Improving working relationships for smallholder farmers in formal organic crop supply chains: Evidence from KwaZulu-Natal, South Africa

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Abstract

The 48 members of the Ezemvelo Farmers' Organisation (EFO) in KwaZulu-Natal, South Africa (SA), that are fully-certified as organic farmers were surveyed in October-December 2004 to assess their perceived levels of satisfaction, trust, cooperation and commitment in a formal supply chain producing amadhumbes (a traditional vegetable tuber), potatoes and sweet potatoes for a major SA supermarket group. Empirical recursive models show that a high level of satisfaction in the working relationship results in these farmers trusting the pack-house agent more. High levels of trust, in turn, lead to higher levels of both commitment to, and cooperation in, the supply chain. A simultaneous-equation model showed that EFO members with higher levels of commitment tend to be more cooperative, and that members with higher levels of cooperation tend to be more committed toward the working relationship. These results suggest that strategies to improve the working relationship with the pack-house agent need to promote satisfaction, trust, cooperation and commitment. For example, co-investment in better crop storage facilities at farm-level would promote satisfaction and hence trust. There is also scope for more cooperation in the planning of new organic crop products to grow and market, and to remove some price uncertainty by giving EFO farmers more information about prices that they will be paid by the pack-house in this supply chain.

1. Introduction

A marked increase in consumer demand for healthier foods in South Africa (SA) since 1999 has led SA supermarket chains to look for new sources of organically (chemical-free) produced foods (Darroch, 2001; Business Times, 2004). This presents opportunities for limited resource, smallholder farmers who already practice organic farming methods to earn higher incomes by producing crops for this niche market. Research on ways to integrate smallholder farmers into such markets can, in turn, help to improve

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knowledge management, raise household incomes and stimulate economic growth (Deutsche Gesellschaft fur Technische Zusammenarbeit (DGTZ, 2002). These outcomes would also help to develop sustainable rural livelihoods and to contribute to alleviating rural poverty. This requires analyzing the organic crop supply chain to identify key relationship aspects that need to be managed, and what links need to be strengthened.

This paper analyzes key relationships between farmers and the pack-house agent in the current organic crop supply chain accessed by the smallholder Ezemvelo Farmers' Organisation (EFO) in KwaZulu-Natal, SA, to grow and market amadhumbes (a traditional vegetable tuber), potatoes, and sweet potatoes. A supply chain is defined as a set of relationships among suppliers, manufacturers, distributors and retailers that facilitate the transformation of raw materials into final products (Mukhtar *et al,* 2002). The EFO members sell these crops via informal supply chains to neighbours and hawkers (local traders), and via a formal supply chain to one agent who owns a pack-house and sells the products on their behalf to a major nationwide supermarket chain. The study argues that satisfaction, trust, commitment and cooperation are key requirements for a successful long-term business relationship between EFO members and this agent in the formal supply chain. Satisfaction relates to an overall evaluation of the relationship between supply chain members, and is, therefore, an indicator of the benefit from their relationship (Skinner *et al,* 1992). Trust exists when one party has confidence in an exchange partner's reliability and integrity (Morgan & Hunt, 1994). Trust thus creates the belief that the partner will act in a way that results in positive outcomes for the other party and will not take unexpected actions that result in negative outcomes (Anderson & Narus, 1990).

Cooperation describes a process by which parties develop mechanisms to interact and form business relationships for mutual benefit. Higher levels of cooperation are expected to improve business coordination, leading to better human and product performance (Smith *et al*, 1995). Commitment is shown when a supply chain partner believes that an ongoing business relationship with another player is so important as to warrant trying to maintain it (Morgan & Hunt, 1994). This implies that 'enduring commitment is a basic requirement for successful supply chain implementation' (Kwon & Suh, 2005:27). Many authors have tried to model these supply chain relationships using recursive models (see Kwon & Suh (2005) for a summary of this research), but *none have used a simultaneous-equation approach* to meaningfully validate the behavioral variables in these relationships. Locally, for example, Hardman *et al*. (2002) applied empirical recursive models that showed that high levels of trust lead to high levels of cooperation, and in turn, high levels

of commitment to working relationships in the SA fresh apple export value chain. Masuku *et al* (2004) showed that cooperation depended on trust, and commitment depended on cooperation, between smallholder sugarcane farmers and millers in the Swaziland sugar industry.

This paper, therefore, extends past international and local research by modeling both recursive and simultaneous relationships between trust, commitment and cooperation in a supply chain, using data obtained from the EFO organic farmers. To the authors' knowledge, it is the first attempt in the literature on supply chain management to try and estimate the simultaneous complex interrelationships between these variables. The next section develops a conceptual model of relationships between satisfaction, trust, cooperation and commitment, and specifies the study research hypotheses. Section 3 describes data sources and the research methodology, and specifies the empirical recursive and simultaneous-equation models. Section 4 compares and contrasts the estimated recursive and simultaneous-equation models of these relationships. A concluding section discusses some management and policy implications of the results.

