Notwithstanding, the quality of the product becomes a serious limitation for further development of both sectors. On the one hand, there are no formal quality standards for chayote and importers in target markets only specify certain physical parameters (color, shape, size, no damages). Control of chemical residues is only performed by phytosanitary authorities in the import markets, because it is costly and limited when carried out in Costa

Rica. Most chayote producers turned out to be aware of basic quality requirements for the export market and restrictions in chemical use, but rejection rates are still high at further stages in the chain and rejection of full containers occurs frequently. Since producers can easily sell substandard chayote in the domestic market, chemical residues may represent a serious public health threat. On the other hand, fresh bunches of pepper need to be in a middle stage of maturity—neither immature nor over-ripe—to be processed into white pepper and delivered to the food industry. Proper tests for determining the amount of *piperine* (as a quality indicator) are available in Costa Rica but are not extensively used. However, most food-industries in Costa Rica disregard locally produced pepper and continue to import processed pepper.

Rejection rates are considered high by producers in both supply chains and are a common source of distrust at the first stage of the chain. This factor endangers coordination between producers and processors and suggests a basic problem of information exchange. In the chayote case, the absence of formal standards defined by either public authorities or dominant agents (*i.e.* large retailers or branded manufacturers) causes quality and product uniformity differences. Moreover, the rejection rate varies according to the level of demand in major target markets; low demand is translated into higher rejection rates, thus reinforcing distrust between producers and processors. Trading of chayote is based on quality assessment and market knowledge of the broker. Hence, quality default is penalized via price discounts rather than by exclusion from the market. Exporters enforce informal governing rules when dealing with processors, who in turn enforce them with producers in a backward sequence. This is another source of distrust between farmers and processors.

In the pepper chain the quality issue seems to be relatively simple, since rejection varies according to the type of pepper the processor makes. Production of white pepper requires higher quality bunches than production of black pepper does. However, this factor seems to confuse less-educated farmers, and distrust increases as they note other processors that rely on more relaxed quality standards. In the medium run, import substitution of pepper by local producers requires, however, also more stringent quality standards.

6.2. The role of contracts for smallholder development

Contractual systems with a second party, namely the processor, have been used in both commodities for a number of consecutive years, given the investment requirements for crop establishment and the features of an emerging market. Our analysis of farmers' contract choice in both supply chains led us to identify three major functions of contracts, namely (1) a security device, (2) a provision of incentives, and (3) a provision of information (see Table 6.2). These functions yield certain effects on the farmers' decisions regarding resource allocation and supply chain integration. We therefore discuss the implications of contracts for guaranteeing smallholder access (equity), for production efficiency, and for the long-term sustainability of supply chain cooperation.

The Drivers: Insurance, Incentives and Information

Contracts provide an ***insurance*** device to enable farmers to take up a new production activity and gain access to specialized markets. In the pepper case, insurance mechanisms such as the commitment of the processor to purchase the crop output throughout the productive cycle, the guarantee that farmers receive a fixed price for their produce, and the protection against inflation by adjusting purchasing prices enable resource-poor and income-constrained farmers to become engaged in the production of non-traditional crops, despite market and price uncertainties. In the chayote case, there are no price adjustments with inflation, but farmers benefit from the certainty of a higher purchase price when delivering the produce to the export market. Moreover, the back payment system in use corresponds to transaction frequency; this means that more frequent deliveries result in a more constant flow of income towards the farmers. This insurance mechanism reduces search costs, since chayote producers can obtain a better price, without investing much time in searching for markets outlets.

Table 6.2 Functions of contracts

Functions	Mechanisms
Insurance	• Commitment of purchase (P and Ch) • Price certainty (P) • Price with correction for inflation (P) • International prices are usually higher than the domestic prices (Ch) • Promissory of back payment (Ch) • Frequency in transactions (P and Ch)
Incentives	• Delivery of input provision (P) • Contract functions as collateral for accessing credit from input store (Ch) • Soil conservation measures (P) • Transport costs of delivered produce (P)
Information	• Access to (inter) national markets (P and Ch) • Technical assistance form the processor and a public agency (P and Ch) • Quality requirements and grading (P and Ch) • Measurement of maturity (P)

Note: (P) refers to pepper case and (Ch) refers to chayote case.

Contracts also provide ***incentives*** for investment and thus increase the asset-specificity at the farmer's side.[37] In the pepper case, *resource-providing contracts* offer an incentive that encourages resource-constrained farmers to use more fertilizers and pesticides. This incentive can become even more attractive when costs of transport to the firm are covered by the processor. In addition, *resource-providing contracts* proved to be an effective incentive to encourage farmers to invest in soil maintenance and conservation activities. These cultural measures are usually costly and time-consuming for farmers, and therefore they will only devote labor time to these activities when rewarded by a better output price and continuing transactions. This is in line with the literature regarding the importance of *resource-providing contracts* and vertical integration to enhance sustainable agricultural intensification (Kuyvenhoven & Ruben, 2002). In the chayote case, there are no *resource-providing contracts*, but rather simple *market-specification contracts*, in the form of verbal agreements. However, this contractual form serves as collateral to access credit from the input store. Since frequently delivering farmers obtain their back payments every week, they can easily access credit for input supply when input store owners are aware of these contract terms. Hence, the incentive provided by the contract guarantees flexible and timely access to credit, instead of expensive, time-consuming formal credit procedures.

[37] This function is intimately related to the insurance role of contracts, since farmers would only invest in their plantations, and thereby increase their asset-specificity, if they have certainty regarding market outlet and price.

Finally, contracts function as a mechanism to provide farmers with ***information*** about the structure of the market where they operate. This is very important to prevent false expectations and adverse selection problems. In the pepper case, contracts provide technical assistance that informs the farmers not only about the structure and opportunities of the market, but also about production techniques and product quality requirements. In the chayote case, there is no direct provision of technical assistance by the processor, but services are provided by the Ministry of Agriculture (*Ministerio de Agricultura y Ganadería,* MAG). This public extension agent focuses particularly on inexperienced farmers in peasant settlements that started to produce chayote under a verbal agreement with a processor. Therefore, contracts provide an indirect mechanism to inform these farmers about the production and market requirement.

The Outcomes: Equity, Efficiency and Sustainability

The implications of contractual exchange for income distribution, efficiency in resource allocation and long-term supply chain relationships are outlined in Table 6.3. Contracts have proven to be a mechanism for enhancing ***equity*** by incorporating certain types of producers into specialized (inter)national markets. Comparing farm-households' characteristics in relation to various types of contracts in the pepper case, we have concluded that contracts are mainly suitable for certain categories of farm households, but certainly not for all. We have found different types of farmers choosing between the three available contractual forms, namely written contracts, verbal contracts, and no agreement at all. In a monopsony market, poorer but better educated farmers with small acreages and limited farming experience strongly prefer written or verbal contracts. They operate small areas of non-productive pepper and meet initial investment constraints, thus relying more on non-agricultural income. On the other hand, larger and more experienced farmers with high-yielding pepper plantations and are far less dependent on single agricultural activities and are more likely to rely on spot market exchange as part of their risk diversification strategy. Pepper prices are slightly higher in the competitive market, where better endowed farmers with no contract were able to negotiate a more attractive price.

