

# Environmental factors, supply chain capabilities and business performance in horticultural marketing channels

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## Abstract

This paper investigates the relationship between environmental uncertainty, supply chain capabilities and business performance in the context of the Zimbabwean horticultural industry. We hypothesised that the development of most supply chain capabilities would be negatively associated with environmental uncertainty and that supply chain capabilities would be positively related to the performance of the individual businesses in the supply chain. These hypotheses were tested using structural equation modelling. The hypotheses were generally supported for the relationships between environmental uncertainty and supply chain capabilities. However, most supply chain capabilities and environmental uncertainty were seen to be negatively related to business performance. We used established constructs for environmental uncertainty and business performance and developed new measures of supply chain capabilities. The main contributions of the paper are to simultaneously test the linkages between the three constructs and to develop new measures of supply chain capabilities.

*Key Words:* Environmental uncertainty, supply chain performance, business performance, horticulture, developing country

## Acknowledgements

We acknowledge the valuable editorial contributions of the editors and reviewers, as well as those of our colleagues, Susan Mayson and Liz Dumps

## 1. Introduction

Previous research indicates links between individual business performance and environmental uncertainty (Ashmore, 1992; Bello and Gilliland, 1996). Most writers agree that better knowledge and certainty about the business environment translates into superior performance (Ashmore, 1992; Bourgeois, 1985). However, organisations in stable environments may be less innovative and have a less flexible strategic posture (Ozsomer *et al.*, 1997). While there is a substantial body of literature on the relationship between business performance and environmental uncertainty, less attention has been paid to the linkages between supply chain capabilities and the business environment as well as between supply chain capabilities and individual business performance.

The aims of this paper are to:

- a) Develop new measures of overall supply chain capability based on the perceptions of channel members
- b) To investigate the linkages between environmental uncertainty, specific supply chain capabilities and business performance.

Environmental uncertainty is defined as the degree to which future states of the world cannot be accurately predicted or anticipated (Pfeffer and Salanick, 1978). Thus, channel members perceive environmental uncertainty when there are changes in technology, customers, competitors and supply channel relationships. Firms therefore seek to take actions to reduce the impact of the perceived environmental changes. These activities may result in enhanced supply chain capabilities and business performance.

Following a long tradition in operations and production management, agricultural economics and agricultural marketing, overall supply chain capability is seen as having two dimensions;

- a) **operational efficiency** measured in terms of logistical measures such as processing, inventory and transport costs, delivery lead times, reliability of delivery and stockouts (Beamon, 1999; Collins *et al.*, 2001).
- b) **economic efficiency**, measured by the competitive structure of the marketing channel at each stage and the extent to which prices and margins reflects costs (Marion, 1986).

There has been considerable research on operationalising both of these measures. However, the logistical measures are primarily financial and do not include dimensions of channel performance such as innovation and flexibility in coping with fluctuations in demand and supply. Measures of economic efficiency may provide valuable insights for public policy-makers, but are of little value for managers of businesses in the supply chain.

This study develops a new approach to measuring supply chain capability based on the perceptions of the channel participants of how their channel performs relative to competing channels in the industry. This captures a number of dimensions that are not included in previous work.

Cunningham (2001) has argued that there is a serious deficiency in any sort of research on supply chains in Africa. This research seeks to address this deficiency. Its context is the Zimbabwean horticultural industry which comprises two sectors; the informal (traditional) sector and the modern formal sector driven by the export market. Horticultural supply chains in African countries such as Zimbabwe are increasingly linked into to the global horticultural marketing system, but research on them has been limited relative to that conducted in Europe and the USA. The perishable nature of horticultural products and the complexity of their international distribution system justifies more research on horticultural marketing channels, particularly those that link into developing countries. This study addresses this deficiency by developing measures appropriate to a developing country context and testing them in a particular developing country, Zimbabwe.

The structure of the paper is as follows. First, we review the literature on supply chain management, environmental uncertainty and business performance. Secondly, the conceptual framework and hypotheses are developed. A discussion of the research methodology follows and finally the results, research implications, managerial implications and directions for future research are discussed.

