Assessing the performance of supply chains from a smallholder perspective: A model of farmer-buyer engagement and its application in Nepal

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Abstract

This study considers supply chain performance from the perspective of smallholders. It draws on Transaction Cost Economics to develop a model explaining dyadic relationships between smallholders and their buyers. The model extends the traditional vertical coordination continuum to incorporate missing dyads and informal markets. It aims to identify factors that constrain marketing choices available to smallholders, limiting the chain's robustness from their perspective. The model is used to analyse the supply chain for organic fresh vegetables in Kathmandu, Nepal, and to derive policy recommendations from the analysis. This chain is characterised mainly by relational contracting between smallholders and their immediate buyers. There was also evidence of vertical integration by some buyers, and of growers selling on informal markets. However, there was no evidence of spot market trading or of conventional contracting. Despite this, the chain offered smallholders a range of dyads with different risk-reward trade-offs. It is concluded that government agencies could play a key role in building a more robust chain by helping these parties to deepen and extend their relational contracts, by establishing standards and rules for organic produce traded in municipal spot markets, and by facilitating farmer marketing groups and advising them on production plans, technology and participatory guarantee systems. The government could also improve physical infrastructure, mandate extension staff to facilitate and witness contracts, and provide contractual parties with easy access to legal recourse for small claims.

Key words: Small farmers, markets, transaction costs, farmer-buyer dyads, vertical coordination, organic vegetables

1 Introduction

Agriculture remains a major source of livelihood for most of the rural poor in developing countries (World Bank, 2007). Smallholders need higher incomes to cope with rising prices of food and basic services. Linking smallholders to markets will play a critical role in

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sustaining their livelihoods and promoting both rural and urban food security (Wheatley & Peters, 2004).

Linkages between producers and markets are becoming increasingly coordinated to meet growing demands for high quality, safe food. Such shifts are seldom beneficial to smallholders who struggle to meet the costs imposed by these demands (Markelova, Meinzen-Dick, Hellin, & Dohrn, 2009; Pingali, Khwaja, & Meijer, 2005; Poulton, Kydd, & Dorward, 2006; Shepherd, 2007; Vorley, Lundy, & MacGregor, 2009). It is therefore important to identify ways of maintaining and promoting smallholder engagement in food supply chains. However, literature relating to chain performance (Aramyan, 2007; Brewer & Speh, 2000; Cadilhon, Fearne, Giac Tam, Moustier, & Poole, 2006; Chan & Qi, 2003; Chen & Paulraj, 2004; Gunasekaran, Patel, & McGaughey, 2004; Lohman, Fortuin, & Wouters, 2004) focusses on whole chain issues and seldom considers performance from a smallholder perspective.

This study takes the smallholder view and explores the ability of supply chains to sustain smallholder engagement. It focuses on the dyad between growers and their immediate buyers, and applies the axiom that a chain is robust if it has one or more dyads that sustain smallholder engagement. A chain that offers smallholders a range of such dyads, each with its own risk-reward profile, is considered to be more robust than one that offers smallholders few marketing choices.

The paper draws on Transaction Cost Economics (Hobbs, 1996; Williamson, 1979, 1985) to develop a model explaining dyadic relationships between smallholders and their buyers (Section 2), and uses this model to analyse a case study of the supply chain for organic fresh vegetables in Kathmandu (Section 3). The model extends the traditional vertical coordination continuum to incorporate missing dyads and informal markets. The aim of the analysis is to identify what dyads are (or are not) used by smallholders and to explain why they are (or are not) used by them. The purpose of the analysis is to identify effective ways of improving chain robustness from the smallholder perspective (Section 4).

2 A model to analyse smallholder supply chains

Shepherd (2007) describes some of the common marketing channels used by small farmers. Each channel starts with a farmer-buyer dyad. A dyad is not sustainable unless it generates acceptable levels of risk and reward for the buyer and seller (Lee, 2004; Narayanan & Raman, 2004). Supply chains that comprise several different marketing channels can offer smallholders more choice in their search for acceptable levels of risk and reward. For the purpose of this study, a chain is considered to be robust if it provides smallholders with one or more sustainable dyads. Hence, the wider is the choice of sustainable smallholder-buyer dyads, the more robust is the chain.

Transaction cost economics provides useful insights into dyadic relationships. Hobbs (1996) defines transaction costs as the costs of carrying out any exchange. Williamson (1985, pp. 20-21) distinguishes between *ex ante* and *ex post* transaction costs. *Ex ante* transaction costs are mostly fixed costs associated with the search for trading partners and negotiation of agreements. *Ex post* transaction costs are those associated with monitoring and enforcing agreements, and with the risk of losses caused by a breach of contract. *Ex post* transaction costs are largely variable costs that increase with the volume transacted. Pingali, Khwaja, & Meijer (2005) note that transaction costs could be specific to buyers, suppliers, location and the crop.

2.1 Drivers of transaction costs

Asset specific investment, uncertainty surrounding transactions, and frequency of transactions increase transaction costs (Williamson, 1979; 1985, pp. 52-61). Complexity is also viewed as contributing to transaction costs (Hobbs & Young, 2001; Jaffee, 1995b; Poulton & Lyne, 2009).

Asset specificity

Asset specificity arises when a trading partner invests in assets that have little or no value in an alternative use (Hobbs, 1996). Such investment may be specific to a relationship or a group of potential relationships. Asset specific investment exposes the investor to risk of hold-up that can be exploited opportunistically unless appropriate contractual safeguards

are designed (Klein, Crawford, & Alchian, 1978). From a farmer perspective, Jaffee (1995a) notes that asset specificity arises from the gestation period of the crop, and the degree of specialisation of production technique and knowledge.

