CHAPTER SIX

MODELLING SMALLHOLDER CANE GROWERS' EXCHANGE RELATIONSHIP WITH MILLERS

6.1 INTRODUCTION

The purpose of this study is to investigate the contractual relationship between smallholder cane growers and millers in the sugar industry in Swaziland. The study employed latent behavioural constructs such as trust, commitment, cooperation, influence by the partner, opportunistic behaviour, certainty, relative dependence, and satisfaction to model the relationship between smallholder cane growers with millers. Although these constructs have been used in other studies (Morgan and Hunt, 1994; Dwyer *et al.*, 1987; Ganesan, 1994; Heide and John, 1990), this is the first study to investigate these constructs together in an agricultural supply chain in Southern Africa. Batt and Rexha (1999) used some of these constructs in a study of the seed potato industry. However, their model structure was different and they were focusing on the farmer as a buyer of seed from the seed supplier, whereas this study focuses on the farmers as the supplier of sugarcane to the millers.

The objective of this chapter is to present the empirical results of the model formulated in the theoretical and conceptual framework (Chapter three). This chapter provides a model of the smallholder farmers' relationship with millers as well as identifying the important factors influencing the performance of the smallholder farmers, and hence the performance of the sugar industry supply chain. Three questions will be answered in this chapter.

1. What is the role of social factors in the performance of the smallholder farmers and their relationship with millers?
2. What kind of model would enable the understanding of contractual relationship between smallholder cane growers and millers in the sugar industry supply chain?
3. Which factors are important in enhancing the performance of the smallholder farmers, and hence the sugar industry supply chain?

6.2 RELATIONSHIP BETWEEN CANE GROWERS AND THE MILLERS

The cane growers' and millers' relationship model presented in Chapter three was estimated using two procedures. First, recursive models and multiple regression analysis were used to model the relationship of the two parties. Secondly, structural equation modelling (SEM) was used to determine the structure of the relationship and the fitness of the model to the data.

6.2.1 Measurement model evaluation

SEM contains two inter-related models, the measurement model and the structural model of which both models are defined by the researcher (Gefen *et al.*, 2000). The measurement model defines the constructs that the model will use and assigns manifest variables to each construct, whilst the structural model defines the causal relationship between the constructs (Gefen *et al.*, 2000; Hair *et al.*, 1995, 1998). The measurement model normally uses factor analysis to assess the degree that the observed variables load on their respective constructs. However, in this study factor analysis was not used as the sample was not large enough and the items measuring each construct were limited. Conducting a factor analysis would have risked some of the items being dropped pre-maturely. Some of the items used in this study were adopted from previous studies, but modified for this study's specific situation. Therefore, not using factor analysis in the study was not an issue since items had been used in previous studies before (Morgan and Hunt, 1994; Dwyer *et al.*, 1987).

The item loadings provided by SEM are analogous to a factor analysis, where each factor is a latent variable. SEM techniques assume that each manifest variable has a unique measurement error (a measure of inaccuracy in participant responses and their measurement and theoretical representation of the concept used in manifest variables). However, the use of the covariance matrix as an input in the model is well suited for the analysis of a model containing variables with measurement error (Hair *et al.*, 1995, 1998), thus facilitating a transition from exploratory to confirmatory analysis. This study used a covariance matrix as an input to the model.

The measurement model describes the relationships between the latent (unobserved) factors and their indicator variables. Confirmatory Factor Analysis (CFA) was used in this study to test the adequacy of the measurement model as a prerequisite to structural models. CFA enables the researcher to test if conjectured relationship structures are supported by the observed data. Anderson and Gerbing (1988) argue that CFA should be conducted and if necessary the model has to be respecified before one could simultaneously examine the measurement and the structural models. CFA is more appropriate when the measures have been fully developed and validated. It seeks to determine the extent to which items designed to measure a particular factor actually do so. All sub-scales that are designed to measure a particular construct are expected to load onto their related factor (Barney, 1991). A confirmatory factor analysis of the indicator variables measuring the eight constructs in this study was conducted. Table 6.1 reports the measurement model of the unaggregated items in terms of the composite reliabilities of all constructs, the loadings of all construct items, and the error variance of all constructs, while Table 6.2 presents the measurement model for aggregated indicator variables (detailed CFA are presented in Appendix B and C).

The results in Table 6.1 indicate that all the indicator variables loaded satisfactory on the respective construct and they showed a moderately strong reliability in measuring the construct. Table 6.2 on the other shows the results of aggregated indicator variables. The results show that after aggregation, the variables had higher loading onto their respective constructs. The error variance was also reduced, which means the constructs are better explained by the aggregated indicator variables.

Table 6.1: Confirmatory Factor Analysis (CFA) results of the unaggregated indicator variables of the endogenous variables (λ,Y)

Exogenous variable	Indicator	Standard loading (λ)	Reliability[a]	Error variance[b]
Relative dependence			**0.522[c]**	
	Dep2	0.2060	0.0424	0.9576
	Dep22R	0.4500	0.2088	0.7912
	Dep33R	0.5893	0.2185	0.7815
	Dep7	0.4569	0.3473	0.6527
	Dep8	0.4674	0.2025	0.7975
Influence by partner			**0.645**	
	Inflby1	0.2054	0.0422	0.9578
	Inflby3	0.6407	0.4106	0.5894
	Inflby4	0.8394	0.7047	0.2953
	Rinflov1	0.2290	0.0524	0.9476
	Rinflov2	0.0898	0.0081	0.9919
	Rinflov3	0.8745	0.7648	0.2352
	Rinflov4	0.5999	0.3599	0.6401
Trust			**0.715**	
	Trust1	0.4639	0.2152	0.7848
	Trust2	0.4421	0.1954	0.8046
	Trust3	0.5301	0.2810	0.7190
	Trust5R	0.6010	0.3612	0.6388
	Trust6R	0.7551	0.5701	0.4299
	Rpleave1	0.1963	0.0385	0.9615
	Rpleave2	0.4614	0.2129	0.7871
Cooperation			**0.707**	
	Coop1	0.2953	0.0872	0.9128
	Coop2	0.6519	0.4250	0.5750
	Coop3	0.3879	0.1505	0.8495
	Coop4	0.5043	0.2543	0.7457
	Coop5	0.3168	0.1004	0.8996
	Benefit2	0.7447	0.5546	0.4454
	Benefit3	0.3216	0.1034	0.8966
	Benefit4	0.3394	0.1240	0.8760
	Benefit5	0.3394	0.1061	0.8939
Satisfaction			**0.554**	
	Satis1	0.4650	0.2163	0.7837
	Satis2	0.4440	0.1971	0.8029
	Satis3	0.3907	0.1526	0.8474
	Satis4	0.5619	0.3157	0.6843
Certainty			**0.500**	
	Cert2	0.2693	0.0725	0.9275
	Cert3	0.5611	0.3148	0.6852
	Cert4	0.1248	0.0156	0.9844
	Cert5	0.8239	0.6788	0.3212
Commitment			**0.580**	
	Comit2	0.2466	0.0608	0.9392
	Comit3	0.7526	0.5665	0.4335
	Comit4	0.7000	0.4900	0.5100
	Comit5R	0.3274	0.1072	0.8928
Opportunistic behaviour			**0.546**	
	Rconf1	0.3501	0.1225	0.8775
	Conf2	0.5665	0.3210	0.6790
	Rconf3	0.3449	0.1190	0.8810
	Opp1	0.5746	0.3302	0.6698
	Opp2	0.5606	0.3142	0.6858
	Opp3	0.8961	0.4179	0.5821

R indicates reversed statements
a = Squared multiple correlation
b = 1-indicator reliability
c = Composite reliability

Table 6.2: Confirmatory Factor Analysis (CFA) results of aggregated indicator variables of the endogenous variables (λ,Y)

Exogenous variable	Indicator	Standard loading (λ)	Reliability[a]	Error variance[b]
Relative Dependence			**0.523**[c]	
	Dag1	0.6225	0.3875	0.6125
	Dag2	0.5543	0.3072	0.6928
Influence by partner			**0.671**	
	Iag1	0.8324	0.6929	0.3071
	Iag2	0.7289	0.5313	0.4687
	Iag3	0.5832	0.3401	0.6599
Trust			**0.714**	
	Tag1	0.7383	0.5451	0.4549
	Tag2	0.4716	0.2224	0.7776
	Tag3	0.8084	0.6535	0.3465
Cooperation			**0.691**	
	Pag1	0.7356	0.541	0.459
	Pag2	0.5699	0.3248	0.6752
	Pag3	0.5832	0.3401	0.6599
Satisfaction			**0.526**	
	Sag1	0.5993	0.3591	0.6409
	Sag2	0.5869	0.3444	0.6556
Certainty			**0.504**	
	Cag1	0.3063	0.0938	0.9062
	Cag2	1.4725	2.1682	-1.1682
Commitment			**0.580**	
	Mag1	0.3769	2.2964	-1.2964
	Mag2	0.2872	0.0876	0.9124
Opportunistic behaviour			**0.694**	
	Oag1	0.7058	0.4981	0.5019
	Oag2	0.6739	0.4541	0.5459
	Oag3	0.7237	0.5238	0.4762

a = Squared multiple correlation
b = 1-indicator reliability
c = Composite reliability

The overall model consists of eight factors: opportunistic behaviour, relative dependence, commitment, trust, cooperation, influence by partner, certainty and satisfaction. Each of these constructs was measured by indicator variables, which were later aggregated into two or three manifest indicator variables. Table 6.3 shows the measurement properties of the eight constructs with the aggregated indicator variables. The table shows the standardised pattern of coefficients, the t-statistics and the constructs reliabilities useful in assessing the quality of the measurement model. All the indicator variables loaded significantly at the 5% level of significance to their respective constructs with the exception of those indicator variables measuring certainty and commitment, which were significant at the 10% level.