## 2. Literature review, conceptual framework and hypotheses

The relationship between environmental uncertainty and business performance has attracted considerable interest in prior research (Ashmore, 1992; Bello and Gilliland, 1996; Oswald, Mossholder and Harris, 1997). This research has viewed environmental uncertainty in terms of environmental volatility, competitive intensity and market turbulence (Kohli and Jaworski, 1993; Morgan, 1999). However, the link between environmental uncertainty and supply chain capabilities has received less attention. Researchers who have addressed this issue are Guiltinan *et al.*, (1980), Gunasekaran *et al.*, (2001), Monczka *et al.*, (1997) and Frazier (1999).

Supply chains are sets of sequentially, vertically organised transaction systems (Lazzarini *et al.*, 2001). They include all companies and organizations with which a focal company directly or indirectly interacts, through its suppliers and customers (Lambert and Cooper, 2000). Supply chain management is a multi-faceted construct involving intra-organisational and inter-organisational activities aimed at

delivering reliable products and services at competitive prices with minimal difficulty and inconvenience (Morash and Clinton, 2000). Supply chain management is crucial for companies involved with highly perishable products such as fruit and vegetables as it can contribute to stabilising prices and returns, and can create economies of scale through collaborative activity.

Organisational performance is a result of organisational capabilities that result in an organisation being able to repeatedly outperform its competitors (Grant, 1996). However, a firm cannot attain a strong competitive position on its own; performance is dependent on being a member of an effective supply channel. Prior research has identified a positive relationship between channel management and business performance (Bello and Gilliland, 1997; Buchanan, 1992). In this study, we conceptualise supply chain capability as the ability to outperform competing channels in terms of marketing, cost efficiency and innovation. For perishable products, these dimensions of performance are better addressed at the channel level, rather than by individual firms. Therefore, we would expect that individual firm performance would be related to the performance of the supply chain in which it operates.

Developing supply chain capability is influenced by environmental uncertainty. Claycomb *et al.* (1999) argued that increased environmental volatility and competition between supply chains has resulted in adoption of supply chain management to develop sustainable competitive advantage. Kim (1999) suggests that joint action in marketing channels provides a source of competitive advantage especially in an unstable environment. Aijo (1996) observed that the transformation of business in general has been due to the rapid and radical changes in the environment that have resulted in a change of emphasis from the product to the consumer construct. Customer heterogeneity has also been identified as a precursor to increased environmental uncertainty (Achrol and Stern, 1988; Gundlach and Achrol, 1993). Diverse and demanding consumers are the major driving force for the development of new varieties and higher quality standards in the production and distribution of fresh produce.

Higher levels of supply chain coordination can create inflexibility, which may result in greater instability and uncertainty. For example, a higher degree of channel integration can result in 'flow balancing' problems between successive stages of the supply chain. Guiltinan *et al.* (1980) found environmental uncertainty to be negatively associated with channel coordination. Sivadasan *et al.* (2000) view the supply chain as a set of linkages in which even basic supplier-customer relations can be operationally complex. This complexity increases as supply chains grow to networks (Beamon, 1999; Harland, 1996). Thus, research linking

environmental uncertainty, supply chain and business performance is important, especially within consumer markets, which are viewed as being more fickle and unpredictable than industrial markets (Johnston and Arunthanes, 1995).

The effectiveness of marketing activities is, in part, determined by the extent to which organisational structures and behaviours are able to cope with uncertainties in the market place. Therefore, we propose that environmental uncertainty results in organisations taking actions to enhance supply chain efficiency and this affects the performance of the individual business and the chain as a whole. These proposed linkages are shown in Figure 1.

The three components of this model are discussed in more detail below.

### Environmental uncertainty

In this study, environmental uncertainty included competitive intensity, environmental volatility and market turbulence.

Market turbulence. Kohli and Jaworski (1993) defined market turbulence as the extent to which the composition and preferences of the organisation's customer base changes over time. Bourgeois (1980) found that firms adapted their operations to customer needs more in turbulent environments than stable ones. This observation was supported by Jaworski and Kohli (1994) who found that organizations make fewer changes to the marketing mix in stable environments.

Environmental volatility: Environmental volatility refers to the instability of aggregate market demand (Ganesan, 1994). Environmental volatility has emerged as one of the central constructs in the study of the relationship between the environment and organizational performance (Goll and Rasheed, 1997; Dollinger and Golden, 1992). Harrigan (1983) found a negative relationship between environmental volatility and channel integration.