The level and sources of income have a clear effect on farmers' contract choice and their bargaining power. Income diversification under farmer's control (*i.e.*, access to alternative

household income sources, such as other cash crops and livestock activities) enables them to increase their asset-specificity in pepper crops, even without the security provided by contracts. Since these farmers are able to refrain from long-term contractual ties, they tend to be less reliable partners for contractual arrangements with processors.

Table 6.3 Implications of contracts

Effects	Mechanisms
Equity (access)	• Selection of farmers with high labor availability • Selection of farmers with budget constraints • Selection of farmers with more fertile plots • Co-investment/credit directed to smallholders
Efficiency	• Technical recommendations and supervision. • Higher and better input use • Quality up-grading • Frequent deliveries • Sustained product quality leads to frequency
Sustainability	• Frequency of successful transactions • Enforcement of loyalty • Building up reputation • Preference of frequent and loyal suppliers

In the chayote case, we identified farmers strictly delivering products to either the export market or the domestic market, whereas a third group engaged in both national and international markets. Several farm household characteristics are positively related to the orientation towards export market, such as scale of production and experience. This points to traditional farmers with a long background in the activity. However, we also find newcomer farmers in peasant settlements oriented towards the export markets. Since these producers rely more on family labor and their high-quality land, they are able to develop small-scale albeit intensive cultivation. Hence, we have concluded that not only are traditional farmers able to engage into the export markets, but newcomer farmers also can by making use of their comparative advantages. Moreover, we have noticed that farmers who were able to make agreements with processors are more likely to become involved in export delivery. This is plausible since contracts are initially a useful device for providing security against market uncertainty. Producers deliver a larger share to the export market when a more intensive production system has been established and thus a higher quality of produce can be maintained. Otherwise, better endowed producers use their dedication to export markets as a

twofold mechanism: as a way of gaining additional bargaining power *vis-à-vis* the processor, and as another source of income.

The analysis of contract choice in chayote revealed that scale of production is positively related to engagement in verbal agreements with a processor, whereas experience is negatively related. This is similar to the outcome in the pepper case, where young and less experienced farmers are more likely to become involved in contractual arrangements, since contracts provide a certain level of security against market and price uncertainty. Moreover, farmers with a previous delivery arrangement received a higher average price than farmers selling only in the domestic market. Hence, the delivery agreement is convenient as a risk-reducing device for less-experienced farmers.

In terms of *efficiency*, a contractual relationship between farmers and processors has a positive effect on resource allocation and product quality. Non-price factors involved in the contracts, such as input supply, technical assistance and information result in better input use, an improvement of production systems, and quality upgrading, thus favoring frequent and successful transactions. These facilities also tend to reduce risk exposure and enable farmers to adopt enhanced production technologies. However, this efficiency may be endangered when opportunistic behavior arises and market conditions change and enforcement of contracts becomes more difficult.

The analysis of market channel choice indicates that farmers require contracts especially in the early phase of the establishment process of perennial crops, as a guarantee for their investment efforts. In subsequent phases and under more competitive market conditions, producers prefer verbal commitments to written contracts. Furthermore, in the absence of penalties, pepper farmers with delivery commitments may become disloyal to their buyer in markets with increased competition. Most farmers keep selling the major share of the harvest to their fixed buyer but deliver small volumes to competitors as well. Consequently, contracts fulfill rather different roles during the farm household life cycle and vary under diverse market conditions.

Regarding ***sustainability***, contracts play an important role in intensifying farmers' production systems by enhancing land use and involving more labor in crop management and post-harvest handing. This may have positive implications for soil conservation and generation of

employment at the community level. This intensification could also lead to higher product quality and less rejection, and thus strengthens mutual confidence. This is mainly accomplished by the selection of a certain type of farmers, namely inexperienced farmers with a large family available, and those who have chosen the crop as their main source of income.

Frequent and successful transactions require the accomplishment of quality criteria defined by the processor and a continuous flow of information between the contracting parties. We have noticed that opportunistic behavior (*i.e.* selling produce to other buyers when a better price is offered) is effectively controlled by delivery contracts, since farmers prefer stable relations with their buyers in order to safeguard their investments. This outcome is in line with the literature indicating that successful, continuous transactions build up the reputation of the contracting parties (Hobbs, 1996). Non-price aspects in the contract, such as technical assistance, collection frequency, regular payments and encouragement of group action thus reinforce long-term supply chain cooperation.

6.3 Public and private roles for supply chain integration

While contracts are essentially private, there is still an important place for public action to safeguard the efficiency, equity and sustainability of supply chain cooperation. The development of grades and standards, as well as the support provided for supply chain coordination towards product and process upgrading are of utmost importance.

The implementation of formal grades and standards (G&S) is of key importance for the future development of supply chains. Clear rules of measurement defined by a recognized authority and a clear system of classification could improve chain coordination and reduce distrust between contracting parties. In both case studies, product quality was determined only by simple visual inspection.[38] However, these 'rules' are informally transmitted to producers by technicians and other experienced producers, and disputes on rejection rates are frequent. Due to the absence of G&S, we could not establish a positive relationship between contractual arrangements and quality performance. This suggests large inefficiencies in the procedures for quality assessment and poor agreements on generally accepted G&S.

In the pepper and chayote supply chains, small- and medium-scale processors are dealing with smallholder producers. None of these actors usually have the capital and human capacity to create and implement private G&S, without the support of governmental agencies or third party certification agents (Reardon *et al*., 2001). The government and local universities can play an important role in defining minimum G&S and providing information on new market opportunities and characteristics, while forming a consensus regarding the desired behavior from the plot to the target markets.

The latter issues are particularly significant in the chayote case, where eight exporters have limited control of quality supervision in the main target market in Miami. More importantly, the government, along with these exporters and other non-profit actors, can use G&S as an instrument to promote high quality chayote in new markets. In the pepper case some international G&S are applied between the processing company and its main buyer, but certainly none for the retail sector. There is a great deal of competition among brands selling pepper in Costa Rica, but none specify the type (*i.e.* white or black pepper) and quality of the pepper source. G&S provide market information to consumers and may increase market opportunities for black pepper. Finally, a combination of contractual terms with a proper definition of G&S could become an important inclusive strategy aiming to promote local sustainable production. This would require private-public alliances towards agreements regarding generally recognized product and process standards and related reward and enforcement mechanisms.

Upgrading the commodities is another important strategy for enhancing value-added generation in small- and medium-scale enterprises operating in global markets. Increasing processing to gain a better market position is a desirable "recipe" for firms in developing countries, but little attention is usually paid to the global conditions that may favor such an upgrading process. Product innovation and differentiation require in-depth investments in research and development, and tend to be steered by agents close to the retail sector. Therefore, the governance structure of the chain plays an important role in successful upgrading (Giulani *et al.*, 2005).

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[38] In the pepper case the maturity of bunches is assessed visually (one or two red grains per bunch), whereas in the chayote case quality is based mostly on product uniformity (basically size, shape and color).

In our two case studies, the supply chain organization explains to a large extent why these commodities are still traded in their current state. In the pepper case, the commodity is processed upstream in the chain and governance is guided by monopsonistic enterprises. This may explain why upgrading for the processor is limited to simple compliance with the domestic food processor's standards. On the other hand, in the chayote chain there is no dominating operator and in this highly competitive (and sometimes opportunistically behaving) setting investments in product innovation tend to be risky. Therefore, any upgrading could only be expected through coordinated action, dovetailing the interests of a capital-investing processor and an organized group of suppliers. As shown in the literature and confirmed in our simulation analysis (see Chapter 5), upgrading in supply chains of perishable commodities strongly depends on an appropriate amount of collective initiatives (Giulani *et al.*, 2005). This points to another important role for the government (and voluntary agencies); they should promote agency coordination as part of a comprehensive strategy for supply chain integration and integrated rural development.