Uncertainty

Uncertainty refers to unanticipated changes in the circumstances surrounding a transaction. Such changes may arise due to environmental or behavioural risks (Jaffee, 1995b). Environmental risk arises when suppliers are otherwise trustworthy but cannot honour the terms of trade for reasons that are beyond their control; for example, unfavourable weather may prevent farmers from fulfilling supply contracts. Such outcomes are frequently observed in trading relationships with small scale farmers because they do not have the capital, technical skills and technologies to mitigate adverse changes in farming conditions (Vorley et al., 2009). Producers might also face uncertainty in finding a buyer if products are of idiosyncratic quality (Hobbs & Young, 2001).

Behavioural risk arises when a contracting party alters its behaviour after a contract has been agreed. Pervasive opportunism, which is defined by Williamson (1985, p. 47) as self-interest seeking with guile, manifests as a lack of trust. Side-selling and price manipulation are perhaps some of the more common symptoms of opportunism in relationships between smallholders and their buyers. The presence of opportunism gives rise to transaction costs in the form of monitoring behaviour, safeguarding assets, losses caused by a breach of contract, and contract enforcement (Grover & Malhotra, 2003).

Complexity

Perishability, specificity of quality standards, seasonality of supply and traceability requirements increase the complexity of transactions (Jaffee, 1995b; Poulton & Lyne, 2009). Complexity increases transaction costs by increasing the uncertainty of supply, by increasing information and monitoring costs (Hobbs & Young, 2001; Jaffee, 1995b), by increasing the need for assets that have little value in alternative uses, and by increasing the cost of renegotiating (incomplete) contracts *ex post* (Poulton & Lyne, 2009).

Frequency

Transaction costs are also expected to increase with the frequency of transactions. However, frequency should not be confused with recurrence. Recurrent transactions involve the same trading partner and could reflect a lack of alternative trading parties or an attempt to avoid high transaction costs associated with frequent transactions. Williamson (1985, p. 60) argues that the cost of specialised governance structures will be easier to recover for large transactions of a recurring kind.

Size

Although transaction costs increase as the volume traded increases, they decline relative to the value of the transaction. For small farmers transacting small quantities, aggregate transaction, compliance and marketing costs can easily exceed the value of their transaction. Vorley et al. (2009) note that inadequate infrastructure and support services in developing countries tend to accentuate this problem, and there is mounting evidence that smallholders are being increasingly excluded from agri-business supply chains by rising transaction and compliance costs associated with demands for a continuous supply of safe, value added food products (Batt & Cadilhon, 2006; Pingali et al., 2005; Reardon, Timmer, & Berdeque, 2005). Collective marketing can reduce these costs but introduces other costs that may prevent market participation (Lyne & Martin, 2008).

Information and power

Vulnerability to opportunism may increase due to information asymmetry regarding intentions and capabilities of trading partners, and the attributes of the product traded (Dorward, 2001; Hobbs & Young, 2001; Jaffee, 1995b; North, 1991). Opportunism may also arise due to power asymmetry between buyers and sellers in the supply chain (Ganesan, 1994; Heide & John, 1988; Vorley et al., 2009). Woods (2004) argues that power is related to dependency created by a lack of alternatives. Information and power asymmetry provide incentives for more informed and powerful agents to extract undue benefits from transactions, or to pass excessive risk to their transaction partners. Perceptions that risks and rewards are not distributed fairly between trading partners tend to discourage

participation by 'weaker' agents, undermining the sustainability of dyads and the robustness of chains (Lee, 2004; Preckel, Gray, Boehlje, & Kim, 2004).

2.2 Transaction costs and the nature of transactions

The factors that influence high transaction costs not only help to explain the presence or absence of farmer-buyer dyads but also help to explain the mode of engagement between farmers and buyers where dyads do exist. Observed dyads are often categorised according to their level of coordination, ranging from spot market through different forms of contracting to vertical integration (Frank & Henderson, 1992; Hobbs, 1996). The principal motive for this progression from 'loose' to 'tight' vertical coordination is the desire to avoid high transaction costs (Frank & Henderson, 1992; Hobbs, 1996; Williamson, 1979; 1985, pp. 129-130; 1991). Consequently, the mode of engagement between transacting parties will be influenced by the drivers of transaction costs (Williamson, 1985, pp. 52-61).

This traditional continuum of vertical coordination from spot market to vertical integration tends to ignore the distinction between spot markets and informal markets. Price is often viewed as the only coordinating mechanism needed to facilitate impersonal transactions between multiple buyers and sellers in spot markets (Gereffi, Humphrey, & Sturgeon, 2005; Hobbs, 1996). However, North (1990) contends that spot markets are coordinated by strong institutions that allow traders to compete purely on price. Poulton & Lyne (2009) note that 'near perfect' spot markets, like commodity exchanges, can focus on price alone thanks to well-defined standards and rules enforced by private or public agencies. This is entirely different from informal markets that lack the benefit of such coordinating institutions. In a smallholder context, such markets tend to be patronised by small numbers of buyers and sellers engaging in highly personalised cash transactions in order to reduce their exposure to opportunism. In addition, the traditional vertical coordination continuum does not explicitly account for the absence of transactions. Figure 1 models vertical coordination as a continuum that progresses from 'no-transaction' to the informal market, spot market, contracting and vertical integration. The model highlights relationships between the drivers of transaction costs and modes of engagement between sellers and buyers, recognising that

the absence of transactions provides valuable information about what it might take to create sustainable dyads.