Competitive intensity: Competitive intensity refers to the degree of rivalry between competitors and is an important construct in industry analysis (Porter, 1980) Competitive

intensity can compel firms to engage in extensive product adaptation to gain a competitive edge (Johnston and Arunthanes, 1995). According to Kim (1999), competitive intensity can be the major driving force for joint action in distribution channels. Competitive pressure can promote collaboration and cooperation between marketing channel participants and encourages product differentiation (Kim, 1999; Kogut, 1988).

These three dimensions of environmental uncertainty influence the performance of the horticultural sector in Zimbabwe. The sector is highly export-oriented and focused on the European market. Turbulence in this market is driven by frequent and substantial changes in product specifications, usually imposed by European supermarket buyers. Aggregate supply and demand is also unstable, mainly due to climatic variation and fluctuations in production by competing Southern hemisphere exporters. Competitive intensity can become extreme when failure in export markets results in a glut on the domestic market and perishable produce from many sources comes on the market at the same time.

### Supply chain capability

The literature points to increased interdependence between successive stages of supply chains that transcend geographic, national and functional boundaries (Rademakers and McKnight, 1998). According to Anderson *et al.* (1997), supply chain management requires understanding and meeting consumer needs, as a way, not only of optimising value to consumers, but also of improving returns to all the stakeholders in the chain. Macbeth and Ferguson (1994) stated that collaborating within the supply chain has the potential to deliver the benefits of vertical integration without the costs of ownership, through information sharing, transfer of technical expertise, process and equipment as well as a belief in 'shared vision'. Emerging industries such as horticultural industries in developing countries often lack knowledge about the consumer and can benefit from adopting supply chain management practices, provided they have access to practical

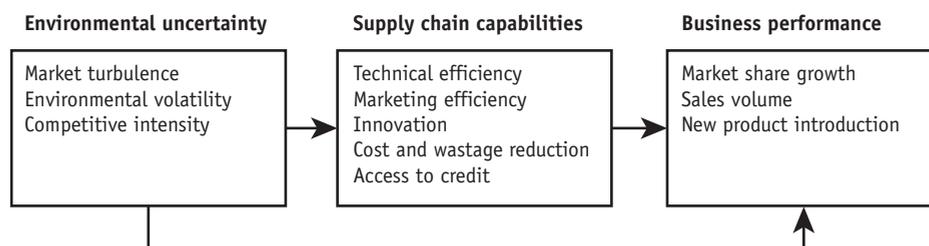


Figure 1. Model of the effect of environmental uncertainty on supply chain performance and business performance.

methods of improving information flow from the market place (Mowat and Collins, 2000). Meulenbun (1993) indicates that integrated marketing operations through the value chain are increasingly becoming important, particularly for perishables.

Several writers have called for practical and action-oriented research on the measurement of supply chain performance (Cooper *et al.*, 1996). van Hoek (1998) contends that such measurements can provide supply chain managers with a set of actions for improving performance and enhancing competitiveness. Most of the existing published performance measures such as total cost of ownership and direct product profitability are more effective in assessing performance of specific segments of the supply chain than they are for chain-wide performance assessment (La Londe and Pohlen, 1996). Loader (1997) assessed logistic performance by investigating improved customer service and quality as well as reduction in costs and cycle time. Grimsdell (1996) identified the fundamental requirements for efficient supply chain performance between the agricultural growers and consumers as being; the scale of operation, producer flexibility, continuity of supply, quality control, strategic alliances and communication.

Five measures of supply chain capabilities were developed for the present study; technical efficiency, marketing efficiency, innovation, cost and wastage reduction and access to credit.

### **Business performance**

Monczka *et al.* (1998) observed that supply chain activities can result in improved business performance and found a positive relationship between supply chain flexibility and return on assets (ROA), return on investment (ROI) and market share growth. Supply chains can contribute to improving the competitiveness of a channel and this translates into improved performance for all channel members (Cooper *et al.*, 1997). Business performance can be assessed in terms of financial performance, sales, market share, innovation, HRM performance or other measures. Performance can be measured in absolute terms, relative to competitors or in terms of changes from a previous time period and may be based on objectives or subjective measures. As respondents may be unwilling or unable to provide objective performance information, subjective measures of business performance have been used in prior research and a positive association between subjective and objective measure of business performance has been demonstrated (Dess and Robinson, 1984). The measures used in the present study were sales volume, market share growth and the rate of new product introduction. These measures were used because they were understood by

respondents ranging from farmers to multinational processors.