2. Conceptual models of the working relationship

Conceptual models were developed to analyse the levels of, and links between, satisfaction, trust, cooperation and commitment in the working relationship between EFO members and the pack-house agent. The EFO members' perceptions of these aspects of the working relationship were evaluated using two recursive models of cooperative behavior that were then combined into a simultaneous-equation model: the first model is based on work by Anderson & Weitz (1991), Campbell (1992), Smith *et al* (1995), Schroder *et al* (2000), Hunt *et al* (2002), and Claro *et al* (2003), while the second model is the *Key Mediating Variable* (KMV) model proposed by Morgan & Hunt (1994).

The first model postulates that high levels of satisfaction and trust are precursors for high levels of cooperation and, subsequently, human resource commitment in the supply chain. Causality thus runs from SATISFACTION→TRUST→COOPERATION→COMMITMENT. This model supports Mould & Starr's (2000) contention that cooperative behavior demands commitment of resources and sharing of proprietary information. All parties in the working relationship have a stake in the outcome of cooperative behavior to ensure ongoing commitment (Mentzer, 2001). The initiation of cooperation requires trust, and high levels of cooperative behavior result in commitment. "Once trust is established, firms learn that coordinated,

joint efforts will lead to outcomes that exceed what the firm would achieve if it acted solely in its own best interest" (Anderson & Narus, 1990:45).

The KMV model suggests a different causality link between the latter two relationships, advocating that causality rather runs from SATISFACTION→TRUST→COMMITMENT→COOPERATION. Both of these models imply that the EFO members need to perceive relatively high levels of satisfaction in their working relationship with the pack-house agent before they can develop trust in this relationship. Given the competing views on the causality between cooperation and commitment, both models will be estimated separately as recursive models that follow the links described above, and then combined into a simultaneous-equation model. The concepts of satisfaction, trust, cooperation and commitment are described in the following sections before the study hypotheses for these models are defined.

2.1 Relationship satisfaction and trust

For members to perceive high levels of trust, they should also perceive high overall satisfaction with the relationship (Schroder *et al,* 2000). Overall satisfaction is the overall evaluation of the relationship between channel members, and, therefore, a measure of the outcome of the buyer-seller relationship (Skinner *et al,* 1992). Trust reflects the extent to which one party believes that its requirements will be fulfilled through future actions undertaken by the counterpart (Anderson & Weitz, 1989), and shows an individual's confidence in the goodwill of others and belief that others will make efforts consistent with the groups' goals. Anderson & Narus (1990) define trust as a firm's belief that another company will perform actions that will result in positive outcomes for the firm and will not take unexpected actions that result in negative outcomes. Trust, therefore, refers to the shared belief that in the long run, rewards will be distributed fairly among partners. When trust is operative, the risk of opportunism (i.e. getting advantages in an unprincipled way) is reduced. Long term relationships and trust encourage effective communication between players in the supply chain (Claro *et al*, 2003).

Without trust, there is a culture of suspicion in working relationships (Mason & Lefrere, 2003). Hunt *et al* (2002) found that mutual trust must be present before a strategic alliance can flourish. Relationships characterized by trust are so highly valued that potential supply chain partners will desire to commit themselves to the supply chain (Morgan & Hunt, 1994). An environment of trust is also conducive to coordinative behaviour (Claro *et al*, 2003), although Mason & Lefrere (2003) argue that high levels of cognition-based trust may be

a principal predictor of "free riding" (one party may willingly take advantage of the other's trust in him or her). The presence of trust implies that the actions or outcomes of the trading parties will be acceptable and tend to serve the interest of all (Claro *et al*, 2003).

2.2 Relationship cooperation

Cooperation is a departure from the anchor point of discreteness that underlines spot-market transactions toward a relational, bilateral exchange (Claro *et al*, 2003). The outcomes of such cooperation are effective coordination, resulting in lower administrative costs and higher performance (Smith *et al,* 1995). Thus, in relational bilateral exchange, cooperative behavior entails activities undertaken jointly, and communication between the parties. Joint action comprises joint planning and joint-problem solving (Claro *et al*, 2003). When one partner's actions influence the ability of the other to compete effectively, the need for jointly set goals, long-term plans, responsibilities and expectations increases. Cooperative relationships can enhance supply chain performance as partners work together to try and achieve mutual gains (Anderson & Narus, 1990; Morgan & Hunt, 1994).