Table 6.3: Measurement properties for constructs

Aggregate Indicator variable	Measurement item	Factor loading (λ)	t-statistic	Composite reliability
Tag1 (V6)	Trust	0.7383	8.7313	0.71407
Tag2 (V7)		0.4716	5.0810	
Tag3 (V8)		0.8084	9.7587	
Oag1 (V14)	Opportunistic behaviour	0.7058	8.3590	0.69361
Oag2 (V15)		0.6739	7.8806	
Oag3 (V16)		0.7237	8.6324	
Cag1 (V17)	Certainty	0.3063	1.6515	0.50468
Cag2 (V18)		1.4725	1.8774	
Iag1 (V3)	Influence by partner	0.8324	9.8963	0.67083
Iag2 (V4)		0.7289	8.4349	
Iag3 (V5)		0.5832	6.4462	
Mag1 (V19)	Commitment	0.3769	1.6579	0.58028
Mag2 (V20)		0.2872	1.6760	
Pag1 (V9)	Cooperation	0.7356	8.6791	0.69081
Pag2 (V10)		0.5699	6.4387	
Pag3 (V11)		0.5832	6.6133	
Dag1 (V1)	Relative dependence	0.6225	6.1815	0.52253
Dag2 (V2)		0.5543	5.6205	
Sag1 (V12)	Satisfaction	0.5993	5.9184	0.52617
Sag2 (V13)		0.5869	5.8209	

A model is said to fit the observed data to the extent that the covariance matrix is equivalent to the observed covariance matrix (elements of the residual matrix are near zero) (Hoyle, 1995). The results show that the overall fit indices support the measurement model. Table 6.4 presents the fit indices for the confirmatory factor analysis of the aggregated manifest variables. The χ^2 fit statistic was 324.49 with degrees of freedom of 142 ($p<0.001$); while the root mean squared error of approximation (RMSEA) was 0.10. The root mean squared residual (RMSR) represents the average discrepancy between the observed sample and the proposed variance-covariance matrices and indicates a well fitting model. The results show a RMSR of 0.09, which is slightly greater than the recommended upper cutting point of 0.08 for a good model. The goodness of fit index (GFI) was 0.806 and the ratio of χ^2/df was 2.29. Generally GFI and AGFI scores ranging from 0.80 to 0.89 are interpreted as representing reasonable fit, while scores of 0.90 and above represent a good fit model (Doll *et al.*, 1995). The ratio of the χ^2/df should not be more than 3. Based on these indices the measurement model is moderately acceptable.

Table 6.4: Fit indices for CFA of aggregated manifest variables

Model	χ^2	df	χ^2/df	GFI	AGFI	CFI	NFI	NNFI	RMSR	RMSEA
Null model	324.49	142	2.29							
Eight factor model				0.80	0.71	0.78	0.79	0.71	0.09	0.10

Note: N = 124; GFI = Goodness of fit index; RMSR= Root Mean Square Residual; RMSEA = Root Mean Square of Approximation; AGFI = Adjusted Goodness of Fit Index CFI = Comparative Fit index
NFI = Normed Fit Index; NNFI = Nonnormed Fit Index

6.3.2 Scale development: reliability and validity

6.3.2.1 Internal consistence

Internal consistence is the extent to which the individual items that constitute a test correlate with one another or with the test total (Hatcher, 1998). The most widely used indices of internal consistence in social sciences is the coefficient alpha (Cronbach, 1951) and the widely used rule of thumb is alpha of 0.70 as suggested by Nunnally (1978). However, Hatcher (1998) argues that this is only a rule of thumb, and in social science literature coefficient alpha reliabilities of under 0.7, and even under 0.60 have been reported. The reliability of indicator variables is defined as the correlation between a latent factor and their indicator variables (Hatcher, 1998; Hair *et al.*, 1998). Reliability indicates the percentage of variation of the indicator variable that is explained by the factor that it is supposed to measure. Items within each scale were summed to obtain each respondent's score. The Cronbach's alpha was then calculated to determine the internal consistency of each scale. Appendix D shows the reliability of the items used in the study. Based on Hair *et al.* (1995), Appendix D shows all constructs to be satisfactorily reliable. According to Hair *et al.* (1995) an alpha level of 0.5 is acceptable since below that it would mean more than 50% of the construct variance would be an error variance.

The composite reliability on the other hand estimates the internal consistency of a construct. Composite reliabilities for aggregated manifest variables are presented in Table 6.3. The results show composite reliabilities ranging from 0.50 to 0.71.

6.3.2.2 Convergent validity

Convergent validity is the extent to which different measures intended to measure the same construct concur with each other. If different indicator variables are used to measure a construct (latent variable), those observed indicator variables should be highly correlated. In this study, convergent validity was assessed by examining the standardised parameter estimates of the CFA for both unaggregated and aggregated indicator variables for the measurement model and their t-statistics. Table 6.3 reveals that indicator variables for two constructs; certainty and commitment were significant at the 10% level, while indicators for the other constructs were significant at the 5% level. Thus, an acceptable convergent validity was achieved.

6.3.2.3 Discriminant validity

Discriminant validity addresses the concept that indicator variables measuring different constructs should not be related. It is the extent to which different indicator variables measuring different constructs diverge in their constructs. The correlation between these indicator variables should be minimal. In most cases correlation coefficients between ±0.8 and ±1 are considered to be highly correlated, between ±0.6 and ±0.8 to be moderately correlated, between ±0.4 and ±0.6 to have a weak correlation, between ±0.2 and ±0.4 to posses very weak or low correlation, and between +0.2 and –0.2 to have little or no correlation at all (Burns and Bush, 1998). Table 6.5 shows the correlation between the constructs. The highest correlation is 0.57, which is a weak correlation. Therefore, these results support the discriminant validity of the constructs. If the correlations were high, a chi-square difference test in the constrained model would have to be compared to the chi-square for the unconstrained model, and if there is no significant difference in the two chi-squares then the discriminant validity is achieved (Anderson and Gerbing, 1988).

6.3.2.4 Relationship among latent variables

Table 6.5 presents the correlations between exogenous and endogenous latent variables. The bold values are correlations of the variables depicted in the proposed model of the relationship of farmers and the millers.

Table 6.5: Correlation between latent factors

	Opp	Cert	Trust	Comit	Coop	Dep	Influby
Opp	1						
Cert	.083	1					
Sig	.362	.					
Trust	**-.576****	**-.069**	1				
Sig	.000	.444	.				
Comit	**-.048**	-.067	**.111**	1			
Sig	.595	.459	.220	.			
Coop	**-.552****	**-.059**	**.452****	**.288****	1		
Sig	.000	.517	.000	.001	.		
Dep	-.383**	-.165	.192	.215*	**.543****	1	
Sig	.000	.067	.033	.017	.000	.	
Influby	.496**	-.020	-.177*	-.305**	-.429**	**-.267****	1
Sig	.000	.829	.050	.001	.000	.003	.
Satis	-.380**	**-.029**	.393**	.175	**.556****	.440**	**-.252****
Sig	.000	.747	.000	.052	.000	.000	.005