6.4 Contributions to the debate and limitations of the study

Literature on contract farming usually presents two opposite views regarding the potential of this alternative market institution as a "bridge" for trading between agroprocessing firms and smallholders. Positive views basically sustain that contracts are a adequate mechanism to incorporate smallholder into dynamic advanced markets by substituting failing markets for credit, insurance, information, factors of production, outlet produce; and diminishing transaction costs associated with the search of prices and markets, transfer of technology, and distribution of bargaining power, monitoring and enforcement in transactions (Glover, 1984; Grosh, 1994; Key and Runsten, 1999). Conversely, other authors warn about the downside of contract farming—in developing countries—which may yield some undesired welfare effects for smallholders (see Willson, 1986; Rickson and Burch, 1996; Singh, 2002).

Earlier work on both opposite views seemed to suggest positive or negative effects for indistinctly all farm households operating in a similar market context. Earlier literature continued to be pessimistic about the performance of contracts as an alternative market institution, but at the same time suggesting potential opportunities for certain types of contracting agents. However, the literature does not provide enough empirical indicators under which conditions the smallholders and agroprocessors would engage into contract

farming, and if such institutional arrangements could be a Pareto-improving form of governance. This is a comprehensible fact because there are many different applications of contract farming and different interacting actors. Therefore, most of the empirical analyses have focused on specific case studies rather than the analysis of a generic contract institution.

This research confirms most of the roles of contracts proposed by Key and Runsten (1999) in response to the above mentioned market failures and transaction costs (see also Chapter 2, pages 22-23). The most important contribution of this study to the contract farming debate is the variable character and effectiveness of contracts under different market settings and with different contracting agents. We identified the mechanisms under which contracts function as a provision of insurance, incentives and information (see Table 6.2), and the derived effects on farmers' decisions regarding input use, soil conservation measures and supply chain integration. Our research also identified which type of farm households and processing firm can participate in contract farming and under which conditions. We proved that contract farming could become a suitable institution with implications in terms of equity, efficiency and sustainability (see Table 6.3), which contribute to understand the outcomes of contracting for the involved agents. None-price aspects in contracts like frequency of transactions, promissory of back payment, input supply, technical assistance proved to have a positive effect for production efficiency and the long-term sustainability of supply chain cooperation.

The research provides an empirical framework for assessing the effectiveness of contract farming in agri-food supply chains, in a developing country like Costa Rica. However, further research is required beyond the analyzed case studies. This research is useful to provide an analytical framework that can be used at higher sector levels, which should yields elements for public and private efforts to strength supply chain integration and enhance competitiveness in the agricultural sector.

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Summary

Transaction costs and other market failures are widely present in the agricultural sector of emerging economies and negatively affect to low-income smallholders, making difficult their integration into dynamic agri-food supply chains. Earlier literature mentions contract farming as an economic institution with the potential to incorporate smallholders into more advanced markets and strength supply chain integration. However, the application of contract farming in some countries of Latin America has shown diverging experiences and the mere presence of contracts does not assure the sustainability of trade relationships. This research seeks to analyze the effectiveness of contract farming as a market institution between smallholders and agro-processing firms in Costa Rica. The research aims to identify and analyze the following key issues: (1) structural characteristics of the two typical agri-food supply chains for non-traditional products, namely pepper (*Piper nigrum* L.) and chayote (*Sechium edule* Sw.); (2) patterns of behavior adopted by the agents for adapting or adjusting to the market where they operate under given contractual arrangements; (3) effectiveness and rationale of the current contractual arrangement; and (4) opportunities and constraints for improving the contractual arrangement between the firm and the farmers. To address these issues, we rely on an analytical framework based on the Structure-Conduct-Performance approach, and a modeling assessment of organizational strategies under monopsonic market conditions. These frameworks enables us to analyze and explain the different strategic interactions between two parties (firm and farm), given the set of expected asymmetries of information and transaction costs that they are facing.

In Chapter 2 we first analyze the causes of market failures in developing countries and the emergence of alternative institutions as response to such market failures. Contract farming is a form of governance that emerges in response to market failures for credit, insurance, information, factors of production, outlet produce; and transaction costs associated with the search of prices and markets, transfer of technology, and distribution of bargaining power, monitoring and enforcement in a transaction with a second party (Grosh, 1994; Key and Runsten, 1999). For the next actor in the chain, namely the buyer firm, contracts assures him a continuous flow of product, at the right moment, with the desired characteristics, and without operating the whole production operation. Therefore, `contracts take an intermediate position between spot markets and full vertical integration, and correspond to certain level of supply chain management, as a suitable mechanism for distributing risk between the contracting parties. The literature points out three main non-exclusive categories for contracts, namely market specification, production management and resource-providing contracts. Resource-providing contracts are particularly important for enforcing sustainability criteria or for promoting quality upgrading. The selection of a specific type of contract depends on the type of commodity, the characteristics of the contracting parties, and the prevailing market conditions at a certain period of time. Moreover, uncertainty, bargaining power, asset specificity and enforcement are

key issues for the selection of supply chain governance regimes. The opportunities for reaching and maintaining a *win-win* situation through an agreement depends on the level of mutual trust, the exchange of information between agents, the relative distribution of bargaining power, and the enforcement costs of the contractual terms. Successful integration of small and medium size farmers into export markets seems to depend particularly on the type of contract they maintain with the firm. This contract determines their income levels, degree of autonomy and the level of risk they accept or share with the firm, and influences their willingness to invest in quality improvements or resource conservation measures. Dynamic chain advantages can only be maintained when contracts enable farmers to adapt to these changing market demands. Besides, non-price factors implicit in the contract may positively affect farmers, by improving the efficiency in their production systems and contractual relationship.

In Chapter 3 we analyze the rationale and effectiveness of different types of contractual regimes, under two market configurations, between small-scale producers of pepper and agro-processing firms in the Northern region of Costa Rica. Particular attention is given to the incentives derived from contracts for the adjustment of production systems and livelihood strategies. Pepper is an attractive diversification activity for smallholders because it is a labor-intensive crop, does not require complex technologies or machinery, requires detailed attention and frequent disease control through the cropping cycle, and can reach high, fairly stable yields per hectare. This gives family farms a competitive advantage compared to large commercial plantations. A major drawback for small farmers are the high entry costs during the start-up phase, necessary for initial investments in crop establishment and the long maturation time before the first harvest. Contracts may be helpful as a strategy for overcoming these constraints and permit market access at reduced levels of uncertainty (Dorward, 2001).

In the Costa Rican pepper sector we can distinguish two different market situations (competitive market and local monopsony) and three types of contractual arrangements (written contracts, verbal commitments and none agreement). The data analysis has been conducted making use of the Structure-Conduct-Performance framework (Bain, 1968; Martin, 1993) for the operations on the pepper market, followed by a statistical analysis of household and production characteristics to identify the determinants and effects of contract choice, and to estimate the importance of contracts for resource use efficiency. We conducted a survey amongst pepper producers using a semi-structured questionnaire to obtain data on production systems and marketing arrangements. We successfully collected data from 50 producers, which represented 65% of all pepper producers related to three processing companies.