The scope of supply chain enhancement depends on the nature of the supplier relations in the chain, with the closeness of the relationships being one of the defining factors. Long-term cooperation may produce more net benefits for the exchange partners than are available from the traditional competition-based arrangements. Such long-term cooperation has to be accompanied by the commitment to the relationship, trust and proactive customers and suppliers. These benefits often enhance the competitive position of both the producer and the buyer, resulting in a 'win-win' situation (Burnes & New, 1996; Mukhtar *et al*, 2002). The adapted models that are specified in Section 3 assume that cooperative behavior does not continue unless the expected benefits equal or exceed the expected costs (Smith *et al,* 1995). This cooperative behavior rests upon sharing information, knowledge, risks and profits (Mentzer, 2001), and it continues on the strength of trust. Stronger cooperative behaviour makes exiting from the business relationship undesirable, and causes a deeper commitment from the players to reevaluate their linkages over time and to implement necessary changes to make the supply chain perform better (Doz, 1996).

The KMV model proposes that trust and commitment are precursors of cooperation (Morgan & Hunt, 1994). Cooperation also depends on the relationship costs (in the EFO case this refers to membership fees, time

attending meetings, increased input expenditure, etc.) that members incur in order to participate in the supply chain (Smith *et al*, 1995). Members can have ongoing disputes about business goals, but continue to cooperate due to relatively low relationship costs. Mould & Starr (2000) emphasized that both parties to the cooperative relationship must have the required capabilities to deliver. If capabilities exist, the commitment of management and resources is required to cope with disagreements over working details and procedures. Without resources (both capital and people), the benefits of cooperative relationship will lose visibility and eventually the psychological and physical boundaries that separate organizations will overcome the links. Excessive cooperation has potential to bring bias, conformity and economic collusion (Smith *et al*, 1995). Mould & Starr (2000) also point out that cooperation may demand the sharing of sensitive proprietary information.

2.3 Relationship commitment

The enduring desire to maintain a valued relationship (Moberg, 2003) implies some vulnerability for each party, as mistrust decreases commitment and shifts the transaction to one of more direct short-term exchanges. Loyalty leads to superior business performance, and it needs commitment. A partner committed to the working relationship will likely cooperate with the other because of the desire to make the relationship work and *vice versa*. The outcomes of commitment can include higher motivation and an increased sense of belonging to the relationship. The development of trust, cooperation and commitment can treated as a dynamic process where participants constantly evaluate their decision to continue in such a relationship (Claro *et al*, 2003; Smith *et al,* 1995).

The above discussion on relationship satisfaction, trust, cooperation and commitment suggests the following research hypotheses to investigate the conceptual models:

H_1: *The higher are the levels of satisfaction that the EFO farmers have in their working relationship with the pack-house agent, the higher are their levels of trust.*

H_2: *The higher are the levels of trust that the EFO farmers have in their working relationship with the pack-house agent, the greater will be their levels of cooperation, as shown by higher levels of joint-problem solving and communication.*

H_3: *The higher are the levels of trust that the EFO farmers have in their working relationship with the pack-house agent, the more human resources they will commit to this relationship.*

H_4: *The higher are the levels of cooperation that the EFO farmers have in their working relationship with the pack-house agent, the more committed they will be to this relationship.*

H_5: *The higher are the levels of commitment by the EFO farmers to their working relationship with the pack-house agent, the more cooperative they are likely to be in this relationship.*

3. Data sources and research methodology

Primary data were collected from EFO members between October and December 2004 in the Embo district of KwaZulu-Natal, SA. The EFO has 151 members from 127 households, and 48 members were fully-certified as organic farmers at the time of the study. To qualify for full certification, farmers must meet the following specifications (Modi, 2004): (a) the land on which organic foods are grown must be free of prohibited substances, such as commercial fertilizers, for a given period (usually three years before certification); (b) farmers and processors must keep detailed records of the methods and materials used in the growing or processing of organic produce; and (c) all methods and materials must be annually inspected.

All of the 48 EFO fully-organic certified growers were personally interviewed to obtain their perceptions of (a) their levels of trust, joint-problem solving, communication and commitment in the working relationship with the pack-house agent; and (b) their levels of cooperation in production planning, harvesting, scheduling, marketing and quality control. Perceived levels of trust in their working relationship were estimated using an index derived from their scores on Likert-type scales that showed how strongly they agree with statements such as "We have a strong personal confidence in each other", "We have a strong business confidence in each other", "We can always rely on each other when it counts", " This agent will work hard in future to maintain a close relationship with EFO", "I am very confident that this relationship will continue in future", "This agent is trustworthy" and "This agent has always been fair in his negotiations with us" (see Appendix 1A).