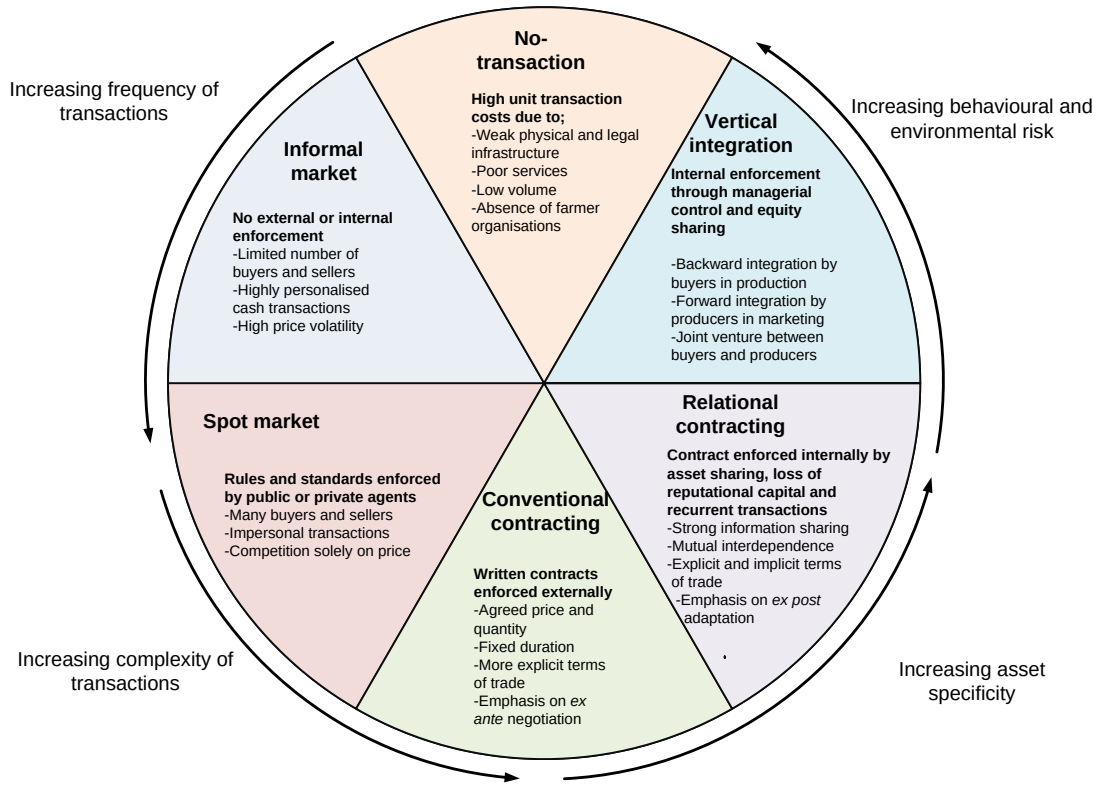

Figure 1: Modes of engagement between farmers and buyers

In Figure 1, the 'no-transaction' segment refers to missing dyads where producers or buyers are either unwilling or unable to transact. Following the logic of TCE, this extreme outcome could reflect prohibitively high unit transaction costs (Benham & Benham, 2000) and could well be characterised by weak physical and legal infrastructure, poor services, small and volatile marketable surpluses, high levels of distrust and the absence of farmer organisations to facilitate joint bargaining and marketing. Some of these attributes might be readily observable, while deeper and more qualitative studies would be required to establish the presence or absence of others.

The 'informal market' segment is analogous to the thin market described by Dorward, Kydd, Poulton, & Bezemer (2009) where prices are not discovered through competition owing to small numbers of buyers and sellers. In the informal market, individual buyers and sellers

trade small quantities of surplus products that have inconsistent supply and quality – especially in the case of perishable products that must be harvested and sold frequently. In the absence of standards, rules and reliable information, unit transaction costs tend to be high and participants often resort to personalised and cash-based transactions in order to reduce their exposure to opportunism.

In contrast, 'spot market' segment is characterised by effective standards, rules and information flows that help to reduce participant transaction costs. Consequently, these markets can draw large numbers of buyers and sellers who compete on price for standardised products and services. Transactions tend to be impersonal without any commitment to engage in repeat transactions. Dyer & Singh (1998) contend that such exchange is seldom characterised by asset specific investment. From a smallholder perspective, well-managed fresh produce markets operated by town and city municipalities may approximate spot markets.

The 'conventional contracting' segment in Figure 1 refers to contracts that specify terms agreed *ex ante* relating to duration, quantity, quality and price, and that are formalised in writing to facilitate external legal enforcement. Williamson (1979), elaborating on Macneil's work, distinguishes between classical and neo-classical contracting. Classical contracting is an efficient form of governance when all contingencies are known *ex ante* and efficient legal remedies are available. On the other hand, neo-classical contracting accepts that contracts are incomplete and that third-party arbitration may be required to address unforeseen contingencies. In either case, conventional contracting is characterised by ready access to external enforcement in a market burdened with environmental and behavioural risk.

The 'relational contracting' segment refers to written or verbal contracts relying on mutual promise between transactors. Relational contracts possess many implicit and some explicit terms, which are open to *ex post* adaptations to unforeseen circumstances. These contracts emerge when there is a threat of hold-up to asset-specific investment for mutually beneficial value-adding, and external enforcement is costly or impractical due primarily to incomplete and complex contracts. Under such conditions, investors seek assurance for the continuity of trade in order to recoup investments by devising internal enforcement

mechanisms. The 'promise' as a contracting process in the absence of opportunism (Williamson, 1985, p. 31) rarely exists in a real world situation. In reality, such contracts are backed with internal enforcement measures such as shared investment in specific assets, incentive payments and the threat of losing reputational capital and repeat business opportunities. These internal methods of addressing opportunism often appear to manifest as trust in relational contracting. Relational contracts are also characterised by strong information exchanges (Dwyer, Schurr, & Oh, 1987; Dyer & Singh, 1998) as there is a need to continually adapt incomplete and complex contracts.