The analysis of market channel choice indicates that income-constrained farmers require contracts especially in the early phase of the establishment process of perennial crops as a guarantee for their investment efforts. In subsequent phases and under more competitive market conditions, producers prefer verbal commitments to written contracts. Furthermore, in the absence of penalties, pepper farmers with delivery commitments may become disloyal to their buyer in markets with increased competition. Most farmers keep selling the major share of the harvest to their fixed buyer but deliver small volumes to competitors as well. Consequently, contracts fulfill rather different roles during the farm household life cycle and are shaped differently under various market conditions. The analysis has also revealed that the sources of income have a clear effect on farmer's contract choice and bargaining power. Income diversification enables farmers to increase their asset specificity in pepper crops, even without the insurance provided by contracts. Besides, farmers with contracts are definitely investing more inputs and time in soil maintenance activities on their pepper plots. *Resource-providing contracts* in the competitive market have a stronger effect than simple *market specification* contracts in the monopsonistic segment. This confirms the literature regarding the importance of *resource-providing contracts* and vertical integration for sustainable agricultural intensification (Kuyvenhoven and Ruben, 2002). Budget-constrained farmers that intend to tailor their investment decisions in line with the designed technological package may substitute for their default in fertilizer use with additional labor investments in soil maintenance activities. Farmers without agreements can still be efficient pepper producers, but maintain substantially lower investments for resource management.

The effect of contracts under different market situations indicates that local monopsonies might generate rather perverse incentives for making fixed investments in pepper plantations compared to situations where competition between buyers exists. We have recorded yields per hectare that are substantially lower in the monopsony region, even when farmers use more inputs. Local monopsonies could favor a transition towards more capital-intensive production systems, especially when relying on *resource-providing contractual regimes* that (temporarily) reduce input costs. This points to close complementarities between the decisions on technology choice and the type of market organization. Finally, farmers with contracts are usually better informed and more committed to the agreement with the buyer. However, the loyalty of these farmers is likely to be more related to their lack of bargaining power rather than to the availability of market information.

In Chapter 4 we determined the critical factors that make chayote producers eligible for export delivery to traders-processors and we analyze the impact of contracts on quality performance and loyalty relations within the chayote supply chain. Indigenous vegetables, like chayote, represent an increasing share of non-traditional exports from Costa Rica. Farmers' possibilities to become engaged in global agro-food chains depend on the relationships established with packers and (inter)national

brokers. Farmers who are able to deliver better quality and stable amounts tend to become preferred suppliers. Harvesting the crop at an immature stage and quick delivery to exporters improve post-harvest shelf-life and quality, since storage affects the firmness, appearance, flavor and nutritional value (Marín-Thiele, 1997). Contractual agreements may be helpful to reduce farmers' uncertainty and are intended to increase their loyalty towards the processor-exporter. While prices paid to the farmers are only slightly higher than those of the national market, other purchase conditions – like the terms of payment, the provision of credit for inputs and the frequency of collection – are equally or more important for the decisions regarding outlet choice (Hart and Holstrom, 1987). Furthermore, additional services (*i.e.* seed, credit and technical assistance) enable farmers to improve their product quality at relatively low costs, whereas can be helpful to control farmers' opportunistic behavior (Chiarelli *et al.*, 2002). Farmers who deliver chayote to exporters make higher amounts for inputs and labor use, but face delays before receiving their final payment. Therefore, specialization in chayote production is only a feasible option when delivery contracts provide sufficient certainty. We use an analytical framework based on the Structure-Conduct-Performance approach (SCP) (Bain, 1968; Martin, 1993). Robust parameter estimates from binary regressions are presented to examine the determinants of farmers' engagement in export production. Tobit and Logit models are used to examine the probability of contractual engagements between producers and exporters, and to analyze the key factors influencing quality performance and loyalty. Field data were collected from chayote producers located in approximately fifteen villages in the valley of *Ujarrás* in central Costa Rica. 120 farmers were selected using a stratified sampling technique of a total population of 450 chayote producers, separated in two categories: traditional chayote producers and IDA settlers.

Contracts provide an important device for improving security and enhancing the involvement of smallholders in international marketing chains. Farmers delivering under (in)formal contracts with processors/exporters have better access to credit, critical inputs and information, enabling them to benefit from economies of scale and scope. Producers' preferences for a certain processor-exporter are determined by the price paid for their product, but non-price factors (such as access to credit, technical assistance and market information) appear to be equally or more important. Moreover, prices appear to be positively related to export contracts, and these contracts in turn provide incentives for the intensification of chayote production systems. The existence of a contract improves the certainty for the producer, enabling investments in land improvements and better crop management. No direct relation was found, however, between contractual delivery and the quality of the produce, but a strong impact on loyalty was confirmed. Therefore, contracts influence farmers' production systems and household revenues in two different ways. In the first place, quality is improved as a result of better land use and more labor available for crop management and handling. This is mainly guaranteed through the selection of recently settled farmers with larger families as contractual partners. In the second place, loyalty is increased especially when these farmers can be ensured high

delivery frequency. The latter is particularly important to maintain post-harvest quality and reduce rejection rates. Loyalty with processors/exporters requires contractual arrangements including provisions for technical assistance and market information as well as adequate facilities for timely product delivery and payment regimes.

In Chapter 5 we analyze the dynamics of contracts in the pepper supply chain of Costa Rica. There are no spot markets for pepper and since 2001 only one processor buys fresh pepper from producers under defined quality conditions. Yet, rejection rates are in average of 10 percent of each delivery. This is a very sensitive issue for low-income farmers and one of the most common sources of distrust with the processor that tend to discourage the continuation of the relationships. Product rejection is mainly caused by two factors: (1) deficient transport conditions and (2) immature pepper included in the deliveries. Since most farmers act individually at the moment of the delivery, these two factors cause rejection rates that are partially out of their control. We explore possible forms of collective action amongst farmers with the aim of increasing the quality of pepper by improving transport conditions and organizing monitoring at the point of collection. This could reduce rejection rates and increase the farmers' bargaining power. Yet, the costs of organizing collective action should be less than the potential income increase that results from a reduction of refused pepper and/or the received price premium. We conduct the analysis for 19 farm-households from *El Roble* settlement; since this was the only group that started a peasant organization when market conditions changed from a competitive situation in the year 2000 to a monopsonistic market in the year 2001. We design a non-linear integer simulation model inspired by the modeling approach proposed by Dorward, (2001), which can maximize the processor's and farmers' gross income (value of sales less value of variable and fixed costs, not including labor, capital and land costs). We compare different delivery scenarios searching for hybrid organizational forms, and assess the associated trade-off between governance costs and benefits that could optimize farmers' income and processors' profit.