Respondents had to rate these statements on a scale from 1 (strongly disagree) to 4 (strongly agree). An index of the level of trust perceived by each EFO farmer was then estimated taking his/her average score over all the relevant statements that relate to the above aspects of trust. For example, if a grower scores 2, 2, 1, 4, 3, 1 and 1 for the statements, he/she scores 2 on the level of trust index ([2+2+1+4+3+1+1]/7). Index values close to 4 show relatively high perceived levels of trust, while values closer to one suggest low levels of trust

in the working relationship. The 48 respondents' perceived levels of cooperation and commitment in the working relationship with the pack-house agent and in organic crop production planning, harvest scheduling, marketing and quality control were similarly estimated by the average of their respective Likert-type scores (see Appendix 1A and 1B) for statements that describe each of these behaviours. For example, the statements "We often discuss issues such as changes in customers needs for organic products" and "We have extensive formal communications" show the communication component of cooperation, while the statements "We make joint decisions about reducing costs in the pack-house" and "We make joint decisions about organic product delivery scheduling" reflect the joint-problem solving component of cooperation. Statements such as "We work together to achieve productivity gains from which we both benefit" and "We devote considerable time to trying to improve this relationship" capture the growers' perceptions of the levels of commitment in their working relationship with the pack-house agent.

3.1 Empirical recursive and simultaneous-equation models

An empirical recursive model (see Gujarati (2003) and Koutsoyiannis (1987) for model properties) was first used to test hypotheses H_1, H_2 and H_4, assuming that causality runs from SATISFACTION→TRUST→COOPERATION→COMMITMENT. These hypotheses give the following equations, where the signs on the β coefficients indicate the expected direction of the relationship between the dependent and explanatory variables:

$$\text{Trust} = \beta_1 + \beta_2\text{Satisfaction} + \mu_1 \quad (1)$$

$$\text{Cooperation} = \beta_3 + \beta_4\text{Trust} + \mu_2 \quad (2)$$

$$\text{Commitment} = \beta_5 + \beta_6\text{Cooperation} + \mu_3. \quad (3)$$

where μ_1…..μ_3 are the error terms.

A second recursive model was then estimated to test hypotheses H_3 and H_5 in the KMV model using the causal links SATISFACTION→TRUST→COMMITMENT→COOPERATION in the following equations:

$$\text{Trust} = \beta_1 + \beta_2\text{Satisfaction} + \mu_1 \quad (1)$$

$$\text{Commitment} = \beta_7 + \beta_8\text{Trust} + \mu_4 \quad (4)$$

$$\text{Cooperation} = \beta_9 + \beta_{10}\text{Commitment} + \mu_5 \quad (5)$$

where μ_4 and μ_5 are the error terms.

Note that the first equation in this model is the same as equation (1) in the first model. The simultaneous-equation model combining the two recursive models required more explanatory variables in order to identify the individual equations (provide sufficient information to estimate the coefficients (Gujarati, 2003)). Following Rozemeijer *et al.* (2003) and Morgan & Hunt (1994), variables representing the costs of maintaining the working relationship, and price uncertainty, were, therefore, added to give the following simultaneous-equation model:

$$\text{Trust} = \beta_1 + \beta_2\text{Satisfaction} + \mu_1 \quad (1)$$

$$\text{Cooperation} = \beta_{11} + \beta_{12}\text{Trust} + \beta_{13}\text{Commitment} - \beta_{14}\text{RCOSTS} + \mu_6 \quad (6)$$

$$\text{Commitment} = \beta_{15} + \beta_{16}\text{Trust} + \beta_{17}\text{Cooperation} - \beta_{18}\text{PUNC} + \mu_7 \quad (7)$$

where RCOSTS = Relationship maintenance costs; PUNC = Price uncertainty, and μ_6 and μ_7 are the error terms. Note again that the first equation in this model is the same as the first equation that was specified in the two recursive models.

The RCOSTS variable in equation (6) reflects the extent to which the 48 EFO growers perceived that costs such as "Membership fees", "Time attending meetings", "More work effort in crop production", and "Increased expenditure on hired labour and other farm inputs" ranged from 1 (none) to 4 (excessive) on a Likert-type scale (see Appendix 1C). These costs can be interpreted as barriers that negatively affect the desire to cooperate across players in the supply chain (Rozemeijer *et al,* 2003). The PUNC variable in equation (7) shows the growers' perceived level of uncertainty about the price that they would receive for their organic crops from the pack-house, on a Likert-type scale ranging from 1 (no problem) to 3 (severe problem). Following Morgan & Hunt (1994:25), supply chain partners that expect positive relationship benefits from their partnership – relative to other options – on such dimensions as product profitability, will be more committed to the working relationship. Price uncertainty will create uncertainty about expected profits, and, hence, uncertainty about the EFO members' expected relationship benefits. The inclusion of RCOSTS and PUNC thus generates two further research hypotheses:

H_6: *The higher are the perceived levels of relationship maintenance costs that EFO farmers must incur to participate in the formal organic crop supply chain, the lower will be their levels of cooperation*.

H_7: *The higher are the EFO farmers' perceived levels of price uncertainty, the lower will be their levels of commitment to the working relationship*.

4. Results

This section first discusses the 48 fully-certified organic EFO farmers' scores for perceived levels of trust, cooperation and human resource commitment; it then estimates the recursive models, and the simultaneous-equation model for comparison. The farmers' perceptions about their levels of cooperation with the pack-house agent in organic crop production and marketing activities are also discussed.