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

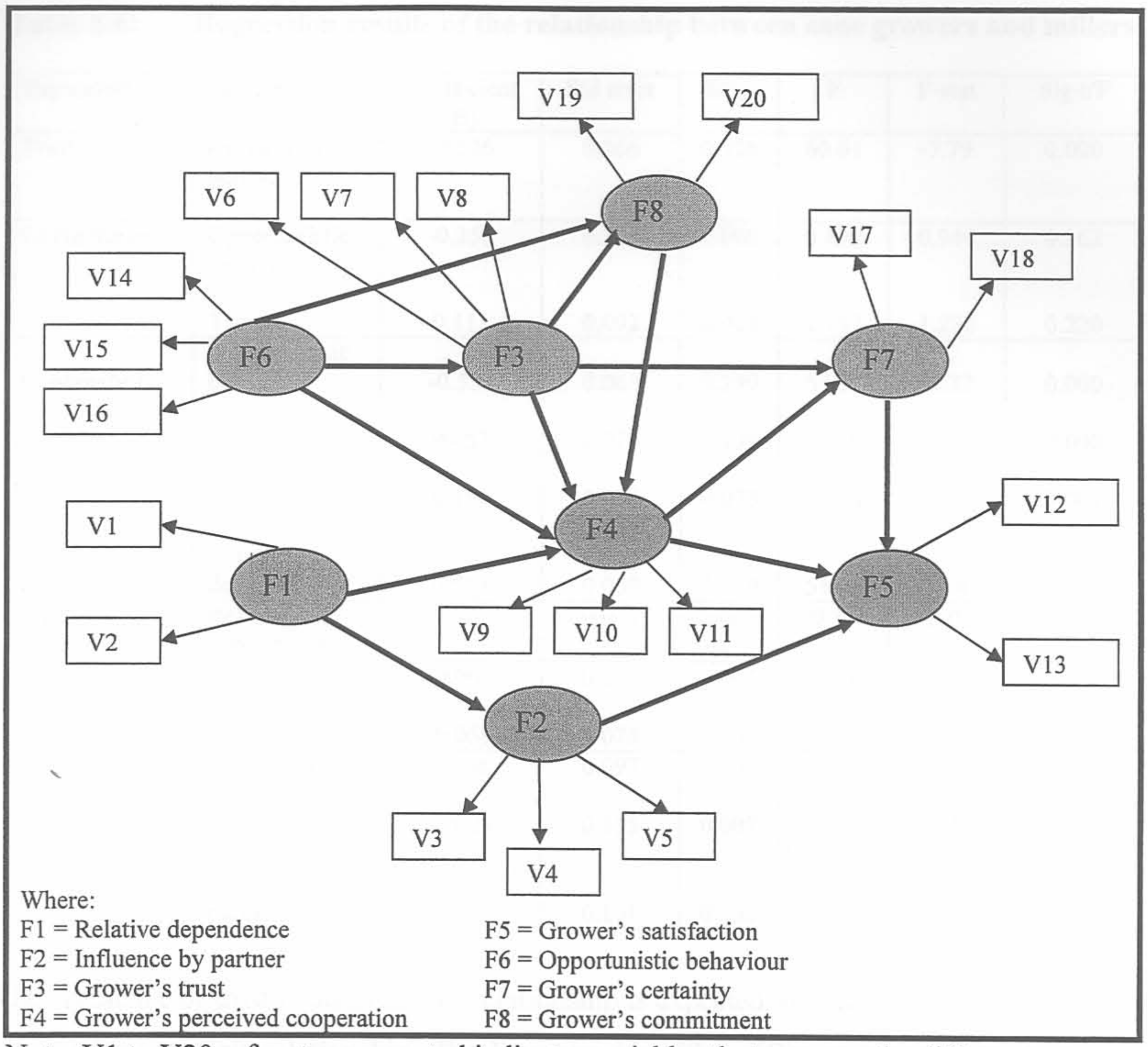
Note: Opp = Opportunistic behaviour; Cert = Certainty
Trust = Trust; Comit = Commitment
Coop = Cooperation; Dep = Relative dependence
Influby = influence by partner; Satis = Satisfaction

The results show a negative relationship between the cane growers' relative dependence on the millers and the cane growers' perceived influence by the millers, while relative dependence and cooperation are positively related. Unexpectedly, certainty is negatively related to trust and cooperation. However, the relationship between these variables was not significant ($p>0.05$). Cane growers' perceived influence by the millers is significant and negatively related to the farmers' satisfaction in their relationship with the millers. The results also indicate that the cane growers' perception of opportunistic behaviour by the millers has a significant ($p<0.01$) negative relationship with cane growers' trust and cooperation with the millers. The presence of trust in a relationship is expected to result in cooperation among the parties, commitment of each partner to the relationship and satisfaction for both parties in the relationship. Although the results show that trust has a positive relationship with commitment, it is insignificant ($p>0.05$). The results indicate that trust has a positive and significant relationship with cooperation as well as satisfaction ($p<0.01$). Cane growers' perception of cooperation is positively related to their satisfaction with their relationship with the millers.

6.4 STRUCTURAL MODEL EVALUATION

6.4.1 Hierarchical regression analysis

Because linear regression cannot test all relationships between the construct variables in a single statistical test, it is necessary to use separate regressions (hierarchical regression) to test the model fully. Figure 6.1 shows the overall model as illustrated in the conceptual framework (Chapter three). The figure shows that "relative dependence" construct (F1) is measured by manifest variables V1 and V2, while the construct "influence by partner" (F2) is measured by V3 through V5, and so forth. The variables V1 up to V20 refer to the items measuring each construct after aggregation. For example V1 is Dag1 and V2 is Dag2 (see Table 6.3). The results of the regression analysis for the model illustrated in Figure 6.1 are presented in Table 6.6.



Note: V1 to V20 refers to aggregated indicator variables that measure the different constructs in the model as explained in Table 4.3.

Figure 6.1 Relationship between smallholder farmers and the millers

The results of the regression analysis indicate a significant negative relationship between opportunistic behaviour and trust. The perception of cane growers that millers are opportunistic explains about 33% of the cane growers' trust. Although there could be other factors explaining farmers' trust in millers, perceived opportunistic behaviour has a significant impact on the farmers' trust in the millers. The results also indicate that opportunistic behaviour, though negatively related to commitment, is however insignificant in explaining commitment.

Table 6.6: Regression results of the relationship between cane growers and millers

Dependent	Independent	Coefficient (B)	Std error	R^2_{adj}	F	F-stat	Sig-t/F
Trust	Opportunistic behaviour	-0.576	0.066	0.326	60.61	-7.79	0.000
Commitment	Opportunistic behaviour	-0.253	0.286	0.008	0.892	0.944	0.362
	Trust	0.111	0.092	0.004	1.152	1.232	0.220
Cooperation	Opportunistic behaviour	-0.552	0.063	0.299	53.57	-7.32	0.000
	Trust	0.452	0.076	0.198	31.39	5.60	0.000
	Commitment	0.152	0.080	0.075	11.00	3.31	0.001
	Relative dependence	0.543	0.060	0.289	51.04	7.14	0.000
Influence by partner	Relative dependence	-0.267	0.077	0.064	9.35	-3.06	0.003
Certainty	Trust	-0.069	0.074	0.003	0.59	-0.77	0.444
	Cooperation	-0.059	0.078	0.005	0.42	-0.650	0.517
Satisfaction	Cooperation	0.556	0.097	0.303	54.53	7.38	0.000
	Certainty	-0.029	0.135	0.007	0.10	-0.32	0.747
	Influence by partner	-0.252	0.101	0.056	8.28	-.877	0.005

The presence of trust in an exchange relationship is expected to encourage partners to commit themselves to their relationship. The literature identifies different types of trust as well as different types of commitment. The results indicate that trust was not significant in explaining cane growers' commitment in their relationship with millers. The insignificant impact of trust on commitment suggests that the kind of commitment the farmers have in their relationship with the millers is the calculative type of commitment rather than affective commitment. Calculative commitment is a case where one partner makes a commitment to a relationship because he expects benefits, whereas affective commitment is based on the fact that the committed partner likes the other partner.

While the millers' opportunistic behaviour, as perceived by farmers, was able to explain 30% of the perceived cooperation by farmers in their relationship with the millers, it was apparent that factors like farmers' trust in the millers, commitment of the farmers to their relationship with the millers and the farmers' relative dependence on the millers also had an impact on the cooperation of the millers and the farmers. Trust accounted for about 20% of the variation in the farmers' perception of cooperation, while commitment explained only 7%, and of significance was the perception of relative dependence by the farmers on the millers, which explained 29% of the farmers' perceived cooperation. As expected opportunistic behaviour had a significant negative influence on the farmers' perceived cooperation, while commitment had a positive influence. The positive influence of relative dependence on cooperation implies the existence of forced cooperation among the parties. Although farmers realise that they are more dependent on the millers compared to the millers' dependence on them, they find themselves having to cooperate because they have no other alternative since they can only sell sugarcane to the assigned mill. Also sugarcane is currently the only crop with a comparative advantage in Swaziland.

Unexpectedly, a significant negative relationship was observed between the farmers' perceived relative dependence on the millers and the influence by the partner (millers). The results suggest that an increase in the farmers' perception of their relative dependence on the millers is accompanied by a low perception of influence by the millers. This could be attributed to the fact that smallholder farmers are just a minority in the sugar industry. Even if they are aware of their dependence on the millers, they do not perceive that as a reason for the millers to influence them because they are forced to cooperate. Therefore, the increase in dependence on the millers makes farmers to comply with millers and as a result there is less need for millers to use their power on the farmers. This possibly explains the negative relationship between relative dependence and influence by partner.