Our model scenarios simulate the effects of collective action under initial monopsonic market conditions[39]. The model results indicate that low procurement prices of fresh pepper can make the farmers breach the group contract, even between different seasons in the year. It is furthermore shown that group contracts are only rational when higher prices prevail. To justify the group contracts, the costs of organizing collection and transport and the membership fee should be lower than the gains reached from the lower rejection rates. If the price is too low, or the organization costs are too high, the farmers may prefer individual contracts, even if the rejection rates are high. At higher prices, they

[39] As soon as all farmers, in a specific location, form a group or a cartel, the market condition changes to a bilateral monopoly.

have an incentive to organize the collection and transport of the pepper through the group. The model shows that the firm should not overuse its bargaining power beyond this self-enforcing price range as the farmers might easily breach the contracts. Furthermore, group contracting can be beneficial for risk-averse farmers in either the low or high season. We also simulate what type of governance structure is chosen when the selling price is endogenously established in the model and the income of the processing firm and the farmers is maximized. This analysis demonstrates that under certain conditions the incomes of the monopsonic processing firm and the farmers' association are jointly maximized by a group contract, enforced by low opportunistic behavior from both agents. The model shows that the processing firm is better-off dealing with a group contract instead of a multiple set of smaller individual contracts when farmers show low opportunistic behavior; even in the monopsonistic market situation. The latter outcome is important in the sense that collective action might be needed only under certain market conditions, but not all the time. The model forecasts a breach of the group contract under conditions of low supply of fresh pepper just because it becomes too expensive or unattractive. However, if the production remains stable throughout the year, with regular weekly supplies and limited season variation, group contracts will be preferred all the time. For the future development of pepper production in Costa Rica, an increase in productivity and stabilization of production throughout the year is required, with the aim of increasing (and especially stabilizing) the frequency of transactions, to improve the trust between actors, encourage low opportunistic behavior, and thereby strengthening the prospects for vertical integration between the parties. This can be done by changing the present market-specification contract for a production-management contract. Otherwise, under irregular supply through the year seasonal contracts will be still the best scenario.

In Chapter 6 we present the most important findings of this thesis and some related policy implications. The present research emphasized in the analysis of supply chains for the pepper and chayote case studies by focusing on differences in the *characteristics of the commodities* as well as the *types of farm households* and the derived *implications* for *market configuration* and *contract choice*. This comparison enabled us to yield insights on the endogenous character of the selected contractual arrangements (Escobal *et al.*, 2000) and draw pertinent conclusions regarding the efficiency and equity effects of supply chain cooperation.

Our analysis of farmers' contract choice in both supply chains led us to identify three major functions of contracts, namely (1) a security device to enable farmers to take up a new production activity and to gain access to specialized markets; (2) a provision of incentives for investment and thus increase the asset-specificity on the farmer's side; and (3) a provision of information about the structure of the market where they operate, which is very important to prevent false expectations and adverse selection problems. These functions yield certain effects on the farmers' decisions regarding resource

allocation and supply chain integration. We therefore discussed the implications of contracts for guaranteeing smallholder access (equity), for production efficiency, and for the long-term sustainability of supply chain cooperation.

Finally, we draw some public and private roles for enhancing supply chain integration. While contracts are essentially private, there is still an important place for public action to safeguard the efficiency, equity and sustainability of supply chain cooperation. Contract farming can become an integral part of agrarian policy-making, where the government, together with farmers and firms, joins efforts and interests in order to promote an inclusive strategy of local sustainable development. This strategy should include public interventions for regulating market access (*i.e.* definition of a framework for legal enforcement and recourse), providing information and control (*i.e.* definition of minimum public grades and standards), and promoting farmers' organization. Moreover, governmental support is required for supply chain coordination towards product and process upgrading are of utmost importance. Through these interventions, a framework can be implemented to enhance bargaining power and reduce the institutional risk for smallholder producers willing to participate in contract farming.

Samenvatting (Summary in Dutch)

Transactiekosten en marktfalen zijn wijdverspreid in de landbouwsector van opkomende economieën en hebben een negatieve invloed op de kleinschalige lage-inkomenslandbouw, die moeilijkheden ondervindt bij de integratie in dynamische landbouwvoedselketens. Bestaande literatuur beschrijft contractteelt in de landbouw als een economische institutie waarmee kleine boeren toegang kunnen verwerven tot beter ontwikkelde markten en geïntegreerd raken in afzetketens. Niettemin zijn de ervaringen met het invoeren van contractteelt in de landbouw in verschillende landen van Latijns Amerika nogal uiteenlopend en biedt de loutere aanwezigheid van contracten geen zekerheid voor duurzame handelsrelaties. Dit onderzoek beoogt de effectiviteit van contracten in de landbouw te analyseren als een markt institutie tussen kleine boeren en verwerkende bedrijven in Costa Rica. Het onderzoek richt zich op het identificeren en analyseren van volgende centrale vragen: (1) de structurele karakteristieken van de twee typische landbouwvoedselketens van niet-traditionele producten, nl. peper (*Peper nigrum* L.) en chayote (*Sechium edule* Sw.); (2) de gedragspatronen van marktagenten bij het afstemmen op, en aanpassen aan de markten waarin zij opereren binnen bepaalde contractuele overeenkomsten; (3) de effectiviteit en de onderliggende rationaliteit van de lopende contractuele overeenkomsten; en (4) de kansen en belemmeringen voor het verbeteren van de contractuele overeenkomsten tussen het bedrijf en de boeren. Teneinde bovenstaande aandachtspunten te bestuderen hanteren we een analytisch kader dat gebaseerd is op de *Structure-Conduct-Performance* benadering, alsmede een modelbenadering ter beoordeling van organisatiestrategieën onder monopsonistische marktomstandigheden. Binnen dit kader kunnen we verschillende strategische interacties tussen de twee partijen (het bedrijf en de boer) analyseren en verklaren, gegeven de te verwachten asymmetrie van informatie en de transactiekosten waaraan het hoofd geboden moet worden.

In Hoofdstuk 2 analyseren we eerst de oorzaken van het marktfalen in ontwikkelingslanden en het ontstaan van alternatieve instituties als reactie op dergelijk marktfalen. Contractteelt is een organisatievorm die ontstaat als antwoord op het falen van markten voor krediet, verzekering, informatie, productiefactoren, en afzet; terwijl transactiekosten zijn geassocieerd met het zoeken naar informatie over prijzen of markten, de overdracht van technologie en de verdeling van onderhandelingsmacht, en het toezicht en de handhaving van transacties met een andere partij (Grosh, 1994; Key en Runsten, 1999). Voor de volgende agent in de keten, namelijk het opkopende bedrijf, verzekert het contract een continue aanvoer van producten, op het juiste moment en met de gewenste karakteristieken, zonder dat het volledige productiesysteem gecontroleerd wordt. Daarom worden contracten geplaatst tussen open markten en volledige integratie, overeenkomstig een bepaald niveau van ketenmanagement, als een geschikt mechanisme voor het spreiden van risico's tussen de contractpartijen. De literatuur onderscheid drie belangrijke elkaar niet-uitsluitende categorieën van

contracten, namelijk: *market specification, product management* en *resource-providing* contracten. *Resource-providing* contracten zijn bijzonder belangrijk voor het afdwingen van duurzaamheidcriteria of voor het bevorderen van kwaliteitsverbetering. De keuze van een specifiek type van contract hangt af van het type product, de karakteristieken van de contracterende partijen en de heersende marktomstandigheden in een bepaalde periode. Daarnaast zijn onzekerheid, onderhandelingsmacht, specifieke kapitaalgoederen, en mechanismen voor het afdwingen van afspraken voorname aandachtspunten bij keuze van het besturingsregime in de afzetketen. De kansen voor het bereiken en bestendigen van een *win-win* situatie middels een overeenkomst hangen af van het niveau van onderlinge vertrouwen, de uitwisseling van informatie tussen de agenten, de relatieve verdeling van de onderhandelingsmacht en de kosten voor het garanderen van de contractvoorwaarden. Succesvolle integratie van kleine- en middelgrote boeren in exportmarkten lijkt meer in het bijzonder af te hangen van het type contract dat wordt aangegaan met het bedrijf. Dit contract bepaalt het inkomensniveau, de mate van autonomie en het risiconiveau dat wordt aanvaard of gedeeld met het bedrijf, en beïnvloedt de bereidheid tot investeringen gericht op kwaliteitsverbetering of op het behoud van natuurlijke hulpbronnen. Dynamische ketenvoordelen kunnen enkel bereikt worden indien contracten de boer in staat stellen om zich aan te passen aan deze veranderingen in de markt. Daarnaast kunnen niet-prijs factoren die impliciet in het contract zijn opgenomen, boeren aanzetten tot het verbeteren van de efficiëntie van hun productiesystemen en contractuele verhoudingen.