4.1 Index scores for EFO farmers' perceived levels of trust, cooperation and human resource commitment

The mean, minimum and maximum index scores showing the 48 EFO farmers' perceived levels of trust, cooperation (joint-problem solving and communication) and human resource commitment in their working relationship with the pack-house agent are reported in Table 1.

Table 1: The 48 fully-certified organic EFO farmers' scores for their perceived levels of trust, joint-problem solving, communication and commitment in the working relationship with the pack-house agent, KwaZulu-Natal, 2004

Aspect of Relationship	Minimum[a] Index Score	Maximum Index Score	Mean Score	Standard Deviation of the Mean
Trust	1.00	4.00	2.76	0.527
Communication	1.00	4.00	2.73	0.451
Joint-problem solving	2.00	3.80	2.88	0.313
Commitment	1.50	3.75	2.66	0.417

Note: [a]Scores range from 1 (strongly disagree) to 4 (strongly agree), and show to what extent these farmers agree or disagree with statements about aspects of their working relationship with the packer. Scores closer to 1 suggest weak aspects of the relationship, while scores near 4 indicate strong aspects.

Scores for this EFO farmer-agent link ranged from a minimum of 1 for trust and communication to a maximum of 4 for the same aspects of the working relationship. Mean scores close to 3.00 for all four aspects of the relationship suggest that these 48 EFO producers, on average, perceived relatively high levels of trust, joint-problem solving and communication in their relationship with the packer, and that they are fairly strongly committed to this relationship. About 21% of these farmers perceived relatively low levels of trust, 33% low levels of communication, 8% low levels of joint-problem solving, and 46% low levels of commitment. These results suggest that there is scope to improve commitment by these farmers to the working relationship by further strengthening communication and joint-problem solving, and working towards building more trust.

4.2 Recursive models

The three equations estimated by Ordinary Least Squares (OLS) regression for the first recursive model, assuming that the error terms are uncorrelated with the endogenous explanatory variables (Gujarati, 2003: 764), using the SPSS statistical package (Norusis, 1994) were (estimated t statistics in parentheses and df = degrees of freedom):

$$\text{Trust} = 1.278 + \underset{(5.316)***}{0.531}\text{Satisfaction} \quad (8)$$

Adjusted $R^2 = 0.37$ $F = 28.26***$ $df = 47$

$$\text{Cooperation} = -3.315 + \underset{(5.556)***}{1.200}\text{Trust} \quad (9)$$

Adjusted $R^2 = 0.39$ $F = 30.87***$ $df = 47$

$$\text{Commitment} = 2.661 + \underset{(5.800)***}{0.271}\text{Cooperation} \quad (10)$$

Adjusted $R^2 = 0.41$ $F = 33.64***$ $df = 47$

The triple asterisk *** indicates statistically significant coefficient estimates at the 1% level of significance for all equations. In equation (8), higher levels of perceived overall satisfaction with the working relationship lead to higher levels of trust. Equation (8) is statistically significant (F=28.26), and variance in satisfaction explains about 37% of the variance in trust. In equation (9), higher levels of trust, in turn, encourage more cooperation by the EFO members in the organic crop supply chain activities. Equation (9) is statistically significant (F=30.87), and the variance in trust explains 39% of the variance in cooperation. Equation (10) indicates that the level of cooperation has a positive impact on the level of commitment. This equation is also statistically significant (F=33.64), and variance in cooperation accounts for 41% of the variance in commitment. These results support hypotheses H_1, H_2 and H_4 that were proposed in section 2.3 of this paper.

The first recursive model was re-estimated by *the Method of Instrumental Variables* (Koutsoyiannis, 1987:376) to allow for possible violation of the assumption that the error terms were uncorrelated with the endogenous explanatory variables. The original Trust variable in equation (9) was replaced by the instrumental variable (TrustIV) that was estimated from equation (8),

and the original Cooperation variable in equation (10) was replaced by the instrumental variable CooperationIV that was estimated by regressing Cooperation on Satisfaction (the exogenous variable in the recursive model). The estimated model equations using the SPSS statistical package (Norusis, 1994) were (estimated t statistics in parentheses):

Trust = 1.278 + 0.531Satisfaction (8)
(5.316)***

Adjusted R^2 = 0.37 F = 28.26*** df = 47

Cooperation = -5.057 + 1.839Trust IV (11)
(5.130)***

Adjusted R^2 = 0.36 F = 26.32*** df = 47

Commitment = 2.657 + 0.438Cooperation IV (12)
(5.491)***

Adjusted R^2 = 0.40 F = 30.15*** df = 47

Equations (11) and (12) are both statistically significant (F=26.32 and 30.15, respectively). Variance in TrustIV explains 36% of the variance in cooperation, while variance in CooperationIV accounts for 40% of the variance in commitment. The positive, statistically significant coefficient estimates in all three equations again support hypotheses H_1, H_2 and H_4 in section 2.3, although the adjusted R^2 and F statistics are marginally lower using the instrumental variables.