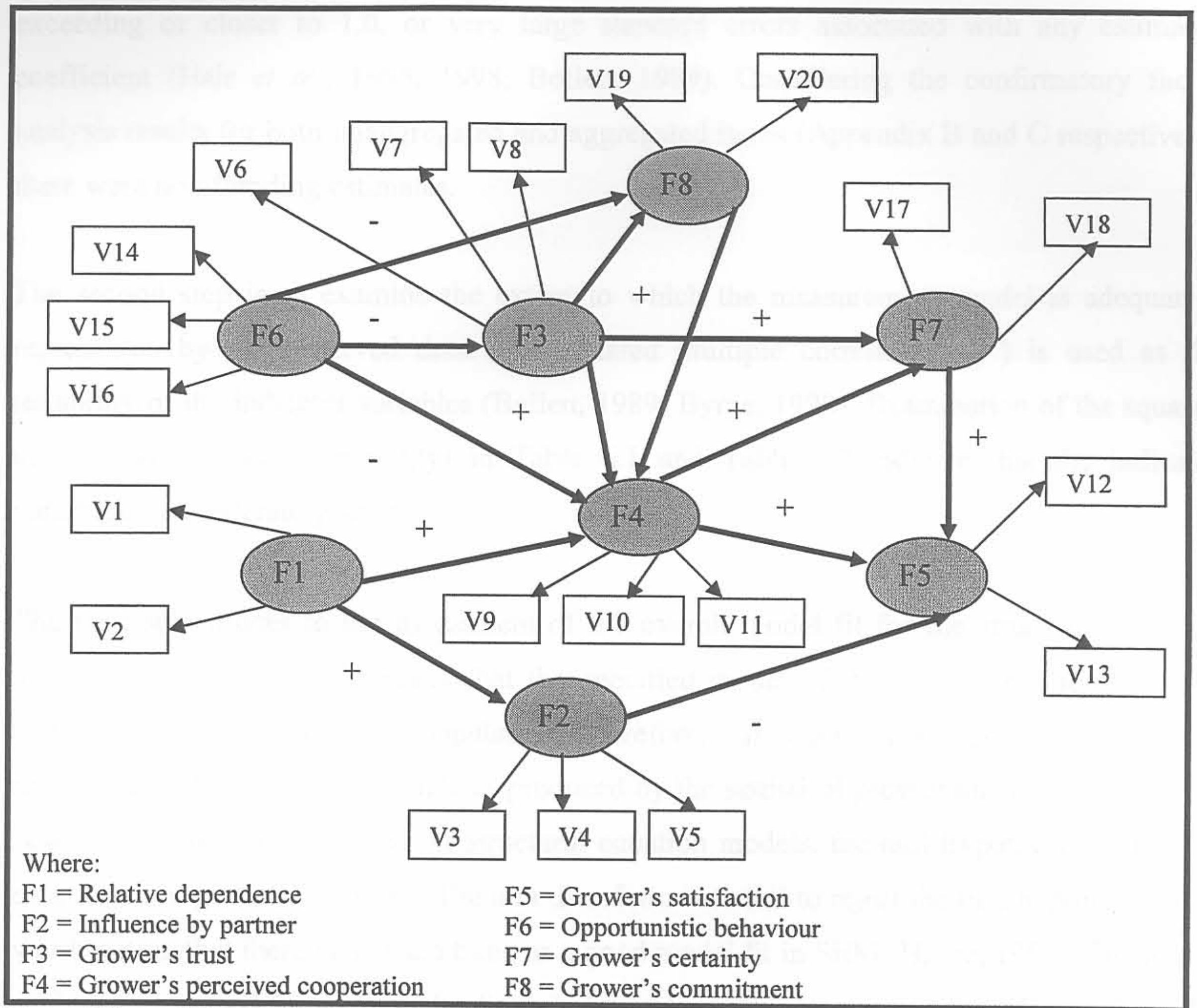
Farmers' trust and their perceptions of cooperation with the millers were expected to be positively related to certainty of the farmers in their relationship but negatively related to certainty. The results show that though trust and cooperation were negatively related to certainty, they were not significant in explaining the certainty of the relationship between the farmers and millers.

A significant positive relationship was observed between perceived cooperation and satisfaction with the relationship. The farmers' perceived cooperation explained 30% of their satisfaction with the relationship. The results suggest that cooperation plays a very important role in enhancing farmers' satisfaction in their relationship with the millers. Farmers' satisfaction is also explained by perceived influence on the part of the millers. The more farmers perceive they are influenced by the millers, the less satisfied they become with the relationship. Influence by partner explained 5.6% of the variation in the farmers' satisfaction in their relationship with the millers.

Collectively, including opportunistic behaviour, trust, commitment and relative dependence, the model was able to explain 86% of the farmers' perceived cooperation between the millers and the farmers, while cooperation and influence by partner explained 35.9% of the farmers' satisfaction in their relationship with millers.

6.4.2 Structural equation modelling

In line with James, Mulaick and Brett (1982), this study used a two-step approach to test the role of behavioural factors in the cane growers and millers' relationship. The first step is to use confirmatory factor analysis (CFA) to test the measurement model. CFA provides evidence for determining whether the manifest indicator variables appropriately measure the latent constructs. Once an appropriate measurement model has been identified, items can then be combined to form scales of the constructs. The second step is to then test the hypothesised structural model. The structural model is in fact the regression part of the latent variables. It depicts the links between the latent variables. Figure 6.2 presents the proposed theoretical structural model and the measurement model of the cane growers' and millers' relationship.



Note: V1 to V20 refers to aggregated indicator variables that measure the different constructs in the model as explained in Table 4.3.

Figure 6.2: Proposed model of cane growers and millers' relationship

There is still some debate regarding determination of model fit and interpretation of the model in structural equation models (Bollen and Long, 1993). A structural equation model with a good fit provides an indication of the general pattern of the relationships among the constructs in the study (Fan and Wang, 1998). Some researchers tend to interpret only the model fit indices, while others argue that the model components fit (direction, strength and significance of the parameters) are equally important. Therefore, in this study both the model fit indices and the components fit of the model are discussed.

The first step in evaluating the overall model was the inspection of "offending estimates", which could be in the form of estimates that exceed acceptable limits in the measurement and structural models. These may include negative error variances, standardized coefficients exceeding or closer to 1.0, or very large standard errors associated with any estimated coefficient (Hair *et al.*, 1995, 1998; Bollen, 1989). Considering the confirmatory factor analysis results for both unaggregated and aggregated items (Appendix B and C respectively) there were no offending estimates.

The second step is to examine the extent to which the measurement model is adequately represented by the observed data. The squared multiple correlations (r^2) is used as the reliability of the indicator variables (Bollen, 1989; Byrne, 1998). Examination of the squared multiple correlations (reliability) in Table 6.1 and Table 6.2 indicate that the indicator variables are moderately strong.

The next step relates to the assessment of the overall model fit for the structural equation model. Joreskog (1993) indicates that the specified model of the researcher should not be assumed to hold exactly in the population. Therefore, it is necessary to assess the model's fit and examine the modification indices produced by the statistical programme to determine the best fitting model to be tested. In structural equation models, the null hypothesis is that the data fit the hypothesised model. The aim therefore, is to fail to reject the null hypothesis. It is worth noting that there is no such thing as a good model fit in SEM (Hattie, 1985). The aim is to find a meaningful pattern of loadings to best reproduce the original covariance. A model with a fit index of 0.80 may be the best that can be achieved given the status of the theory, the adequacy of the measures, and the representativeness of the sample. In contrast, one may get a fit index of 0.95 through over-factoring the data. Therefore, there is no clear-cut measure of goodness of fit, as it is like with other multivariate dependence techniques. Hair *et al.* (1998) argue that although there are many guidelines suggested, there is no absolute test available. Bollen (1989) argue that selecting a rigid cut-off for incremental fit indices is like selecting a minimum R^2 for a regression equation hence any value will be controversial. The main aim of the fit indices, therefore, is to assist in the development of meaningful theory. If the fit is excellent but the model is not meaningful it is useless, whereas if the theory is excellent, the fit indices are, therefore, an indication of the direction to take (Hattie, 1985). Table 6.7 presents the structural results of the proposed model.

There are three main categories of metrics used to test the structural model. They include the chi-square statistic, the fit indices, and the parameter estimates. The chi-square test is an inferential test that determines whether the null hypothesis should be rejected. However, as stated before, the chi-square is sensitive to sample size. Thus, it is commonly used as a guideline. The ratio of the chi-square to the degrees of freedom is a useful index of fit as it gives an indication whether more information could be extracted from the data. The recommended ratio is 3:1. The other category is the fit indices. The fit indices are a descriptive indication of the overall fit of the observed data to the hypothesised model. The fit indices are divided into absolute fit indices and incremental fit indices. Absolute fit indices assess how well an *a priori* model (both measurement and structural models) reproduces or predicts covariance of the sample data (Hair *et al.*, 1995, 1998). It compares the hypothesised model with no model at all (null model). Therefore, this type of indices is analogous to R^2 by comparing the goodness of fit to a component that is similar to a sum of squares, while the incremental fit indices compare the target model with a baseline model, also referred to as the null model, in order to measure the proportionate improvement in fit (Hair *et al.*, 1995).

Table 6.7: Structural parameters of proposed model (for the full model)

Parameter	Estimate	Std Error	t-stat
F6-F4	-0.0468	0.2811	-0.166
F6-F8	-0.4251	0.0674	-2.032
F3-F4	0.0974	0.2509	0.388
F8-F4	0.1060	0.1413	0.750
F1-F4	0.6898	0.2267	3.043
F1-F2	-0.5212	0.0905	-5.759
F6-F3	-0.5706	0.0862	-6.617
F3-F8	0.3934	0.1426	2.758
F3-F7	0.0764	0.3485	0.468
F4-F7	-0.0106	0.0042	-2.493
F4-F5	0.7288	0.1541	4.729
F2-F5	0.2129	0.1031	2.065
F7-F5	0.1846	0.1323	1.395

Where: F1 = Relative dependence
F2 = Influence by partner
F3 = Grower's trust
F4 = Perceived cooperation
F5 = Grower's satisfaction
F6 = Opportunistic behaviour
F7 = Grower's certainty
F8 = Grower's commitment

For indices such as GFI, AGFI, CFI, NFI and NNFI, their values range from 0 to 1.0. Therefore, as a general rule, values closer to 0.9 indicate good fit, whilst for the RMSEA, values less than 0.05 indicate good fit, values between 0.05 and 0.08 indicate reasonable fit, values between 0.08 and 0.10 indicate mediocre fit and values greater than 0.10 indicate poor fit to the data.