In Hoofdstuk 3 analyseren we de beweegredenen en de effectiviteit van de verschillende types van contractuele regimes onder twee marktvormen, tussen kleinschalige producenten van peper en verwerkende bedrijven in de Noordelijke regio van Costa Rica. Speciale aandacht wordt geschonken aan de stimulansen voortkomend uit de contracten voor het aanpassen van de productiesystemen en overlevingsstrategieën. Peper is een aantrekkelijke diversificatie activiteit voor de kleine boeren omdat het een arbeidsintensieve teelt is, geen complexe technologieën of machines vereist, zorgvuldige aandacht en geregelde controle op ziektes tijdens de gehele teeltcyclus vereist, en een hoog en relatief stabiele opbrengst per hectare kan bereiken. Dit geeft de familiale landbouwbedrijven een competitief voordeel ten opzichte van grote commerciële plantages. Een belangrijk probleem voor de kleine boeren betreft echter de hoge kosten gedurende de opstart fase, die noodzakelijk zijn voor de initiële investeringen bij het opstarten van de teelt en gedurende de lange rijpingstijd tot aan de eerste oogst. Contracten kunnen behulpzaam zijn als strategie om deze belemmeringen te boven te komen en staan markttoegang toe tegen een lager niveau van onderzekerheid (Dorward, 2001).

In de peper sector van Costa Rica onderscheiden we twee verschillende marktsituaties (competitieve markt en lokale monopsonie) en drie types van contractuele verbintenissen (geschreven contracten, mondelinge contracten en geen verbintenis). De data analyse werd uitgevoerd gebruik makend van het *Structure-Conduct-Performance* kader (Bain, 1968; Martin, 1993) voor de operaties op de

pepermarkt, gevolgd door een statistische analyse van de huishoud- en productiekarakteristieken voor het identificeren van de oorzaken en effecten van de contractkeuze en voor het inschatten van het belang van contracten voor het efficiënt gebruik van de hulpbronnen. We voerden een enquête uit onder de peperproducenten met behulp van een semi-gestructureerde vragenlijst om gegevens te verzamelen over productiesystemen en marktverbintenissen. We verzamelden gegevens van 50 producenten die 65% van alle boeren vertegenwoordigen die peper leverden aan drie verwerkende bedrijven.

De analyse van de marktkeuze toont aan dat boeren met lage inkomens vooral contracten nodig hebben in de beginfases voor het opstarten van de meerjarige gewassen omdat deze een garantie biedt voor de investeringsinspanningen. In opeenvolgende fasen en onder meer competitieve marktomstandigheden verkiezen producenten verbale verbintenissen boven geschreven contracten. Bij afwezigheid van boetes zouden peperboeren met verbintenissen in markten met toegenomen concurrentie zich minder loyaal kunnen opstellen ten opzichte van hun afnemer. De meeste boeren blijven het grootste deel van hun oogst verkopen aan een vaste opkoper maar leveren ook kleinere volumes aan concurrenten. Bijgevolg vervullen contracten verschillende functies tijdens de levenscyclus van het boerengezin en zijn deze ook verschillend onder diverse marktomstandigheden. De analyse heeft tevens aangetoond dat diversificatie van inkomensbronnen een duidelijk effect hebben op de contractkeuze en de onderhandelingsmacht van de boer. Inkomensdiversificatie maakt het voor de boer mogelijk om specifieke investeringen voor de teelt van peper te verrichten, zelfs zonder de zekerheid die in een contract wordt geboden. Daarnaast investeren boeren met contracten duidelijk meer grondstoffen en tijd in bodemonderhoud op hun peper percelen. *Resource-providing* contracten binnen de competitieve markt hebben een sterker effect dan eenvoudige *market-specification* contracten in een monosponistisch segment. Dit bevestigt de literatuur over het belang van *resource-providing* contracten en verticale integratie voor duurzame intensivering van de landbouw (Kuyvenhoven en Ruben, 2002). Boeren met budgettaire problemen die hun investeringsbeslissingen willen afstemmen op het beschikbare technologische pakket, kunnen het meststoffen deels vervangen door meer arbeid te investeren in activiteiten voor bodemonderhoud. Boeren zonder verbintenissen kunnen efficiënt peper produceren, maar zetten aanzienlijk minder investeringen in voor het beheer van de natuurlijke hulpbronnen.

Het effect van contracten onder verschillende marktsituaties duidt erop dat een lokaal monopsonie perverse stimulansen zou kunnen genereren voor vaste investeringen in de peperplantages in vergelijking met de situaties waar concurrentie bestaat tussen kopers. We hebben beduidend lagere oogsten per hectare opgetekend in de monopsonistische regio, zelfs wanneer de boeren meer hulpbronnen gebruiken. Een lokaal monosponie kan de transitie naar meer kapitaalsintensieve productiesystemen bevorderen, vooral wanneer beroep wordt gedaan op contractuele regimes waarbij

hulpbronnen worden geleverd zodat de inputkosten (tijdelijk) lager worden. Dit duidt op een samenhang tussen de beslissingen over de techniekkeuze en de keuze van marktorganisatie. Tenslotte zijn boeren met contracten doorgaans beter geïnformeerd en meer toegewijd aan de verbintenis met de koper. Echter, de loyaliteit van deze boeren is waarschijnlijk meer gerelateerd aan het gebrek aan onderhandelingsmacht dan aan de beschikbaarheid van marktinformatie.