Vertical integration is an extreme form of vertical coordination and refers to integration by buyers and suppliers into upstream or downstream functions instead of trading with another party. Vertical integration arises when integrators see clear benefits in trade but are constrained by prohibitively high transaction costs (Coase, 1937; Frank & Henderson, 1992; Hobbs, 1996; Williamson, 1979; 1985, pp. 85-102). However, vertical integration is not immune to environmental uncertainty and these management-based transactions may also fail to materialise. Common outcomes of vertical integration in agricultural chains are backward integration by buyers into production and forward integration by producers into processing. Another mode of vertical integration is joint equity investment by buyers and sellers in a single firm. Williamson (1979) argues that the advantage of vertical integration lies in quicker adaptation without the need to negotiate, revise or enforce inter-firm agreements. Enforcement in vertical integration is via managerial control (Gereffi et al., 2005).

3 An empirical application of the model

3.1 Research approach and data collection

Several smallholder supply chains in Nepal were examined as part of a wider PhD study, but this paper analyses only the chain for organic fresh vegetables in Kathmandu. Data were gathered from June to July 2011 using the case study method suggested by Yin (2009, pp. 99-126). The case comprised producers, their buyers, potential buyers and supporting government and non-government agencies. The unit of analysis was the farmer-buyer dyad,

and producers and (potential) buyers were treated as sub-units in the embedded case study design.

Semi-structured interviews were conducted with producers, buyers, potential buyers and staff of government and non-government organisations. Interviews were recorded, transcribed and coded using NVivo software to facilitate data retrieval and analysis. The analysis followed the approach recommended by Trochim (1989), Yin (2009, pp. 136-144) and Babbie (2004, pp. 370-371) of searching for patterns in the data and comparing or contrasting observed patterns with those predicted by theory. In this way, theoretical propositions (such as those summarised by the model illustrated in Figure 1) can be confirmed or rejected. If rejected, the data may suggest alternative propositions, shifting the focus of the analysis to 'theory building'.

Figure 2 outlines the process used to analyse the data. First, existing and missing dyads were identified. Missing dyads included past dyads that were no longer evident and the dyads between producers and potential buyers that were not operating. Next, these existing and potential dyads were matched with those represented by the segments of the model in Figure 1. Propositions about the drivers of transaction costs were then checked against the data, and insights revealed by this process were used to inform recommendations aimed at making existing dyads more sustainable and creating new dyads to broaden the range of market channels available to smallholders.

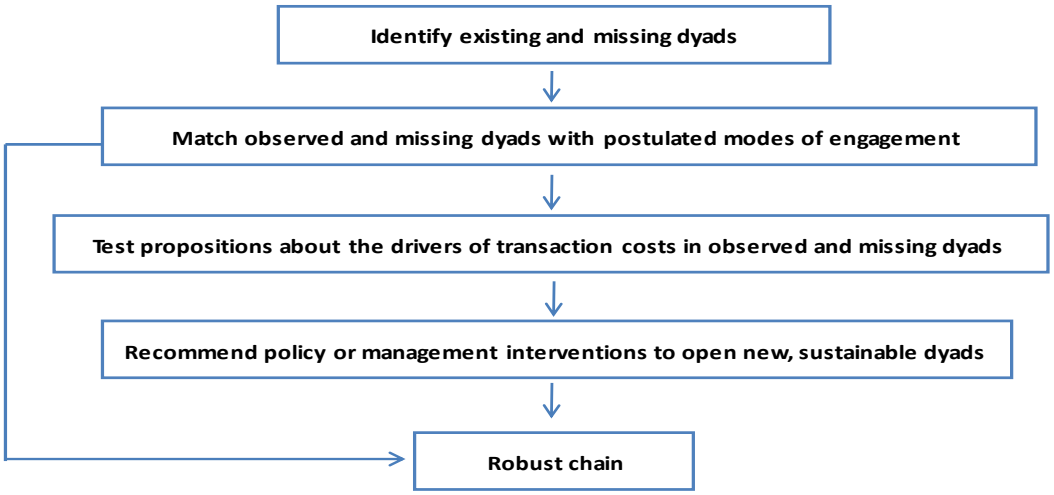

Figure 2: Process used to analyse the supply chain

3.2 A description of the organic fresh vegetable supply chain in Kathmandu

The organic vegetable supply chain is a relatively new chain and includes a range of fresh vegetables. Precise data are not available on the market share of organic vegetables but it is considered to be very small. The aim of this study is not to provide a full account of organic vegetable marketing in Kathmandu but to provide insight into the nature of relationships between producers and their buyers in the case study. The case comprises interviews with six farmers, two immediate buyers (an 'organic wholesaler' and an 'organic retailer'), a supermarket, a premium class tourist hotel, an extension officer and an NGO employee. In this paper, the terms 'farmers' and 'buyers' refer only to these case study respondents and not to all farmers and buyers engaged in the chain of organic vegetable.

The farmers operate in the Kathmandu valley, between 10 and 25km from the city centre. They had been farming organically for the past three to eight years, and most of them produced conventional vegetables before converting to organic farming methods. Five of the six farmers are owner-operators but one is a tenant who rents land. Other farm enterprises included dairy, poultry, goats and apiculture. The farms are accessible by public transport and are mostly less than an hour's walk from all-weather roads. Modern telecommunications like mobile phones and the internet are also accessible in the area. The farmers and their immediate buyers are located close to each other, as are buyers and end consumers further down the supply chain.

Figure 3 illustrates observed linkages between farmers and markets (solid arrows) as well as potential marketing channels (dotted arrows). Four distinct market dyads (Table 1) were observed in the case study. These dyads showed marked differences in contract type, methods used to determine product prices, information exchange, levels of asset-specific investment by buyers, and the presence or absence of horizontal coordination amongst farmers.

The transaction between the organic wholesaler and his supplier (farmer 1) is based on a written annual contact. Prices are fixed at a level negotiated at the beginning of each season. Quality and volumes are mentioned in the contract but volumes are not fixed owing to potential variation in yield and changes in market conditions. The wholesaler specialises

in organic trade and had made asset specific investments in branding and knowledge. The farmer and wholesaler meet occasionally to discuss problems and opportunities. The wholesaler also provides extension advice when requested by the farmer. Payments are supposed to be made weekly, but were often delayed. The farmer occasionally sources product from another farmer (farmer 4) to meet anticipated volumes. The wholesaler also sources organic vegetables from other organic farmers and producer groups. A supermarket retails the wholesaler's supplies, charging a commission of 15 per cent.