The three equations estimated by OLS regression for the KMV recursive model, assuming that the error terms are uncorrelated with the endogenous explanatory variables (Gujarati, 2003: 764), using the SPSS statistical package (Norusis, 1994) were (estimated t statistics in parentheses):

Trust = 1.278 + 0.531Satisfaction (8)
(5.316)***

Adjusted R^2 = 0.37 F = 28.26*** df = 47

Commitment = 1.465 + 0.437Trust (13)
(4.492)***

Adjusted R^2 = 0.29 F = 20.18*** df = 47

Cooperation = -4.145 + 1.557Commitment (14)
(5.800)***

Adjusted R^2 = 0.41 F = 33.64*** df = 47

The triple asterisk *** indicates statistically significant coefficient estimates at the 1% level of significance for all equations. Equations (13) and (14) show that trust and commitment are key antecedents for cooperative behavior. Both equations are statistically significant (F=20.18 and 33.64, respectively). Variance in trust explains 29% of the variance in commitment, while variance in commitment accounts for 41% of the variance in cooperation. These results support hypotheses H_1, H_3 and H_5 in section 2.3 of this paper.

The KMV recursive model was also re-estimated using instrumental variables to again allow for possible violation of the assumption that the error terms were uncorrelated with the endogenous explanatory variables. The original Trust variable in equation (13) was replaced by the instrumental variable (TrustIV) that was estimated from equation (8), and the original Commitment variable in equation (14) was replaced by the instrumental variable CommitmentIV that was estimated by regressing Commitment on Satisfaction (the exogenous variable in the recursive model). The estimated model equations using the SPSS statistical package (Norusis, 1994) were (estimated t statistics in parentheses):

Trust = 1.278 + 0.531Satisfaction (8)
(5.316)***

Adjusted R^2 = 0.37 F = 28.26*** df = 47

Commitment = 0.443 + 0.805TrustIV (15)
(5.491)***

Adjusted R^2 = 0.40 F = 30.15*** df = 47

Cooperation = -6.069 + 2.284CommitmentIV (16)
(5.130)***

Adjusted R^2 = 0.37 F = 26.32*** df = 47

Equations (15) and (16) are statistically significant (F=30.15 and 26.32, respectively). Variance in TrustIV explains 40% of the variance in commitment, while variance in CommitmentIV accounts for 37% of the variance in cooperation. The positive, statistically significant coefficient estimates in all three equations again support hypotheses H_1, H_3 and H_5 in section 2.3 of this paper.

4.2 Simultaneous-equation model

Equations (1), (6) and (7) were all identified, but multicollinearity was detected in equations (6) and (7) at Stage 2 when Two-stage Least Squares (2SLS) (Gujarati, 2003) was initially used to estimate the simultaneous-equation model. The instrumental variable (IV) for the endogenous explanatory variable Trust in Stage 2 was statistically significantly correlated with the IVs for the endogenous explanatory variables Cooperation and Commitment, and with RCOSTS and PUNC, and all variance-inflation factors (VIFs) were greater than 10 (Gujarati, 2003). Principal Component Analysis (PCA) was, therefore, used in Stage 2 to try and remedy this problem (Manly, 1986; Jones, 1985). This technique generates principal components that resemble the original variables but are uncorrelated and account for the variation in the original variables in descending order (Manly, 1986).

Applying PCA produced three principal components (PCs) for both equation (6) and equation (7). The first and second PCs accounted for 99% of the variance in the three variables in both equations, and so multicollinearity was remedied in each equation by using two PCs and estimating the final simultaneous-equation model by 2SLS using the SPSS statistical package (Norusis, 1994) (estimated t statistics in parentheses) as:

$$\text{Trust} = 1.278 + \underset{(5.316)***}{0.531\text{Satisfaction}} \quad (8)$$

Adjusted $R^2 = 0.37$ $F = 28.26***$ $df = 47$

$$\text{Cooperation} = 2.813 + \underset{(5.005)***}{0.187PC_1} - \underset{(-2.010)**}{0.075PC_2} \quad (17)$$

where $PC_1 = 0.963\text{TrustIV} + 0.993\text{CommitmentIV} - 0.127\text{RCOSTS}$
and $PC_2 = -0.257\text{TrustIV} - 0.025\text{CommitmentIV} + 0.992\text{RCOSTS}$

Adjusted $R^2 = 0.37$ $F = 14.58**$ $df = 46$

$$\text{Commitment} = 2.665 + \underset{(5.007)***}{0.244PC_3} - \underset{(-2.432)**}{0.118PC_4} \quad (18)$$

where $PC_3 = 0.984\text{TrustIV} + 0.975\text{CooperationIV} - 0.185\text{PUNC}$
and $PC_4 = -0.173\text{TrustIV} - 0.196\text{CooperationIV} + 0.983\text{PUNC}$