In Hoofdstuk 4 analyseren we de kritische factoren die bepalen of producenten van chayote in aanmerking komen voor exportlevering aan handelaren/verwerkende bedrijven en de invloed van contracten op de kwaliteitsprestaties en loyaliteitsrelaties binnen de chayote toeleveringsketen. Inheemse groenten, zoals chayote, vertegenwoordigen een groeiend aandeel in de niet-traditionele uitvoer vanuit Costa Rica. De mogelijkheden voor boeren om deel te nemen in globale landbouw-voedselketens hangen af van de relaties die opgebouwd zijn met verpakkers en (inter)nationale tussenpersonen. Boeren die een betere kwaliteit en een constante aanvoer kunnen garanderen maken een betere kans om preferentiële leverancier te worden. Het oogsten van de groenten in een onrijp stadium en een snelle levering aan exporteurs verbeteren de houdbaarheid op het schap en de kwaliteit, omdat opslag de stevigheid, het voorkomen, de smaak en de voedingswaarde beïnvloedt (Marín-Thiele, 1997). Contractuele verbintenissen kunnen bijdragen tot het verminderen van de onzekerheid van de boeren en zijn bedoeld om de loyaliteit tegenover de verwerker-exporteur te verbeteren. Terwijl de prijzen die worden betaald aan boeren maar weinig hoger zijn dan de prijzen op de nationale markt, zijn andere aankoopvoorwaarden – zoals de afspraken van betaling, het voorzien van krediet voor grondstoffen, en de frequentie van levering – evenzeer of zelfs belangrijker voor beslissingen betreffende de keuze van verkoopskanaal (Hart en Holstrom, 1987). Verder maken additionele diensten (d.w.z. zaden, krediet en technische bijstand) het voor de boeren mogelijk om hun productkwaliteit te verbeteren tegen relatief lage kosten, terwijl zij eveneens helpen om het opportunistisch gedrag van boeren te controleren (Chiarelli *et al.*, 2002). Boeren die chayote leveren aan exporteurs gebruiken meer grondstoffen en arbeid, maar moeten langer wachten voordat ze uiteindelijk worden betaald. Daarom is een specialisatie in de productie van chayote slechts een haalbare optie als de leveringscontracten ook voldoende zekerheid bieden.

We gebruiken een analytisch kader dat gebaseerd is op het Structure-Conduct-Performance benadering (SCP) (Bain, 1968; Martin, 1993). Met robuste parameter schatters uit binaire regressies onderzoeken we de determinanten van de betrokkenheid van de boeren in de exportproductie. Tobit en Logit modellen werden gebruikt voor het onderzoeken van de kans van contractuele verbintenissen tussen de producenten en exporteurs, en voor het analyseren van de sleutelfactoren die de kwaliteitsprestaties en loyaliteit beïnvloeden. Gegevens werden verzameld van de chayote producenten in ongeveer vijftien dorpen in de vallei van de *Ujarrás* in centraal Costa Rica. 120 boeren werden geselecteerd met behulp van een gestratificeerde steekproef uit een totale populatie

van 450 chayote producenten die zijn opgedeeld in twee categorieën: traditionele chayote producenten en producenten in IDA nederzettingen

Contracten zijn een belangrijke strategie voor het verbeteren van de zekerheid en van de betrokkenheid van kleine boeren in internationale toeleveringsketens. Boeren die leveren onder (in)formele contracten met een verwerkend bedrijf/exporteur hebben een betere toegang tot krediet, kritische hulpbronnen en informatie, hetgeen hen toestaat te genieten van schaalvoordelen. De voorkeur van de producenten voor bepaalde verwerkende bedrijven/exporteurs wordt bepaald door de prijs die wordt betaald voor hun producten, maar ook niet-prijs factoren (zoals toegang tot krediet, technische bijstand en markt informatie) blijken evenzeer of zelfs nog belangrijker te zijn. Bovendien blijken prijzen positief gerelateerd te zijnaan exportcontracten, en deze contracten stimuleren op hun beurt de intensivering van chayote productiesystemen. Het bestaan van een contract verhoogt de zekerheid voor de producent, en maakt investeringen in bodemverbetering en betere teeltmethoden mogelijk. Toch is er geen direct verband gevonden tussen de leveringen onder contract en de kwaliteit van het product, terwijl een sterke invloed op de loyaliteit wel bevestigd werd. Contracten beïnvloeden het landbouwproductiesysteem en de gezinsinkomens op twee verschillende manieren. Ten eerste, de kwaliteit verbeterd als gevolg van een beter landgebruik en meer arbeid is beschikbaar voor teeltmanagement en productbeheer. Dit wordt voornamelijk gegarandeerd door de keuze als contractuele partners van recentelijk gevestigde boeren met grotere gezinnen. Ten tweede, loyaliteit wordt sterker naarmate boeren zich verzekerd weten van een hoge frequentie van levering. Dit is bijzonder belangrijk om de na-oogst kwaliteit te behouden en ter vermindering van het percentage productie dat wordt afgewezen. Loyaliteit met de verwerker/ exporteur vereist verder contractuele verbintenissen waarin voorzieningen worden getroffen voor technische bijstand en marktinformatie, evenals voldoende faciliteiten voor tijdige levering van het product en betalingsregimes.

In Hoofdstuk 5 analyseren we de dynamiek van de contracten in de toeleveringsketen van peper in Costa Rica. Er is geen open markt voor peper en sinds 2001 is er maar één enkel verwerkend bedrijf dat verse peper opkoopt bij boeren volgens vaststaande kwaliteitseisen. Toch wordt gemiddeld 10% van iedere levering afgekeurd. Dit is een erg gevoelig punt voor arme boeren en één van de meest voorkomende bronnen van wantrouwen ten opzichte van het bedrijf, hetgeen bijdraagt aan het ontmoedigen van duurzame verhoudingen. Het afkeuren van het product is voornamelijk het gevolg van twee factoren: (1) slechte omstandigheden van transport en (2) onrijpe peper in de leveringen. Omdat de meeste boeren individueel handelen op het moment van de levering, staan beide factoren die leiden tot afkeuring gedeeltelijk buiten hun controle. We gaan na welke vormen van samenwerking tussen de boeren mogelijk zijn met het doel de kwaliteit van peper te verbeteren door de transportomstandigheden te verbeteren en door het organiseren van de controles bij het verzamelpunt. Hiermee zou het percentage dat wordt afgekeurd kunnen verminderen en de

onderhandelingsmacht van de boeren versterkt kunnen worden. Echter, de kosten voor het organiseren van samenwerking dienen lager te zijn dan de potentiële inkomensstijging als gevolg van een vermindering van de afgekeurde peper en/of de premie bovenop de verkregen prijs. We voeren de analyse uit voor 19 gezinsbedrijven van de *El Roble* nederzetting; dit is de enige groep was een boerenorganisatie reeds is opgestart toen de marktomstandigheden veranderden van een competitieve situatie in 2000 naar een monopsonistische markt in 2001. We ontwikkelden een niet-lineair integer simulatiemodel dat is geïnspireerd door het model voorgesteld door Dorward (2001), waarin het bruto inkomen (*i.c.* waarde van de verkoop minus de waarde van de variabele en vaste kosten, zonder de kosten van arbeid, kapitaal en land) van het verwerkend bedrijf en de boeren wordt gemaximaliseerd. We vergelijken verschillende scenario's voor levering waarbij gezocht is naar hybride organisatievormen, en we bepalen de bijhorende afweging die wordt gemaakt tussen de besturingskosten en de voordelen die het inkomen van de boeren en de winst van het verwerkende bedrijf kunnen optimaliseren.