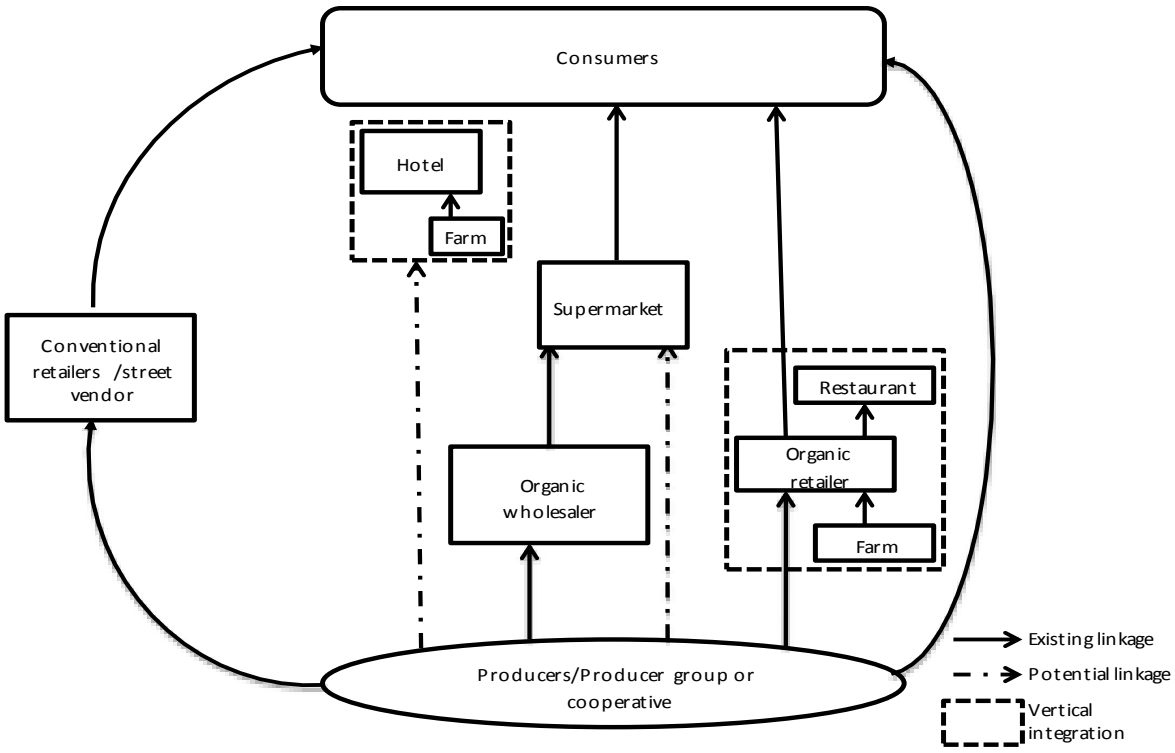

Figure 3: Organic vegetable supply chain observed in the case study

The organic retailer sources fresh vegetables from four suppliers (farmers 1, 2, 3, and 5). The retailer sources individually from farmer 1 but collectively from the other farmers via their cooperative. He has a written contract with farmer 1 and verbal contract with the cooperative. In either case, prices are linked to wholesale prices at the (conventional) wet market and the retailer pays agreed premiums on those prices. Quantities are not mentioned in the contract, but quality standards are specified at the outset. The retailer does not provide any extension advice to farmers. The retailer trades exclusively in organic

produce and had also opened a restaurant offering organic cuisine. Information sharing between farmers and the retailer is confined to prices and quantities of vegetables. In this dyad too, payments are supposed to be made weekly, but were often delayed.

Table 1: Characteristics of existing farmer-buyer dyads

Characteristics	**Organic wholesaler dyad**	**Organic retailer dyad**	**Conventional retailer and street vendor dyads**	**Producer-consumer dyad**
Contract	Written annual	Written and verbal	Verbal	None
Contract with	Individual	Individual and group	Individual	Individual
Price	Fixed	Premium on wet market wholesale price	Discount on retail price of conventional produce	Premium on retail price of conventional produce
Payment	Weekly (often delayed)	Weekly (often delayed)	Next day	At the time of transaction
Extension advice from buyer	Yes	No	No	No
Finance by buyer	No	No	No	No
Asset specific investment by the buyer	Yes	Yes	No	No
Information exchange	Occasionally meet to discuss problems and opportunities	Limited interaction	Information exchange limited to price and quantity	None
Next buyer	Supermarket	Consumers and Restaurant co-owned by the buyer	Consumers	-

The largest farmer (farmer 6) sells most of his produce to conventional retailers. Prices are negotiated at a level slightly below retail market prices, and the retailers sell organic vegetables at prices slightly higher than the retail prices of their conventional counterparts. Farmer 4 sells to a vendor operating at a popular street market. The vendor pays him the selling price less his margin. In these dyads, payment is made the day after the retailers sell

the produce. Although conventional retailers do differentiate organic produce, it accounts for only a small share of their fresh produce sales. None of these buyers had made any asset specific investment in organic trade, and information sharing was limited to product prices and quantities. Farmers tended to take the lead these dyads, delivering to the buyers and bearing the risk of unsold produce.

Farmers 4 and 6 also sell produce directly to consumers at the farm-gate. Farmer 6 is very close to the city and the volume sold directly to consumers is substantial. Farmers set the price slightly higher than the retail price of conventional produce. Many of the consumers are regular customers. Nevertheless, payments are made immediately and in cash.