### **Hypothesised relationships between environmental factors, supply chain capabilities and business performance**

Established measures were used for environmental uncertainty and business performance, while a new construct and its related measures were developed for supply chain performance. Details of the measures are given in the methodology section and Appendices A and B.

Market turbulence was defined as the intensity and rapidity of changes in customer requirements. Channel members would be expected to respond to increased market turbulence by developing competencies in innovation, but marketing costs would increase. The effect on the other measures of supply chain capability would be expected to be negative, at least in the short term. Therefore:

*H1 Market turbulence is:*

- (1a) *negatively related to technical efficiency*
- (1b) *negatively related to marketing efficiency*
- (1c) *positively related to innovation*
- (1d) *negatively related to cost and wastage reduction*
- (1e) *negatively related to access to credit.*

Environmental volatility relates to instability of aggregate demand and supply that, in turn, results in unstable prices. Channel members may respond to environmental volatility by seeking to differentiate their product through quality improvement and continuity of supply (marketing efficiency). For the supply chain as a whole, environmental volatility would be expected to put pressure on grading and packaging facilities (technical efficiency), is not conducive to new product development (innovation) and increases risk, thereby reducing the availability of credit.

Thus, we hypothesise that:

*H2 Environmental volatility is negatively related to:*

- (2a) *technical efficiency*
- (2b) *marketing efficiency*
- (2c) *innovation*
- (2d) *cost and wastage reduction*
- (2e) *access to credit.*

Competitive intensity would be expected to be negatively related to all supply chain capability dimensions. The literature generally supports the idea that competitive intensity results increased innovation and differentiation. However, in the context of this study, where most of the supply chain participants are small businesses, we hypothesise that competitive intensity would have adverse

effects on supply chain performance, because intense price competition leads to lower returns which limit the resources available for innovation and improved marketing and technical efficiency

Therefore, we hypothesise that;

*H3 Competitive intensity is negatively related to:*

- (3a) *technical efficiency*
- (3b) *marketing efficiency*
- (3c) *innovation*
- (3d) *cost and wastage reduction*
- (3e) *access to credit.*

Business performance According to Anderson *et. al.* (1997), supply chain management involves understanding and meeting consumer needs, as a way of optimising value to consumers, with the result that returns to all the stakeholders in the chain are improved. The use of an integrated logistics approach results in greater accuracy, speed and flexibility in responding to customer demands, development of new technology and products as well as more cooperation in maximising profits at the chain level (Folkerts and Koehorst, 1997). This leads to the following hypotheses:

*H4 Business performance is positively associated with*

- (4a) *technical efficiency*
- (4b) *marketing efficiency*
- (4c) *innovation*
- (4d) *cost and wastage reduction*
- (4e) *access to credit*

Environmental factors can also be expected to influence business performance directly. All impacts would be expected to be perceived as negative by channel members, at least in the short term. That is:

*H5: Business performance is negatively associated with:*

- (5a) *market turbulence*
- (5b) *environmental volatility*
- (5c) *competitive intensity*

Supply chain capabilities A positive relationship is also expected between the individual supply chain capability variables. The construct of technical efficiency includes; the availability of alternative markets, packaging and grading facilities. Therefore, we would expect technical efficiency to be positively related to marketing efficiency, innovation, access to credit as well as cost and wastage reduction. Thus:

*H6: Technical efficiency is positively related to:*

- (6a) *marketing efficiency*
- (6b) *innovation*
- (6c) *costs and wastage reduction*
- (6d) *access to credit*

Marketing efficiency includes continuity of supply and product quality. It would be expected to be positively related

to new product introduction, sharing of marketing information and would also lead to wastage reduction and access to credit. Accordingly, we hypothesise that:

*Marketing efficiency is positively related to:*

- (6e) *innovation*
- (6f) *cost and wastage reduction*
- (6g) *access to credit*

Improved grading and packaging facilities within the supply chain leads to reduced produce wastage and encourages lenders and other supply chain members to provide credit. If channel participants have readily available access to credit facilities marketing and produce wastage would be expected to fall.