The issue of sample size in SEM remains an active debate (Hair *et al.*, 1995,1998; Anderson and Gerbing, 1988). With smaller samples (N < 150) there is a danger of not obtaining convergent solutions even for highly specified models (Anderson and Gerbing, 1988). . Small sample sizes may result in unreliable, inflated and spurious results. Therefore, the recommended sample size is at least 100 for simple models or at least 5 observations per parameter (Hair *et al.*, 1995, 1998). Similarly, large sample size, (N > 400) would result in discrepancies in the model fit indices and lead to their rejection when the model is satisfactory because the fit indices are sensitive to large sample sizes. Due to the sensitivity of SEM in terms of sample size and the number of observations per parameter to be estimated, the proposed model was then reduced by splitting it into three sub-models for purposes of analysis in order to make use of the 124 respondents from the cane growers (see detailed results for sub-models 1, 2 and 3 in Appendix E). Figure 6.3 shows the split of the three sub-models.

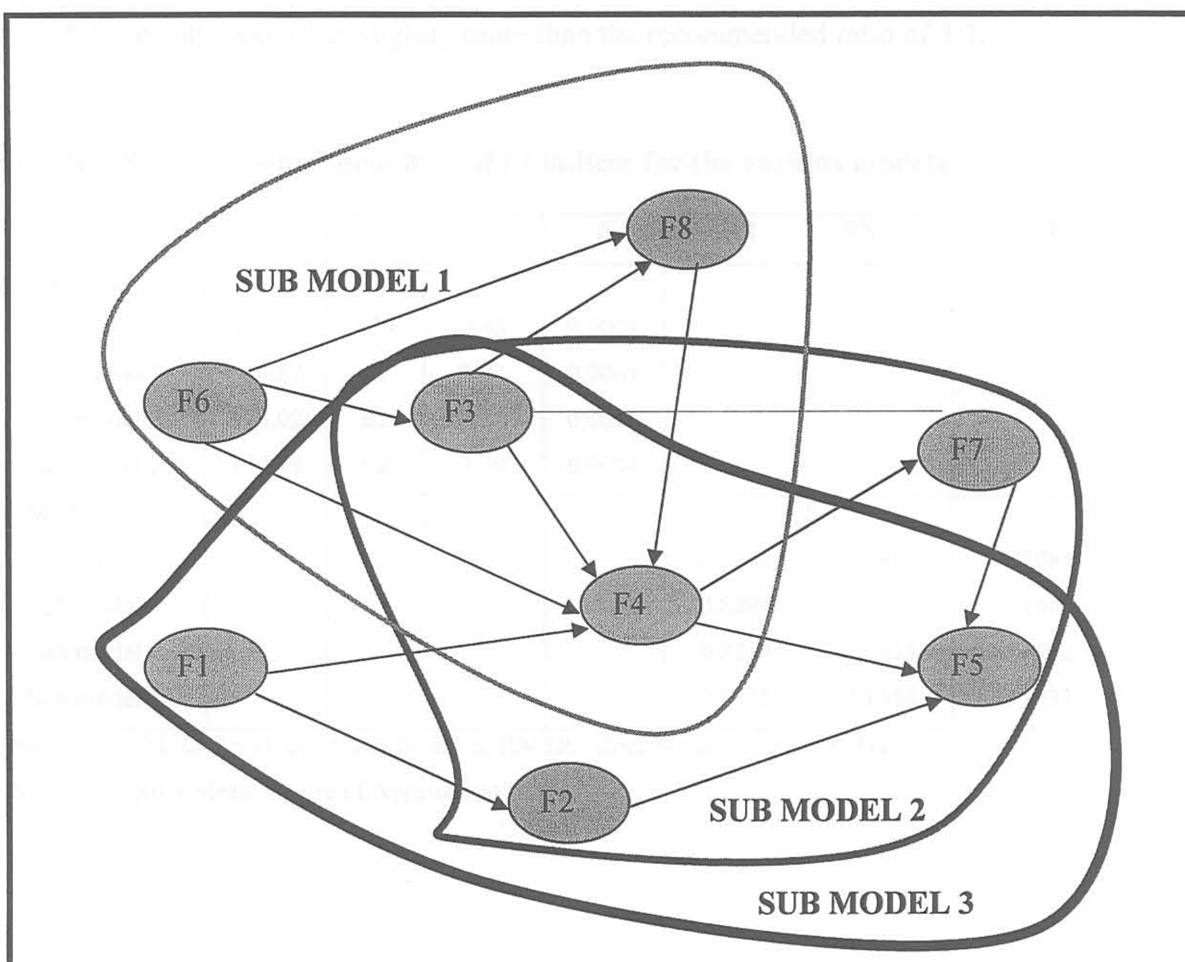


Figure 6.3: Sub-models 1, 2, and 3 of proposed model of cane growers and millers' relationship

Even if the hypothesised model may provide a good fit to the data, it would be premature to accept the model without considering alternative models provided by theory. This is mainly because there may exist some models that may fit the data equally well or even better than the hypothesised model. Therefore, the final approach in model assessment is to compare the proposed model with a series of competing models, which act as alternative explanations to the proposed model (Hair *et al.*, 1995). In this way one can determine whether the proposed model is acceptable, since there is no other similar formulated model that can achieve a higher level of fit. In this study, different models were considered, which could be theoretically supported. While the proposed model does not achieve the recommended levels of a good fit, it represents the best available model in this study. The results of the sub-models are shown in Table 6.8. The results show that all three sub-models had an average fit. The RMSEA is about 0.1, which meets the acceptable level for an average model fit to the data. The overall model fit, though less than 0.90, also shows an average fit for all three sub-models. The GFI is above 0.80. The ratio of chi-square to degrees of freedom is also relatively acceptable, though the one for the sub-model 1 is slightly more than the recommended ratio of 3:1.

Table 6.8a: Absolute goodness of fit indices for the various models

Model	χ^2	*Df*	χ^2/Df	*P*	GFI	RMSR	RMSEA
Null Model:							
Full model.	388.98	159	2.45	0.0001			
Sub model 1.	144.87	39	3.71	0.0001			
Sub model 2.	175.92	62	2.84	0.0001			
Sub model 3.	197.49	62	3.19	0.0001			
Model:							
Full model.					0.7668	0.1386	0.1084
Sub model 1.					0.8296	0.1647	0.1486
Sub model 2.					0.8255	0.1913	0.1222
Sub model 3.					0.8345	0.1554	0.1333

Note: N = 124; GFI = Goodness of fit index; RMSR= Root Mean Square Residual;

RMSEA = Root Mean Square of Approximation

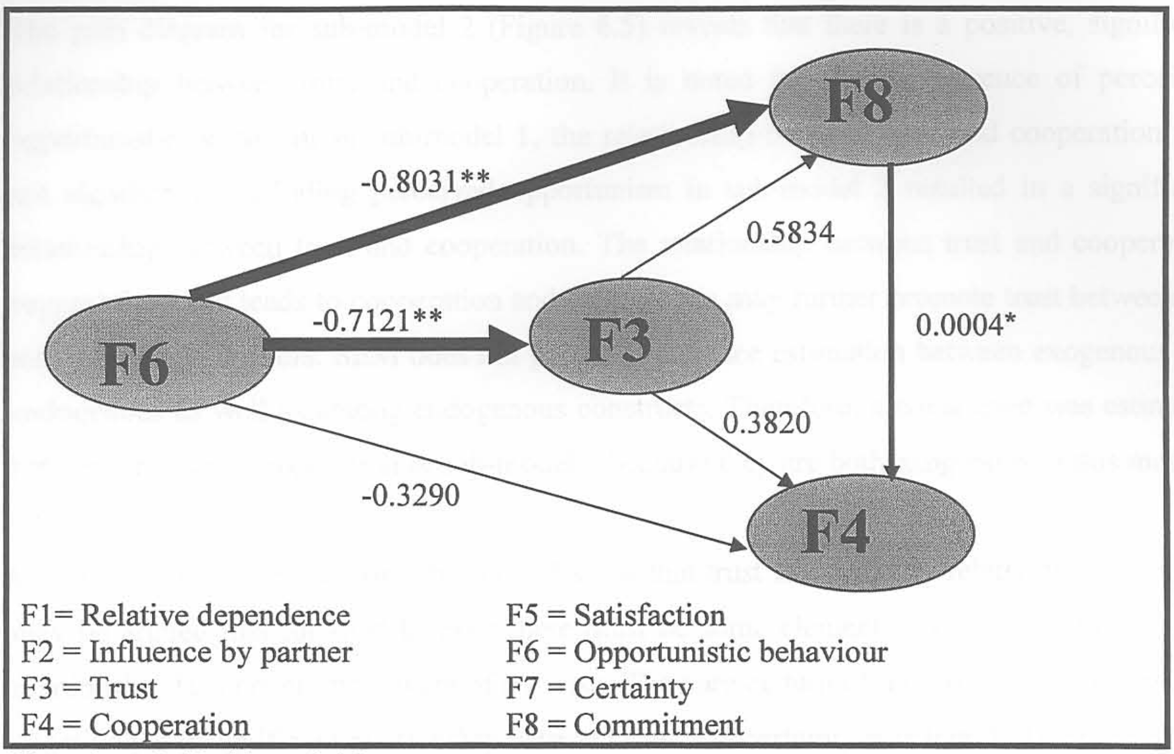
Table 6.8b: Incremental goodness of fit indices for the various models

Model	AGFI	CFI	NFI	NNFI
Null Model:				
Model:				
Full model.	0.692	0.728	0.624	0.675
Sub model 1.	0.712	0.767	0.716	0.672
Sub model 2.	0.744	0.759	0.681	0.697
Sub model 3.	0.757	0.744	0.675	0.678

Note: N = 124; AGFI = Adjusted Goodness of Fit Index CFI = Comparative Fit index NFI = Normed Fit Index; NNFI = Nonnormed Fit Index.