De scenario's in ons model simuleren de effecten van samenwerking onder een initiële monosponische marktvoorwaarde.[40] De resultaten van het model tonen aan dat lage prijzen voor de bevoorrading van verse peper aanleiding kunnen geven tot het verbreken van een contract, zelfs tussen verschillende seizoenen in het jaar. Eveneens wordt aangetoond dat groepscontracten alleen rationeel zijn indien er hogere prijzen heersen. Om groepscontracten te rechtvaardigen moeten de kosten voor het collectief organiseren van het ophalen en transport en de kosten voor het lidmaatschap lager zijn dan de winsten die bereikt worden door een lager afkeuringspercentage. Als de prijs te laag is, of de organisatiekosten te hoog zijn, zou het kunnen dat de boeren voorkeur geven aan individuele contracten, zelfs als het afgekeurde percentage hoog is. Bij hogere prijzen worden ze gestimuleerd om het ophalen en transport van peper te laten organiseren door de groep. Het model toont aan dat als het bedrijf zijn onderhandelingsmacht teveel uitbuit en hiermee de grenzen overschrijdt van de prijszone waarbinnen het contract uit zelfcontrole wordt gehonoreerd, de boeren het contract gemakkelijk kunnen verbreken. Daarnaast kan een groepscontract voordelig zijn voor risicomijdende boeren in het laag- of hoogseizoen. We simuleren ook welk type organisatiestructuur wordt verkozen wanneer de verkoopsprijs endogeen wordt bepaald in het model en het inkomen van het verwerkende bedrijf en de boeren wordt gemaximaliseerd. Deze analyse toont aan dat - onder bepaalde voorwaarden - het inkomen van het monopsonistisch verwerkend bedrijf en van de boerenvereniging gelijktijdig wordt gemaximaliseerd door een groepscontract, afgedwongen door een beperkt opportunistisch gedrag van beide agenten. Het model geeft eveneens aan dat het voor het verwerkende bedrijf voordelig kan zijn om een groepscontract aan te gaan in de plaats van een set van kleinere individuele contracten - zelfs

[40] Zodra alle boeren in een specifieke locatie een groep of kartel vormen, veranderen de marktvoorwaarden naar een bilateraal monopolie.

in een monopsonistische marktsituatie.- vooral wanneer boeren beperkt opportunistisch gedrag vertonen. Dit laatste resultaat is belangrijk in de zin dat samenwerking enkel nodig zou kunnen zijn onder bepaalde marktsituaties, maar niet altijd. Het model voorspelt dat het contract wordt verbroken als het aanbod van verse peper laag is omdat het te duur wordt en daarom onaantrekkelijk. Echter, als de productie stabiel blijft gedurende het jaar, met regelmatige wekelijkse leveringen en beperkte seizoensvariatie, zullen groepscontracten altijd de voorkeur genieten. Voor de toekomstige ontwikkeling van de peperproductie in Costa Rica is een productiviteitsverhoging en een meer constante productie over het hele jaar vereist, waardoor het mogelijk wordt om de frequentie van leveringen te verhogen (en te stabiliseren), het vertrouwen tussen de actoren te verbeteren, een gedrag met beperkt opportunisme te bevorderen, en daarbij de vooruitzichten voor de verticale integratie tussen de partijen te versterken. Dit kan plaatsvinden door het veranderen van de huidige markt-specificatie contracten in product-management contracten. Anderzijds blijven seizoensgebonden contracten het beste scenario bij een onregelmatig aanbod over het jaar.

In Hoofdstuk 6 presenteren we de belangrijkste bevindingen van deze studie evenals enkele gerelateerde implicaties voor het beleid. Dit onderzoek analyseert de toeleveringsketens voor peper en chayote door zich te concentreren op de verschillen in de karakteristieken van de gewassen, op de verschillen in types van bedrijfshuishoudingen en de afgeleide implicaties voor de marktconfiguratie en keuze van contracten. Deze vergelijking staat ons toe om inzicht te krijgen in het endogene karakter van de gekozen contractuele verbintenissen (Escobal *et al.*, 2000) en om duidelijke conclusies te trekken met betrekking tot de gevolgen van ketensamenwerking voor efficiëntie en verdeling.

Onze analyse van de contractkeuze door de boeren in beide toeleveringsketens geeft aanleiding tot het identificeren van drie belangrijke functies van contracten, namelijk (1) een zekerheidsmechanisme dat de boeren toestaat om een nieuwe productieactiviteiten op te starten en om toegang te krijgen tot gespecialiseerde markten; (2) het voorzien van stimulansen om te investeren en dus om de specifieke kapitaalgoederen te vergroten binnen het boerenbedrijf; en (3) het voorzien van informatie over de marktstructuren waarbinnen wordt gewerkt, hetgeen zeer belangrijk is voor het vermijden van valse verwachtingen en onjuiste selectieproblemen. Deze functies leiden tot bepaalde effecten op de beslissingen van de boeren met betrekking tot de hulpbronnenallocatie en de ketenintegratie. We bespraken de implicaties van contracten voor het garanderen van markttoegang voor kleine boeren (gelijkheid), voor de efficiëntie van de productie, en voor de duurzaamheid van de samenwerking in de toeleveringsketen op lange termijn.

Tenslotte duiden we enkele publieke en private functies aan voor het verbeteren van de integratie in de toeleveringsketen. Terwijl contracten voornamelijk private beslissingen zijn, is er een belangrijke

rol weggelegd voor publieke maatregelen die de effectiviteit, gelijkheid en duurzaamheid van de samenwerking in de toeleveringsketen kunnen beschermen. Contractteelt kan een integraal onderdeel worden van het landbouwbeleid, waar de overheid samen met boeren en bedrijven inspanningen levert en interesses verenigd om een inclusieve strategie van locale duurzame ontwikkeling te bevorderen. Deze strategie zou het volgende kunnen omvatten: publieke interventies voor het reglementeren van markttoegang (d.w.z. definiëren van een wettelijk kader voor deelname en beroep), ter beschikking stellen van informatie en controles (d.w.z. definiëren van minimale publieke normen en standaarden), en het bevorderen van landbouworganisaties. Daarnaast is overheidssteun vereist voor de coördinatie in de toeleveringsketen ter versterking van productie en procesinnovaties. Middels deze interventies kan een kader worden gecreëerd ter versterking van de onderhandelingsmacht en voor het verminderen van het institutioneel risico van kleinschalige producenten die willen gaan deelnemen in de contractteelt.

Training and supervision plan

Educational program within Mansholt Graduate School (MGS) completed by F. Sáenz-Segura

Courses			
Name of the course	**Department / Institute**	**Year**	**Credits***
Farm Household Economics	Wageningen University, WUR	1999	3
Regional Agricultural Development: Analysis and Policy	Wageningen University, WUR	1999	3
Macroeconomic Analysis and Policy	Wageningen University, WUR	1999	3
Quantitative Analysis and Development Policy	Wageningen University, WUR	1999	3
Mathematical Methods for Economists	Tinbergen Institut	1999	4
Microeconomic Theory	Tinbergen Institut	1999	4
Macroeconomic Theory	Tinbergen Institut	1999	4
Supply Chain Management: chain responsiveness and the new economy	Mansholt Graduate School	2001	3
Multivariate Methods for the Research in Agriculture	Universidad Nacional, Costa Rica	2002	2
Supply Chains Economics	Mansholt Graduate School	2004	2
II. Presentations at conferences and workshops			3
First research workshop. Project "Improved Sustainability of Agro-Food Chains in Central America: A Techno-Managerial Approach". IVO/TU-CINPE/UNA, Ciudad Guatemala, Guatemala		2003	1
6th Conference Chain and Network Management in Agribusiness and the Food Industry. The Business Administration/Management Studies Group, Wageningen University and Research Centre, Ede ,The Netherlands		2004	1
Mansholt Multidisciplinary Seminar, Wageningen University, The Netherlands		2004	1
Total credits			34

* One credit is equivalent to 40 hours of course work.

Curriculum vitae