Therefore, we hypothesise that:

*Innovation is positively related to:*

- (6h) *wastage reduction*
- (6i) *access to credit*

*Cost and wastage reduction is positively related to:*

- (6j) *access to credit*

### **3. Methodology**

#### **Research Setting and Design**

Zimbabwe was selected as the country to be studied for the reasons discussed above. Data was collected from 655 horticultural supply chain participants including farmers, processors, retailers and wholesalers in the second half of 1998. The research reported here is part of a larger investigation looking at market orientation, buyer-seller relationships and channel performance within the horticultural sector in Zimbabwe. It is one of the first studies linking supply chain performance, business performance and environmental factors. Thus, it provides a foundation for advancing supply chain theory. Most research on fresh produce in developing countries has focused on agricultural marketing policy and there has been less research from the perspective of individual firms or marketing channels (Aksoy and Kaynak, 1994). This study addresses this gap by focusing on the firm's point of view.

Supermarket chains in Europe are consolidating and using fewer suppliers. According to Fearn and Hughes (2000), supermarkets in the UK fresh produce sector are now dealing with a handful of suppliers and pass responsibility for quality control, storage and distribution to their key suppliers. Some of these key suppliers are based in developing countries. Thus, there is a need to study these organizations as they are participants in the global supply chains. Additionally, Morgan (1999) indicated that there was need to study the impact of the internationalisation

process on domestic markets. For example, the internationalisation of the Zimbabwean horticultural sector led to the introduction of foreign horticultural produce such as mange tout, baby corn and baby carrots even into the peasant sector.

### Research Instrument

A structured questionnaire (8 pages long) was used in face-to-face interviews of farmers, retailers and wholesalers in both the formal (mainly supermarkets, speciality shops and horticultural export agents) and informal (open-markets and market gardens) sectors. Appendix A shows the sections of the questionnaire dealing with constructs referred to in this paper. The items reflected the perceptions of managers on; (a) the effect of environmental and marketing factors on their organizations, (b) the performance of the supply chain used to market most of their produce compared to other channels in the industry and (c) organisational performance compared to the previous year.

The research instrument was designed and developed in several stages. The first stage involved item and construct generation. The measurement items were generated based on an extensive review of literature in supply chain management, agricultural marketing and marketing together with consultation with industry experts. The second stage involved drafting of questionnaire in English. The questionnaire was again reviewed by the academics and managers mentioned above. They were specifically requested to indicate the variables they considered as important or unimportant and to assess the clarity of the questionnaires as well as the sequence of questions. Consequently, modifications were made.

The third stage in questionnaire development involved developing of various versions of the questionnaire for the various levels of the marketing channel. Even though the questionnaires were largely similar, the different versions reflect the subtle differences between the different channel members. Seven version of the questionnaire were developed to capture the appropriate wording relevant to the various levels of the marketing channel. For instance the farmers version would be worded *'The quality of other growers' products is threatening our survival.'* and the retailers version would be *'The quality of other retailers' products is threatening our survival.'* The fourth stage involved questionnaire translation (to Shona) and back-translation (to English) by two bilingual speakers to check for accuracy of the versions that were used in the informal sector. The translations were collated to produce a common Shona version and this, in turn, was back translated into English. The final stage involved pre-testing the research instrument. Five respondents at each level of the horticultural channel were

interviewed during the pre-testing stage, whereas at processor and distributor levels only one manager was interviewed. Twenty-seven (27) key informants were interviewed during the pre-test stage. Respondents were requested to indicate ambiguities, clarity and ease of response of the questionnaire. Consequently, final modifications were made incorporating the suggestions from the pilot survey. The pilot survey also helped in identifying the appropriate respondents at each level of the channel and in refining the way interviewers approached various respondents.