Adjusted $R^2 = 0.39$ $F = 15.49**$ $df = 46$

The triple asterisk *** and the double asterisk ** indicate statistically significant coefficient estimates at the 1% and 5% levels of significance, respectively, for all equations. TrustIV, CommitmentIV and CooperationIV denote instrumental variables for trust, commitment and cooperation, respectively. The EFO members that have higher levels of overall satisfaction with the pack-house agent have higher levels of trust in the working relationship (equation (8)). Variance in trust explains about 37% of the variance in overall satisfaction, and equation (8) is highly statistically significant (F=28.26). The estimated component and regression coefficients for PC_1 and PC_2 in equation (17) have the correct signs. High loadings above 0.900 for the instrumental variables TrustIV and CommitmentIV in PC_1 imply that EFO members who perceive higher levels of trust also tend to have higher levels of commitment, which together via the positive coefficient estimate for PC_1 lead to higher levels of cooperation. The high loading on RCOSTS in PC_2 contrasts higher levels of relationship maintenance costs with lower levels of trust, and the negative coefficient estimate for PC_2 indicates that levels of cooperation fall as these costs rise. Variance in PC_1 and PC_2 explains 37% of the variance in cooperation, and equation (17) is highly statistically significant (F=14.58).

In equation (18), the estimated component loadings and regression coefficients for PC_3 and PC_4 again agree with *a priori* reasoning. Higher levels of trust associated with higher levels of cooperation shown in PC_3 lead to higher levels of commitment to the working relationship, while higher levels of price uncertainty in PC_4 cause lower levels of commitment. Variance in PC_3 and PC_4 accounts for 39% of the variance in commitment, and equation (18) is highly statistically significant (F=15.49). The estimated equations thus support hypotheses H_1 to H_5 in section 2.3, and H_6 and H_7 in section 3.1, of this paper. Higher levels of satisfaction lead to higher levels of trust that, in turn, promote cooperation and commitment by EFO members in the formal organic crop supply chain. Higher perceived costs of maintaining the working relationship and more price uncertainty, respectively, reduce levels of cooperation and commitment. There is also some evidence of a two-way, or simultaneous, relationship between cooperation and commitment.

4.3 Cooperation in organic crop production and marketing activities

In Table 2, the EFO farmers view cooperation with the pack-house agent as "relatively high" in organic crop marketing and crop quality control, "moderate" in production planning and harvest scheduling, and "low" to "moderate" in the planning of new products to grow and market.

Table 2: The 48 fully-certified organic EFO farmers' scores for their perceived levels of cooperation with the pack-house agent in key production and marketing activities in the formal organic crop supply chain, KwaZulu-Natal, 2004

Activity	Minimum[a] score index	Maximum score index	Mean score index	Standard Deviation of the Mean
Crop production planning	1	5	3.10	1.12
Crop harvest scheduling	1	5	3.29	1.03
Crop marketing	1	5	3.85	0.85
Crop quality control	1	5	3.74	0.81
Planning to produce new products	1	5	2.53	0.93

Note: [a] Scores were based on these farmers' perceptions of the level of cooperation for each production and marketing activity in the formal organic crop supply chain, and could range from 1 (very low cooperation) to 5 (very high cooperation).

The latter result may reflect the farmers' concerns about a new variety of sugar beans that they had recently planted but was not purchased by the pack-house agent. Production planning, harvest scheduling and new product planning thus seem to be the activities where more cooperation is needed.

5. Discussion and conclusions

Results show that if the 48 fully-certified organic EFO farmers have higher levels of overall satisfaction in their working relationship with the pack-house agent, they will have higher levels of trust. Higher levels of trust, in turn, are a key antecedent for both more cooperative behaviour and more commitment to the supply chain relationship. There is also evidence that cooperative behaviour and commitment can influence each other positively, supporting the concept of simultaneous-equation modelling of these aspects of the working relationship. The 48 farmers' levels of cooperation will also tend to fall as the perceived costs of maintaining the supply chain relationship increase. Finally, these farmers would tend to commit more human resources to the working relationship when they perceive less price uncertainty for the organic crop products that they sell through the pack-house.