In addition to these market dyads, there was evidence of buyers (the organic retailer and tourist hotel) integrating vertically into organic vegetable production. There was also evidence of broken relationships between a cooperative and a supermarket, and between a farmer and a specialised organic asparagus buyer and the organic retailer.

3.3 Chain analysis and discussion

3.3.1 Observed and potential dyads

Farmers close to densely populated residential areas sell part of their produce directly to consumers. In these dyads, producers anticipate a premium on the prevailing retail price of conventional produce, and transactions are personalised and cash-based to avoid behavioural risk. Even so, there is no interdependence between buyer and seller.

The conventional retailer and street vendor dyads do not involve *ex ante* negotiation of price and volume. It is implicitly agreed that price will be based on the retail price of conventional produce and that farmers will bear the risk of unsold produce. Although these dyads involve recurrent transactions, mutual interdependence is weak because organic produce constitutes a small share of the fresh produce sold by conventional retailers and the vendor does not differentiate between organic and conventional produce. Information exchange between producers and these buyers occurs only at the time of trade. Late or incomplete payment is sanctioned by withholding supplies to the buyer.

The organic retailer dyad also does not involve *ex ante* negotiation of price and volume. However, it is explicitly agreed that a certain premium will be applied to the wet market wholesale price. Volumes and prices are agreed when orders are placed. The retailer and producers engage in recurrent transactions and are mutually interdependent as the retailer trades exclusively in organic produce. However, the retailer is more dependent on producers than are producers on the retailer as there are alternative buyers and limited sources of supply. Information sharing is not particularly strong because the retailer and producers interact only at the time of ordering and delivering produce. Producers sanction the retailer for late or incomplete payment by withholding supplies, and the retailer sanctions farmers who side-sell or who deliver sub-standard produce by removing them from his preferred suppliers list.

The organic wholesaler dyad involves considerable *ex ante* negotiation regarding price and volume, but allows for *ex post* adaptation of volume due to yield risk. This dyad is also characterised by recurrent transactions and mutual interdependence due to the buyer's specialisation in organic produce. Again, the wholesaler is more dependent on producers than are producers on the wholesaler as there are alternative buyers and limited sources of supply. Information sharing is fairly strong in this dyad because the wholesaler provides extension advice (when consulted) and occasionally organises formal meetings with producers. The contract enforcement mechanism is similar to that in the organic retailer dyad.

All of the dyads involving intermediaries (conventional or organic buyers) rely on internal contract enforcement. They all represent forms of relational contracting yet differ in their degree of *ex ante* negotiation, explicit contractual terms, frequency and type of information exchanged, and mutual interdependence. In Figure 4, the organic wholesaler dyad is located towards the upper end of the relational contracting segment as it is characterised by mutual interdependence and a relatively high level of information sharing. The conventional retailer and street vendor dyads are characterised by low levels of mutual interdependence and information sharing and therefore occupy the lower end of this segment. The organic retailer dyad positions itself between these two dyad types.

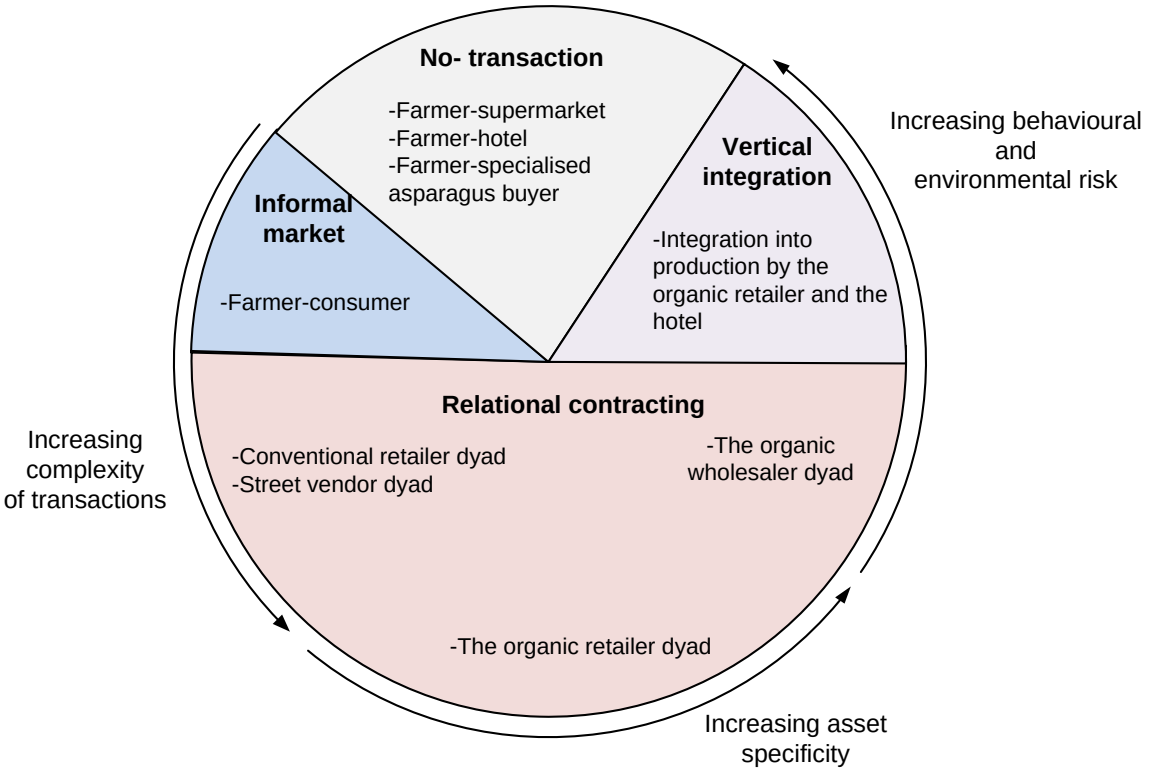

Figure 4: Observed modes of engagement and their drivers

The hotel and organic retailer both developed organic farms of their own, which fits into the vertical integration segment of Figure 4. The organic retailer still sources most of his supply from producers, but the backward integration into production by the hotel effectively excluded other growers from participating in this dyad. The potential farmer-hotel dyad is therefore located in the 'no-transaction' segment, along with discontinued dyads between a cooperative and a supermarket, and between a farmer and a specialised asparagus buyer. Figure 4 emphasises the dominant role that relational contracting appears to play in Kathmandu's supply chain for fresh organic vegetables. Spot markets and conventional contracting are both missing.