### Measures

Respondent's perceptions of channel performance were measured by asking them to identify the channel through which most of their horticultural products were marketed and to compare this channel with other channels in the industry. The measures used in this study with the exception of supply chain capabilities, were adapted from previously-used scales and all constructs were measured using multiple items on a seven point Likert scale (see Appendices A and B). There were no existing measures of supply chain capabilities. Thus, the development of the supply chain measurement capabilities construct measurement items followed several stages. The initial list of items was developed after an extensive review of marketing, supply chain management, distribution, logistics and agricultural marketing literature. The second stage involved in-depth interviews with two academics and three managers who were requested to indicate the issues and measurement items they regarded as important for supply chain performance in the horticultural sector. Items identified were added to those generated from the literature review. The third stage involved drafting the questionnaire that was refined using the methods outlined above in section on developing the research instrument.

Environmental uncertainty included competitive intensity, environmental volatility and competitive turbulence and was operationalised by measures adapted from previous research (Kohli and Jaworski, 1993; Appiah-Adu 1998). Respondents were asked to indicate their agreement or disagreement with a number of statements about environmental uncertainty on a Likert-type scale

Business performance measures were adapted from Slater and Narver (1996) and respondents were asked to compare current performance of their organisations to that of the previous year. Prior research on performance has found a close relationship between subjective and objective measures of business performance (Dess and Robinson, 1984; Venkatraman and Ramanujam, 1987). The measures used were; market share growth, sales growth and rate of new product introduction and were adapted from Baker and

Sinkula (1999). These measures were used because they were the only ones for which reliable responses could be obtained across all levels of the channel and in both the formal and informal sectors.

Supply chain capabilities were seen to be a multi-dimensional including several logistic, innovation, financial and marketing measures. Previous measures of supply chain performance have mostly been cost-based (Beamon, 1999). According to Maskell (1991), supply chain performance measures should be based on organisational goals and strategies. Within the produce sector, supply chains are viewed as having logistical/technical, marketing, financial and innovation dimensions and measures that could capture these constructs were; marketing efficiency, innovation, technical efficiency, cost and wastage reduction and access to credit facilities. (See Appendix B for more detail).

### **Purifying the measures**

To investigate the dimensionality of the measurement scales, exploratory factor analysis (with varimax rotation) was performed to determine which items best captured the various dimensions of environmental uncertainty and supply chain capabilities. (The composite variables are presented in Appendix B).

For the environmental uncertainty dimensions, analysis of the item-to-total correlation indicated that three out of the 18 measurement items used to assess environmental uncertainty did not load on any factor and these were not included in further analysis. The three factors extracted were labelled environmental volatility, competitive intensity and market turbulence. For the supply chain capability dimensions, four items were extracted. Factor 1 loaded on variables that appeared to explain logistics issues and was labelled technical efficiency. Factor 2 comprised variables that captured marketing issues and was labelled marketing efficiency. Factor 3, labelled innovation, included factors that explained innovative or entrepreneurial behaviour. Factor 4 included produce wastage and cost reduction and was labelled cost and wastage reduction. The last factor was a single item measure, access to credit facilities. 'Credit' includes both conventional credit and also credit in kind where inputs such as seed and agrochemicals are supplied by buyers and paid for at harvest. The three items used to measure performance of the organization compared to the previous year loaded on a single factor, 'business performance'.

### **Sampling procedure and data collection**

The sampling frames for the smallholder sector were drawn from lists of horticultural producers supplied by local

committees, government and non-governmental horticultural extension officers. Using random sampling techniques, 360 horticultural producers were interviewed. During the interviews, producers were requested to identify their major buyer in terms of sales volume and were instructed to respond to questions in respect of this most important customer. Producers were informed that interviews would also be held with the major buyer. This procedure was followed in identifying wholesalers and retailers and a total of 655 channel participants were interviewed (see Table 1).

Trained interviewers were used to carry out face-to-face interviews. During the training of interviewers, they were asked to translate and back-translate the questionnaire and reconcile their version with that of a language specialist. This helped in further purification of the research instrument and scales.

The units of analysis were the business unit and the supply channel. The key informant method was used and only senior managers and owners of the organizations were requested to respond to questions. Key informants were viewed as appropriate respondents on SBU phenomena if appropriate selection procedures are used (John and Reve, 1982). Thus, using guidelines on selecting key respondents from previous research (Campbell 1995), key informants were screened and chosen on the basis of their knowledge of the research issues, their formal role in the organisation and willingness to respond. The pilot survey also confirmed that senior managers were in a better position to provide more accurate information on company performance and policies than supervisory level managers and employees. A quota sampling technique was used to ensure that the various types of firms involved in horticultural marketing were adequately represented. In particular respondents were chosen from both the formal and informal sectors. The organisation covered included horticultural producers, wholesalers and retailers and at channel levels, respondent organisations ranged from small family businesses (less than 5 employees) to large multinational corporations.