The results of the paths for the three sub-models are presented in Figures 6.4, 6.5, and 6.6. The results of the path diagram for sub-model 1 (Figure 6.4) show that opportunistic behaviour is negatively related to trust and commitment. A lack of significance was observed in the relationship between opportunistic behaviour and perceived cooperation. Surprisingly, trust was not significant in influencing commitment and farmers' perceived cooperation with the millers. This insignificance could be a result of the trade-off between the level of perceived opportunistic behaviour and the level of farmers' trust to the millers. As discussed in Chapter five, farmers have minimal trust in the millers. Hence, the presence of a greater perception of opportunistic behaviour results in less trust, which becomes insufficient to influence the farmers' perception of cooperation. Minimal trust implies contractual trust only; this is based on the contractual obligation of the parties and hence does not influence commitment. A significant relationship was found between commitment and cooperation.

Table 6.9 presents the structural parameters and the squared multiple correlations of the factors in sub-model 1. The results in Table 6.9b show that 78% of the variance in trust is explained by the perception of opportunistic behaviour, 62% of the variance in cooperation is explained by commitment and 0.08% of the variation in commitment is explained by the farmers' perception of opportunistic behaviour by millers.



Note: $*p < 0.10$, $**p < 0.05$

Figure 6.4: Path Diagram for sub-model 1

Table 6.9a: Structural Parameters for sub-model 1

Parameter	Estimate	Std Error	t-stat
F3-F8	0.5834	0.4281	1.3628
F6-F8	-0.8031	0.3443	-2.3326
F6-F3	-0.7121	0.0845	-8.4278
F3-F4	0.3820	0.2842	1.3441
F6-F4	-0.3290	0.2280	-1.4430
F8-F4	0.0004	0.0003	1.6838

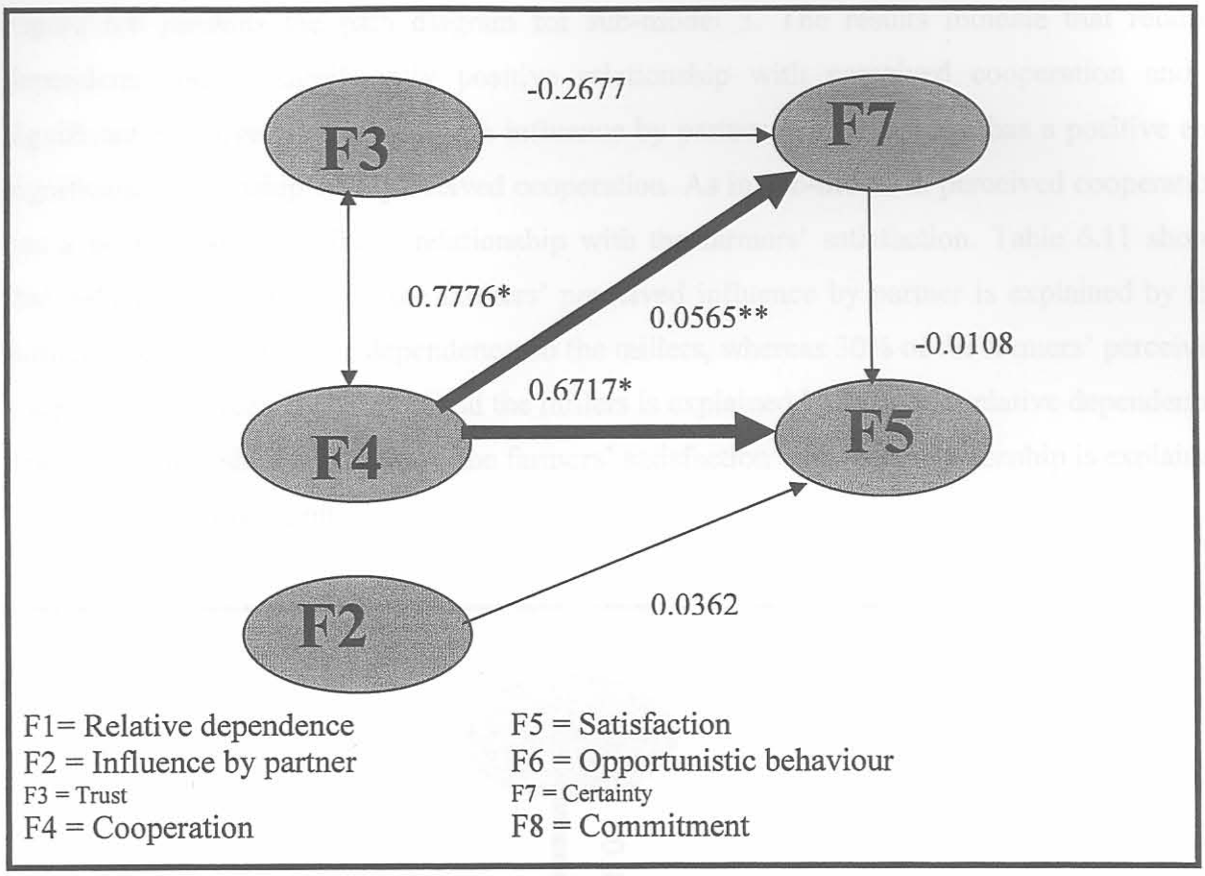
Table 6.9b: Squared Multiple Correlations

Variables	Error Variance	Total Variance	R-squared
F3	0.1449	0.6519	0.7777
F4	0.2353	0.6178	0.6191
F8	236.0768	236.2765	0.0008

The path diagram for sub-model 2 (Figure 6.5) reveals that there is a positive, significant relationship between trust and cooperation. It is noted that in the presence of perceived opportunistic behaviour in sub-model 1, the relationship between trust and cooperation was not significant. Excluding perceived opportunism in sub-model 2 resulted in a significant relationship between trust and cooperation. The relationship between trust and cooperation suggest that trust leads to cooperation and cooperation may further promote trust between the millers and the farmers. SEM does not permit covariance estimation between exogenous and endogenous as well as among endogenous constructs. Therefore, a covariance was estimated between trust and cooperation in sub-model 2 because they are both exogenous in this model.

Unexpectedly, the results for sub-model 2 show that trust is negatively related to certainty. It may be argued that for trust to exist there must be some element of risk. Therefore, in this relationship farmers are not aware of any risk. They are certain of their relationship. Hence, a negative yet insignificant relationship between trust and certainty was found. As expected, the farmers' perceived cooperation was positive and significantly related to the farmers' certainty in their relationship with the millers as well as the farmers' satisfaction with the relationship. However, certainty was negatively related to satisfaction but this was also insignificant. A possible explanation for the negative relationship between certainty and satisfaction could be that as farmers become certain of their relationship with millers, they tend to expect more benefits from this relationship and if they do not get the expected benefits, their satisfaction with the relationship decreases. As noted also in Chapter five, farmers with more experience are less satisfied because of complacency when they are expected to be more certain and more satisfied with their relationship with the millers because they have been in the sugar industry for a long time.

The results in Table 6.10 reveal that 81% of the variation in the farmers' satisfaction with their relationship with the millers is explained by their perception of cooperation between farmers and the millers. The results further show that the perceived cooperation explains about 0.8% of the variation in certainty.