3.3.2 Dyad drivers

Producers included in the case study were located within Kathmandu valley, enjoyed similar levels of physical and legal infrastructure, similar access to extension and credit services, and farmed the same products. The frequency of transactions was high in all dyads because vegetables are perishable and produced year-round. All producers made substantial asset-

specific investments in production infrastructure and in acquiring specialised knowledge. Power asymmetry was not an issue for smallholders in this chain due to the presence of alternative buyers. There is some variation in these transaction-cost drivers (due primarily to distance from Kathmandu) and their impacts on chain performance are the subject of a future paper that compares supply chains for different products in different parts of Nepal.

Participating in the informal market segment involved little complexity for farmers and consumers who visited the farms. Consumers purchase what farmers offer, pay in cash and do not seek proof of organic compliance. Search, negotiation and monitoring costs are particularly low for farmers. This meant that farmers could transact small quantities in the informal market without any need for collective action to reduce their unit transaction costs. Transaction costs are higher for consumers, and increase with distance from the growers. Of the two farmers participating in the informal market, one located very close to the city sells a sizeable volume of produce through this channel. This dyad appears to exist due primarily to low transaction costs associated with easy physical access and low complexity of transactions.

Given the prevailing infrastructure and transport services, physical access tends to diminish sharply with increasing distance between consumers and farmers. Commercial growers therefore required alternatives to the informal market in order to sell produce in excess of the small volumes purchased at the farm gate by neighbouring consumers. However, spot markets and conventional contracting did not feature amongst the alternatives used by smallholders producing organic vegetables. The wholesale market operated by the Department of Agriculture provided the physical infrastructure for trading, but did not enforce the rules and standards required to differentiate organic produce. As a result, the wholesale market does not compensate farmers for asset specific investments in organic production methods, nor does it meet the specific requirements of ‘organic consumers’. The absence of a spot market for organic fresh vegetables can therefore be attributed partly to high transaction costs associated with asset specificity and complexity.

Conventional contracts usually come with specific terms of trade regarding volume, quality, delivery and price. Although farmers had invested in plastic houses and irrigation to

alleviate environmental risk, this technology did not give them sufficient protection from unfavourable weather, pests and disease to consistently meet the terms of conventional contracts. Under these conditions, improved access to the legal system would do little to encourage conventional contracting, a view reinforced by the following statement:

> *"Initially a fix-priced contract was tried. However, it failed due to fluctuation in market price and the organic retailer switched to a price linked to wholesale market price"* (farmer 2).

However, there was also an element of behavioural risk because farmers were averse to losing potential income when market price exceeded the contracted price:

> *"I have encountered several cases of farmers not willing to supply at the contracted price. I do not think the legal option of contract enforcement will work in ensuring supplies"* (organic retailer).

This statement suggests that buyers lacked access to an affordable and efficient legal system, and helps to explain why most organic fresh vegetables are sold via relational contracts. All dyads clustered in the relational contracting segment of Figure 4 involved recurrent transactions. The conventional retailer and street vendor dyads were positioned in the lower band of relational contracting and so were closer to the informal market, due to low switching costs for buyers, as these buyers did not make any asset specific investment in organic trade. These dyads were perceived to offer quicker payment and prices higher than (or at least comparable to) those offered by specialised organic buyers.

> *"I sell to conventional retailers at a price slightly lower than the retail price. This price is higher than the price offered by organic buyers*" (farmer 6).

Transactions were also less complex because the buyers did not specify a delivery schedule or quality and compliance requirements. The conventional retailers and the street vendor did not reject supplies from producers as they did not bear the risk of unsold produce.

The organic retailer had made asset specific investments in branding and in an organic restaurant. Quality and delivery standards were more specific in this dyad than in

conventional retailer dyads. The organic retailer did not insist on formal organic certification, but asked farmers for a letter of commitment stating that they would not use inorganic chemicals and fertilisers. He offered a premium on the wholesale market price to discourage farmers from side-selling when market prices were bullish. However, weak information sharing often resulted in scarcity of one product and abundance of another.

> *"Production of some vegetables is beyond the capacity of organic buyers to absorb. As a result, we have to sell surplus organic produce in the wet market. On the other hand, we cannot supply the required volume of some other products. Joint planning of production is not practiced yet. I think the buyer is not too interested in supporting farmers to plan production in accordance with consumer demand"* (farmer 2).

> *"If everyone produces cabbage, how can the market absorb so much cabbage? My customers are looking for a variety of fresh organic products for their kitchens"* (organic retailer).

The organic wholesaler had made asset specific investments in branding, in acquiring knowledge and in providing extension advice to farmers. Transactions in this dyad were relatively complex as the wholesaler required consistent delivery and specified terms for product quality and organic compliance, possibly because he supplied a supermarket. The wholesaler rewarded compliance with a bonus payment, provided extension advice (when consulted) and organised meetings with producers. These interactions helped to strengthen the organic wholesaler's relationships with farmers.

> *"I have more contact with the organic wholesaler. He gives due recognition to farmers and their efforts"* (farmer 1).