Satisfaction, and hence more trust, in the formal organic supply chain working relationship could be built if the pack-house agent and the EFO members work together to develop resources, opportunities and benefits (e.g. price premiums) that are superior to the offerings of alternative partners. For example, the 48 respondents identified more reliable transport to the pack-house and co-investment in better crop storage facilities at farm-level as

potential ways to improve crop quality, prices and net returns. Currently there is no empowerment label for EFO organic products sold by the major nationwide supermarket chain at the retail link. This label could earn price premiums for the EFO farmers via brand loyalty from higher-income consumers that are willing and able to pay relatively more for such a product, but further research is needed to establish if the expected costs of developing the label would be less than the expected price premiums. The 48 EFO farmers overall expressed moderate satisfaction with the working relationship with the pack-house agent during the survey, but price uncertainty for products sold tends to reduce their commitment to the working relationship. Continuous and open communication to share information between and among supply chain partners can help to reduce such uncertainty (Kwon & Suh, 2005). This may enable the EFO farmers to better plan which crop combinations to grow and what areas to allocate to each crop. Communication, which is a component of cooperation, could be improved between the retailer and the pack-house agent so that the agent can communicate better with the EFO members about crop production schedules and market quality expectations, and evaluations of the farmers' crop deliveries.

Preis (2003) recommended that performance evaluation systems be kept as objective as possible and that all parties share purchasing decision criteria in a supply chain. In this case, these comments apply to the pack-house agent better informing EFO farmers about organic crop quality standards and why their crop deliveries are sometimes rejected. Improved information flows between the EFO farmers and the pack-house agent through education, technology development, and extension could also enhance commitment to the working relationship. To offset the relationship maintenance (transaction) costs, the EFO farmers could try to negotiate higher premiums for the organic crops sold through the pack-house. The EFO farmers may also consider developing new formal markets in which consumers are prepared to pay a premium for crop products that meet organic quality standards.

Finally, there is some scope for improving cooperation between EFO members and the pack-house agent in organic crop production planning, and planning to produce new varieties. This will increase the likelihood that organic crops are produced and harvested on schedule for the retailer. Actions that reduce overall satisfaction, trust, cooperation and commitment reduce the competitiveness of the study organic crop supply chain. Lessons learnt from the study could be adapted to help to improve the performance of, and/or develop new, organic crop supply chains for smallholders in other provinces in SA, and in other countries in Southern Africa. Areas for future research suggested by this study include identifying the sources of price uncertainty in

this formal organic crop supply chain, and further analysis of the power relations that exist between the partners. For example, the EFO farmers' lack of relative bargaining power may, in part, be responsible for perceived relatively low price premiums received from the pack-house.

Acknowledgement

The authors would like to thank the Ford Foundation (South Africa) (as part of Grant Number 1035-1796) for funding this study. All conclusions and recommendations expressed in this paper are those of the authors and are not to be attributed to the Ford Foundation.

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Appendix 1A: Questions used to capture the 48 KwaZulu-Natal EFO farmers' perceptions about the levels of satisfaction, trust, cooperation (joint-problem solving and communication) and commitment in their working relationship with the packer.

To what extent do you **agree or disagree** with the following statements about your **working relationship with the agent** at the pack-house?

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
Trust:				
We have a strong personal confidence in each other				
We have a strong business confidence in each other				
We can always rely on each other when it counts				
This agent will work hard in the future to maintain a close relationship with EFO				
I am very confident that this relationship will continue in the future				
This agent is trustworthy				
This agent has always been fair in his negotiations with us				
Communication:				
We often discuss issues such as changes in customers needs for organic products				
We have extensive formal communications				
We have extensive informal communications				
We discuss only need-to-know information that relates directly to our relationship				
We make joint decisions about:				
Reducing costs in the pack-house				
Organic product delivery scheduling				
Organic product quality control				
Improving organic product quality				
New organic products to grow				
Commitment:				
We work together to achieve productivity gains from which we both benefit				
We devote considerable time to trying to improve this relationship				
We devote considerable time trying to improve pack-house productivity				
We have made major changes in our delivery schedule in order to deal more effectively with the pack-house				

How **satisfied** are you with your **working relationship with the agent** at the pack-house over the last season (tick where appropriate)?

Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied

Why? _____

_____

Appendix 1B: Questions used to capture the 48 KwaZulu-Natal EFO farmers' perceptions about the levels of cooperation in key crop production and marketing activities with the pack-house agent in the organic crop supply chain.

How do you describe the **level of cooperation** between **you and the agent** at the pack-house in the following activities (tick where appropriate):

Activity	Very High	High	Moderate	Low	Very Low
Organic crop production planning					
Organic crop harvest scheduling					
Organic crop marketing					
Organic crop quality control					
Planning to produce new organic crops					

Appendix 1C: Questions used to capture the 48 KwaZulu-Natal EFO farmers' perceptions about relationship maintenance costs incurred by being an EFO member in the organic crop supply chain.

What **costs** does EFO **actually** impose on you? Rank perceived costs from **1 to 4**, where **1 is no cost and 4 is excessive cost** (tick where appropriate):

	1 None	2 Some	3 Reasonable	4 Excessive
Cost item				
Membership fees				
Time attending meetings				
More work effort in crop production				
Increased expenditure on hired labour and other farm inputs				
Other: Please specify				