Note: $^{**}p < 0.01$, $^{*}p < 0.05$

Figure 6.5: Path Diagram for sub-model 2

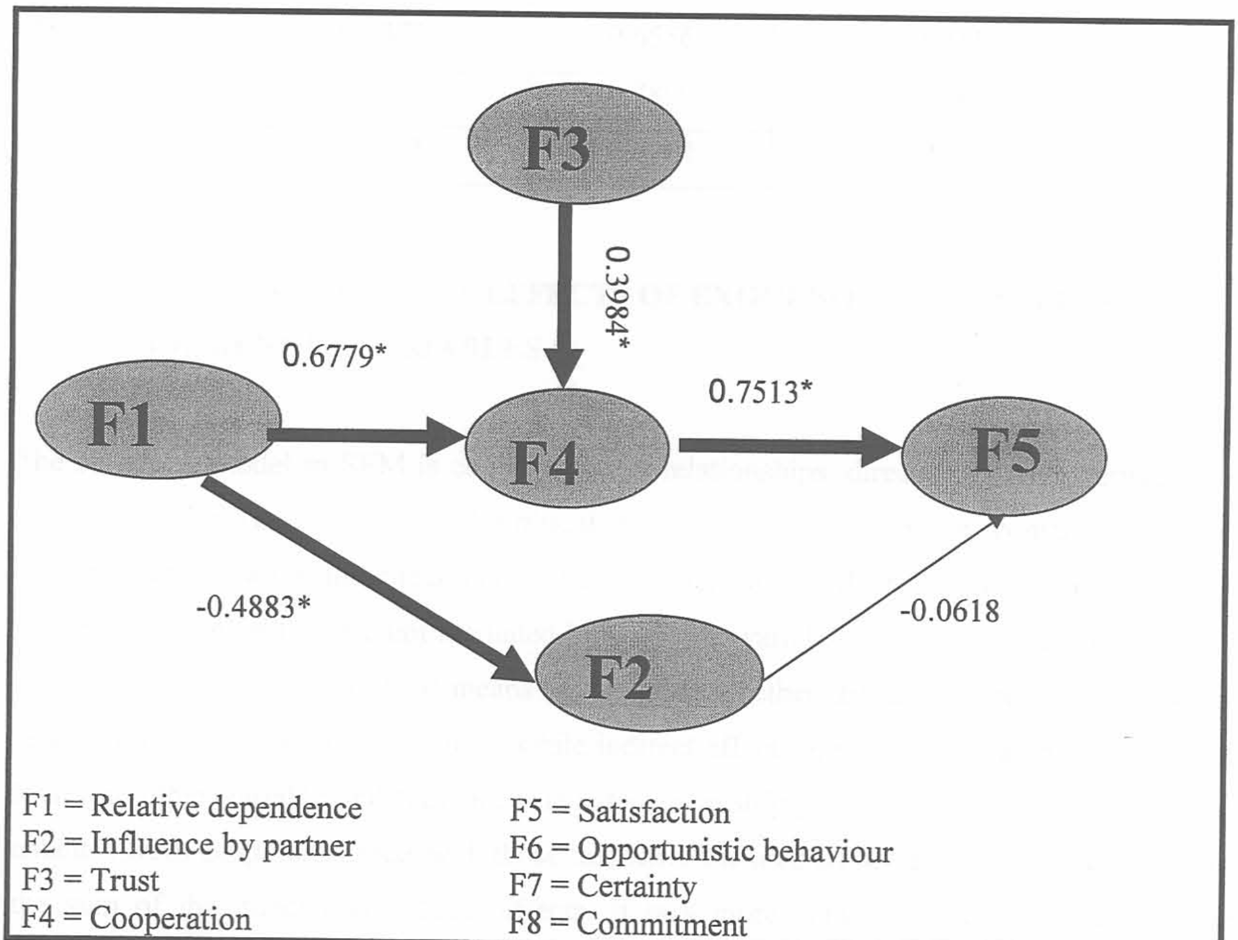
Table 6.10a: Structural Parameters for sub-model 2

Parameter	Estimate	Std Error	t-stat
F3-F7	-0.2677	0.1840	-1.1830
F4-F7	0.0565	0.1906	2.0565
F2-F5	0.0362	0.0682	0.5313
F4-F5	0.6717	0.0878	7.6473
F7-F5	-0.0108	0.0830	-0.1303
Cov: F3F4	0.7776	0.0545	14.27

Table 6.10b: Squared Multiple Correlations for sub-model 2

Variables	Error Variance	Total Variance	R-squared
F5	0.1078	0.5586	0.8069
F7	8.0175	8.0797	0.0077

Figure 6.6 presents the path diagram for sub-model 3. The results indicate that relative dependence has a significantly positive relationship with perceived cooperation and a significant negative relationship with influence by partner (millers). Trust has a positive and significant relationship with perceived cooperation. As in sub-model 2, perceived cooperation has a positive and significant relationship with the farmers' satisfaction. Table 6.11 shows that 94% of the variation in the farmers' perceived influence by partner is explained by the farmers' perceived relative dependence on the millers, whereas 30% of the farmers' perceived cooperation between themselves and the millers is explained by trust and relative dependence. The results also show that 82% of the farmers' satisfaction with their relationship is explained by perceived cooperation.



Note: $*p < 0.05$

Figure 6.6: Path Diagram for sub-model 3

Table 6.11a: Structural parameters for sub-model 3

Parameter	Estimate	Std Error	t-stat
F3-F4	0.3984	0.0675	5.9004
F1-F4	0.6779	0.0817	8.2956
F1-F2	-0.4883	0.0931	-5.2441
F2-F5	0.0618	0.0933	0.6619
F4-F5	0.7513	0.1322	5.6827

Table 6.11b: Squared Multiple Correlations for sub-model 3

Variables	Error Variance	Total Variance	R-squared
F2	0.0373	0.6556	0.9431
F4	0.5515	0.7899	0.3018
F5	0.0728	0.4152	0.8246

6.5 TOTAL AND INDIRECT EFFECTS OF EXOGENOUS VARIABLES ON ENDOGENOUS VARIABLES

The structural model in SEM is concerned with relationships, direct or indirect between the latent variables (Bollen, 1989). Empirical analysis of links between constructs can be examined in two ways, the direct and total effects. The direct effects are the influences of one variable on another that are not mediated by any other variable. The test of the direct effects provides a more straightforward means of assessing whether the data supports the proposed relationships between two constructs, while indirect effects are those that are mediated by at least one other variable and they are calculated by multiplying all the significant links that emanate from single constructs with those that leave the mediating variables. Total effects are the sum of the direct and indirect effects. It is a more comprehensive indication of the influence of one construct on another. Indirect and total effects are useful in answering questions that may not be addressed by direct effects (Bollen, 1989). Tables 6.12 and 6.13 present the direct, indirect and total effects of each construct.

Table 6.12: Indirect, direct, and total effects for hierarchical regression

	F2	F3	F4	F5
F1: IDE				0.0673
IDE				0.3019
DE	-0.2670		0.5430	
TE	**-0.2670**		**0.5430**	**0.3692**
F2: IDE				
DE				-0.2520
TE				**-0.2520**
F3: IDE				0.2513
DE			0.4520	
TE			**0.4520**	**0.2513**
F4: IDE				
DE				0.5560
TE				**0.5560**
F6: IDE				-0.1448
IDE			-0.2604	-0.3069
DE		-0.5760	-0.5520	
TE		**-0.5760**	**-0.8124**	**-0.4549**
F8: IDE				0.0845
DE			0.1520	
TE			**0.1520**	**0.0845**

Table 6.13: Indirect, direct and total effects for SEM in sub model 1, 2 and 3

	F2	F3	F4	F5	F7	F8
F1: IDE				0.5093		
DE	-0.4883		0.6779			
TE	**-0.4883**		**0.6779**	**0.5093**		
F3: IDE				0.2993		
DE			0.7776*			
DE			0.3984**			
TE			**0.5880*** **	**0.2993**		
F4: IDE						
DE				0.6717*		
DE		0.7776		0.7513**	0.0565	
TE		**0.7776**		**0.7115** ***	**0.0565**	
F6: IDE			-0.0003			
DE		-0.7121				-0.8031
TE			**-0.0003**			**-0.8031**
F8: IDE				0.0003		
DE			0.0004			
TE			**0.0004**	**0.0003**		

* = direct effect from sub-model 2
** = direct effect from sub-model 3
*** = total effect (average of sub-model 2 and 3 direct effects)

Note: F1= Dependence; F2 = Influence by partner; F3 = Trust; F4 = Cooperation ; F5 = Satisfaction; F6 = Opportunistic behaviour; F7 = Certainty; F8 = Commitment

Note: DE = Direct effect; IDE = Indirect effect; TE = Total effect

The results in both Tables 6.12 and 6.13 indicate that, though relative dependence (F1) does not have a direct effect on satisfaction (F5), it does however have a significant positive influence on perceived cooperation (F4) and a negative impact on influence by partner (F2). Relative dependence (F1) has a positive significant relationship with farmers' satisfaction via cooperation. Trust (F3) is regarded as an important element influencing cooperation in relationships and as an indispensable asset in successful relationships. The results in both tables show that trust is important in the smallholder cane growers' satisfaction with their relationship with millers. Through cooperation, trust has a positive significant influence on satisfaction.

The presence of opportunistic behaviour in any exchange relationship affects the performance of the parties in the relationship. The results show that cane growers' perceptions of opportunistic behaviour (F6) by millers has a significant negative impact on the cane growers' satisfaction via trust and perceived cooperation.

The results also indicate that commitment (F8) is important in an exchange relationship. It has a significant positive impact on cooperation and through cooperation also positively influences the cane growers' satisfaction in their relationship with the millers.

6.6 ANALYSIS OF HYPOTHESES

The study aims to determine factors affecting the performance of cane growers in their exchange relationship with millers and hence the sugar industry supply chain. It further seeks to identify the importance of social factors such as trust, commitment, opportunism, dependence and cooperation in the contractual relationship between these farmers and the millers. Finally, this study presents, and empirically tests a model that describes the contractual relationship of cane growers and millers as important units of the sugar industry supply chain.

Following a discussion of the issues and challenges in the Swaziland sugar industry, hypotheses were developed to guide the study process. The analysis of these hypotheses is addressed in this section.

Hypothesis 1: social factors such as trust are important mechanisms that can complement formal governance mechanisms in exchange relationships between smallholder cane growers and millers. An analysis of the perceptions of the farmers in Chapter five showed that trust is inevitably an important element in relationships. Exchange relationships can rely on trust as one of the governance mechanisms. The results in the study have shown that both millers and farmers have minimal trust in each other within their relationship, which is mainly the contractual trust based on fulfilling what they are obligated to by contract. The results further indicated that more farmers who trust than those who do not are committed to their relationship and more farmers who do not trust millers than those who trust them perceive millers to be opportunistic. Similarly, more of the farmers who do not trust the millers than those who do perceive poor cooperation between farmers and millers.