The small size of the informal market and the absence of spot markets and conventional contracting meant that relational contracting was the only option for most farmers. Premiums, bonus payments and recurrent transactions facilitated internal enforcement of these relational contracts, reducing transaction costs associated with asset specificity and behavioural risk. When buyers made asset specific investments (the organic wholesaler and the organic retailer dyads) they also took the lead role in coordinating the dyad. In the

absence of asset specific investment by buyers (conventional retailers and the street vendor dyads), farmers played the main role by bearing the risk of unsold produce. Dyads involving specialised organic buyers were in the upper band of relational contracting due to increasing complexity of transactions and asset specific investment by buyers.

Despite their efforts to incentivise compliance, the organic wholesaler and retailer were still vulnerable to environmental and behavioural risk. They both stated that they were unable to expand business due to uncertain supplies. Internal enforcement measures were not sufficient to address behavioural risks in the absence of shared assets and in the presence of alternative buyers. Consequently, buyers were reluctant to invest in storage, processing and certification due to possible hold-up problems.

> *"I am confident of raising capital from financial institutions. But I cannot take a risk as the volume of supply is small and uncertain. A hotel approached me for organic fresh vegetable but the contract did not materialise because I could not ensure consistent supply"* (organic retailer).

> *"Due to uncertainty of supply, I had to stop supplying a supermarket. I am also unable to enter into a supply contract with the supermarket and have to sell on a commission basis"* (organic wholesaler).

The organic wholesaler and retailer sourced produce from cooperatives and individual growers. Contracting with cooperatives helped to reduce unit transaction costs for buyers and producers. Collective marketing also helped in meeting compliance requirements through peer monitoring in the absence of formal certification. However, it did not solve the problem of uncertain supply as producer groups and cooperatives had not succeeded in coordinating members' production plans to meet buyer requirements. As a consequence, uncertainty persisted despite group contracting, and buyers with high asset specific investment (such as the organic retailer and the hotel) integrated backwards into production.

> *"I had to start my own farm due to uncertainty of supply as I need consistent supply for my restaurant"* (organic retailer).

The hotel cited inability to demonstrate organic compliance as another reason for its decision to integrate backwards into production.

> *"Lack of assured supply of organic produce and organic certification forced us to start our own farm"* (purchase manager of the hotel).

Vertical integration helped the organic retailer to stabilise supply and to continue buying from other suppliers. However, backward integration into production by the hotel displaced transactions with small farmers. Uncertainty of supply also forced a supermarket to reduce its purchases from a cooperative and the relationship collapsed due to high unit transaction costs. Other dyads were discounted by farmers who were dissatisfied with the terms offered by buyers or their reluctance to accept more produce at times of peak production.

> *"I am not happy with the premium offered by organic buyers because their base price is the wholesale market price. I do not normally supply to them except when they approach me with better offer during short-supply from their regular sources" (farmer 6).*

> *"I supplied to a specialised asparagus buyer for two years. I came to know the huge difference between his buying and selling price and stopped supplying to him" (farmer 4).*

> "*The organic retailer could not absorb all of my produce, so I stopped supplying him*" (farmer 4).

4 Conclusions and recommendations

Organic vegetable farmers were able to trade small volumes in informal markets because unit transaction costs were low due to inexpensive physical access and non-complex transactions. Improving road access may extend informal market opportunities to more smallholders but this market will remain small and easily saturated.

Farmers were denied opportunities to engage in spot market trading because the municipal wholesale market did not differentiate organic produce. Standards and rules for organic

produce could facilitate spot market trading. However, third party certification is costly and may not be economically feasible for smallholders selling to domestic markets where few buyers are willing to pay the required premiums. Less expensive methods of certification such as Participatory Guarantee Systems (PGS) have been successfully trialled in several developing countries (Fonseca, Wilkinson, Egelyng, & Mascarenhas, 2008; Nelson, Gómez Tovar, Schwentesius Rindermann, & Gómez Cruz, 2010) and warrant consideration by the Department of Agriculture and organic farmer groups in collaboration with specialised organic buyers.

Farmers and buyers were also unable to engage in conventional contracts owing to uncertain yields and weak external enforcement. Extension staff could help farmer groups to develop well-coordinated production plans. Similarly, an effective certification scheme should encourage investment in on-farm technologies that reduce yield variability. Buyers are also more likely to brand and promote organic produce that is certified, and more so if the legal system gives them affordable and effective protection against side-selling by farmers.

Despite these missing dyads, the supply chain for organic fresh vegetables in Kathmandu is reasonably robust because smallholders with different risk-reward profiles can, and do, engage in a variety of relational contracts with buyers. These contracts addressed increasing transaction costs associated with asset specific and complex transactions that required higher levels of coordination and internal enforcement. Enforcement mechanisms included extension advice, recurrent transactions and the payment of premiums and bonuses.

Even so, relational contracts were vulnerable to uncertainties arising from environmental and behavioural risk. Behavioural risk stemmed mostly from side-selling by farmers who could get better prices from alternative buyers. Improved production planning and on-farm technology, better information sharing and agreement on *ex post* adaptation to price changes would help to strengthen relational contracting and perhaps encourage buyers to make the asset specific investments needed to differentiate fresh organic vegetables.

As matters stand, buyers selling into premium organic markets tend to integrate into production activities in order to improve consistency of supply and compliance with organic standards. Shared investment in labelling and promotion by farmers and their buyers could provide another avenue for the internal enforcement of relational contracts, but will most likely require prior investment in a PGS or third-party certification scheme.

Given their small size, it is unlikely that individual farmers will lead innovation in this supply chain. Leadership is more likely to come from farmer groups and specialised organic buyers that handle relatively large volumes of organic produce. Government agencies could play a key role in building a more robust chain by helping these parties to deepen and extend their relational contracts, by establishing standards and rules for organic produce traded in municipal spot markets, and by facilitating farmer marketing groups and advising them on production plans, technology and participatory guarantee systems. The government could also improve physical infrastructure, mandate extension staff to facilitate and witness contracts, and provide contractual parties with easy access to legal recourse for small claims.

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