The results indicate the important role played by trust as a governance mechanism. The presence of trust in a relationship tends to influence the perceptions of the parties within the relationship.

Hypothesis 2: The relationship of cane growers and millers is explained by the structural model developed in Chapter three (Figure 3.3). Table 6.14 provides a summary of the analysis of the hypothesis. The analysis of this hypothesis shows that some of the proposed relationships between the constructs were supported, and some were not supported, while others were partially supported. Partially supported relationships, refers to those that were either supported by the regression analysis or by the SEM but not both. Although both methods result in the same conclusion in terms of the direction of the relationship, the SEM also provides an indication whether the proposed structure of the relationship really fits the data. This is achieved through the goodness of fit indices.

Table 6.14: Summary of hypothesised farmers' relationship with millers.

Factor	Hypothesised relationship	Results
F6-F3	-	Supported
F6-F4	-	Partially supported
F6-F8	-	Partially supported
F1-F2	+	Not supported
F1-F4	+	Supported
F3-F4	+	Supported
F3-F7	+	Not supported
F3-F8	+	Not supported
F8-F4	+	Supported
F4-F5	+	Supported
F4-F7	+	Partially supported
F2-F5	+	Partially supported
F7-F5	+	Not supported

F1 = Dependence
F2 = Influence by partner
F3 = Trust
F4 = Cooperation
F5 = Satisfaction
F6 = Opportunistic behaviour
F7 = Certainty
F8 = Commitment

Hypothesis three: The performance of smallholder farmers in the sugar industry is a function of their perceived opportunistic behaviour, trust, perceived cooperation and the growers' proximity to the mill to which they deliver sugarcane. The summary analysis of this hypothesis is presented in Table 6.15.

Table 6.15: Summary of hypothesised determinants of farmers' performance

Variable	Variable description	Performance measure	Hypothesised relationship	Results
Distance to the mill	Milldist	Profit/ha	-	Supported
		Revenue/ha	-	Not supported
		Perception of profit	-	Not supported
Perceived Opportunistic behaviour	F6	Satisfaction (F5)	-	Supported
Trust	F3	Satisfaction (F5)	+	Supported
Cooperation	F4	Satisfaction (F5)	+	Supported

6.7 SUMMARY

This chapter first examined the results of the statistical analyses performed on the smallholder cane growers' relationship with the millers. The role of social factors in the performance of smallholder farmers and hence the sugar industry supply chain, and a test of the model representing the relationship between the farmers and the millers' were simultaneously examined using both multiple regression and structural equation modelling analyses.

Table 6.16 provides a summary of the factors explaining the relationship between the farmers and the millers. The results indicate that absence of opportunistic behaviour, perceived cooperation, trust, commitment, and dependence are important factors in the relationship between smallholder cane growers and the millers.

Table 6.16: Summary of factors affecting the relationship of farmers and the millers

Dependent variable	Independent variable	Regression	SEM
Trust	Opportunistic behaviour	-***	-
Commitment	Opportunistic behaviour	-	-**
	Trust	+	+
Cooperation	Opportunistic behaviour	-***	-
	Trust	+***	+/+**
	Commitment	+***	+*
	Relative dependence	+***	+**
Influence by partner	Relative dependence	-***	-**
Certainty	Trust	-	-
	Cooperation	-	+**
Satisfaction	Cooperation	+***	+**
	Certainty	-	-
	Influence by partner	-***	-

* = Significant at 10% level, ** = Significant at 5% level, *** = Significant at 1% level

The final model of the relationship between the cane growers and millers, based on both the multiple regression and SEM analysis, is presented in Figure 6.7. This figure combines the results from the hierarchical regression and the three SEM sub-models. The model suggests that farmers' perceived opportunistic behaviour by millers is negatively related to farmers' trust, perceived cooperation and commitment, while farmers' perception of cooperation is positively influenced by trust, commitment, and relative dependence. Perceived influence by the partner is negatively influenced by relative dependence. The overall model indicates that perceived cooperation positively influences the farmers' satisfaction and the certainty of the farmers in their relationship.

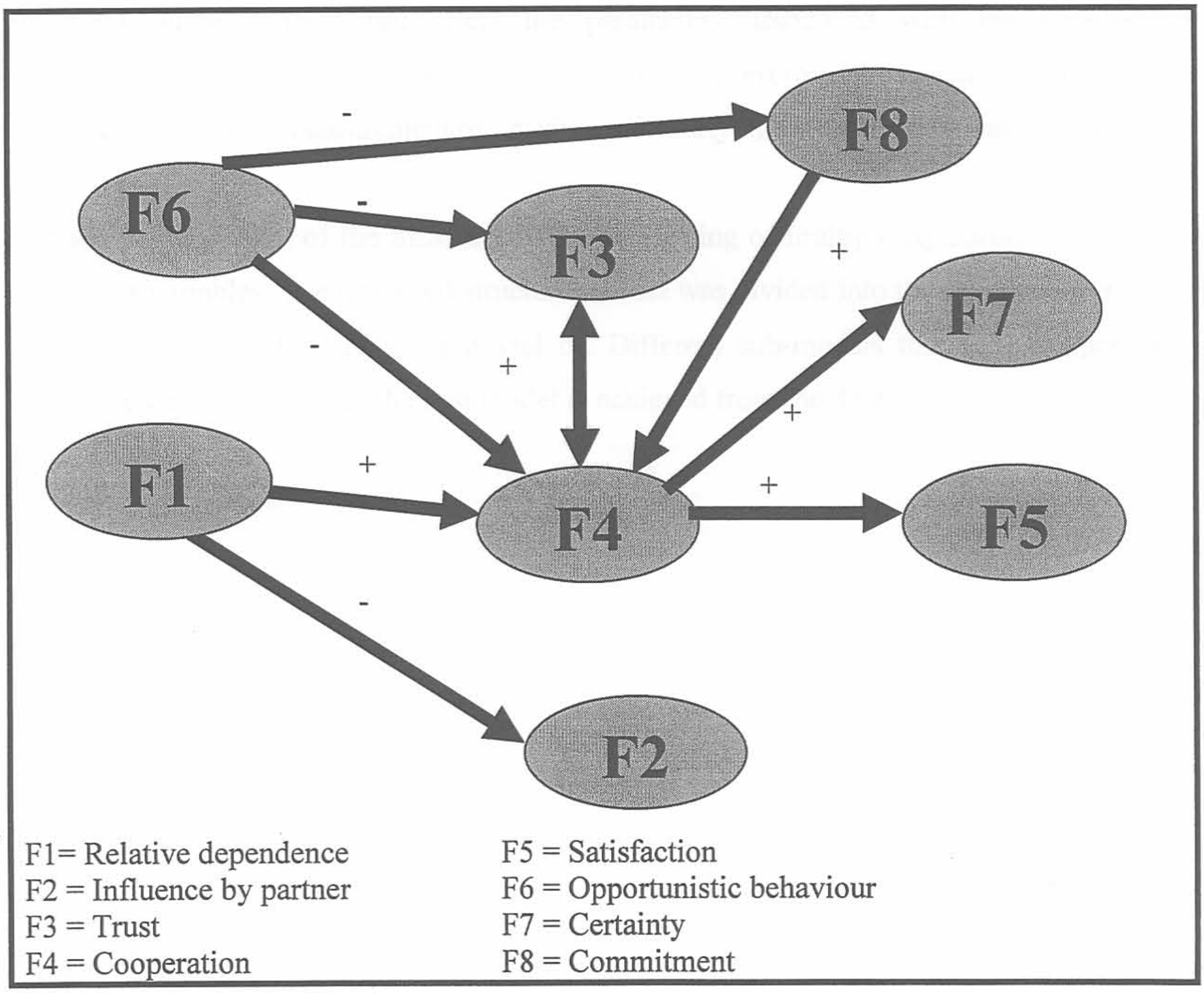


Figure 6.7: A model of smallholder cane growers' relationship with millers

A structural equation model (SEM) was utilised to empirically test the relationships between the constructs in this study. SEM allows simultaneous estimation of (1) a measurement model that relates the items in each scale to the construct they represent, giving factor loadings for each item, and (2) a structural model that relates constructs to one another, providing parameter value (i.e., path coefficients). This method was chosen so that both an a priori model accounting for measurement error in the construct and their respective scale measurements and simultaneous estimation of those relationships for the complex model can be achieved. The properties of the items of the constructs in the proposed model and the hypotheses were tested using the SAS Procalis version 8 with maximum likelihood (ML) method of estimation.

The use of confirmatory factor analysis (CFA) ensures the uni-dimensionality of the scales measuring each construct in the model and avoids the interaction of the measurement and structural models that could affect the parameters associated with the hypothesised relationship between the constructs in the model. Therefore, before testing the overall measurement model, measurement of uni-dimensionality of each construct was assessed.

The structural portion of the SEM allows for the testing of multiple equations with multiple dependent variables. The proposed structural model was divided into three sub-models, which were then tested individually for model fit. Different sub-models that were supported by theory were tested to ensure the best model is achieved from the data.