### **Reliability and validity measurement**

Standard measures were used. Cronbach alphas are presented in Appendix B. They are generally on the low side, although satisfactory for an exploratory analysis. One of the reasons for the Cronbach alphas being low is that the analysis covers a wide range of respondents from smallholder farmers to export agents and large retailers. The Cronbach alphas were much higher when the responses were disaggregated.

**Table 1. Characteristics of organisation covered in the study.**

	Formal retailer	Informal retailer	Informal wholesaler	Smallholder farmers	Commercial farmers
Relationship for over a year (%)	88	87	91	82	92
Legal ownership of enterprise (%)					
Proprietorship/owner managed	52	84	66	88	71
Proprietorship/manager operated	15	1	21	3	25
Partnership	24	2	7	5	-
Cooperative	6	9	3	4	2
Other	3	4	3	-	2
Number of employees (%)					
Less than 5	20	38	70	11	8
5 - 10	27	35	27	48	33
11 - 20	9	22	1	27	15
Over 20	44	5	2	14	44

#### Data analysis

Structural equation modelling was used to analyse the relationships between the three sets of variables. Beamon (1999) argues that structural equation modelling is an appropriate technique for analysis of supply chain issues because it captures the complexity of the underlying multidimensional relationships. SPSS Version 10 and Amos 4 were used to analyse the data.

#### 4. Results and discussion

The profile of the respondents and the organisations that were covered in the study are shown in Table 1.

Path analysis was used to test the hypothesized relationships. The model was judged adequate and found to have acceptable goodness-of-fit indices:  $\chi^2 (8.6) = 15$ ,  $p = 0.839$ , CFI = 1.00, NFI = 0.895, TLI = 1.3, GFI = 0.948, AGFI = 0.843, RMSEA = 0.001. The standardized regression coefficients are shown in Table 2. Only statistically significant results are reported. The results indicate that while the impacts of environmental factors on supply chain capabilities were generally as hypothesised, the relationships between supply chain capabilities and business performance were mixed.

##### Relationships between environmental uncertainty and supply chain capabilities

Market turbulence was positively associated with innovation but negatively with access to credit. The results suggest that changes in customer demand and preferences can stimulate

innovation. For example, crops such as mange tout and baby corn are new products developed specifically to meet the requirements of export buyers. However, when customers' needs are changing rapidly, changes in production and marketing activities result in marketing channel participants incurring higher costs and lower returns. Large customers (such as processors, export agents and export buyers such as, Heinz, Lever, Brothers and Tesco) are less likely to provide credit to finance production, packaging and transportation of produce in a turbulent market environment. Thus, changes in customer composition and preferences can result in reduced access to credit for down-stream channel members.

Environmental volatility was negatively related to innovation and technical efficiency, as hypothesised. This would be expected, as instability in supply, demand and prices is not conducive to innovation because price instability discourages long-term investment in packaging and grading facilities. Furthermore, fluctuations in supply and demand put pressure on existing facilities, reducing technical efficiency. However, contrary to the hypothesis, there was a positive relationship between environmental volatility and marketing efficiency. It appears that channel participants responded to market uncertainty by improving quality and product differentiation

As expected, competitive intensity was negatively related to quality and continuity of supply (marketing efficiency). The relationship between competitive intensity and wastage reduction was, however, positive. This may be because increased competition leads to suppliers being unable to market produce in profitable markets, thereby increasing produce wastage.

**Table 2. Results of Analysis.**

Hypothesis	Hypothesised Relationship	Standardised Regression Coefficients	Supported/ Not supported
Market turbulence related to:			
H1c: Innovation	Positive	.401*	Supported
H1e: Access to credit	Negative	-.438**	Supported
Environmental volatility is related to:			
H2a: Technical efficiency	Negative	-.192*	Supported
H2b: Marketing efficiency	Negative	.471**	Not supported
H2c: Innovation	Negative	-.309*	Supported
Competitive intensity is related to			
H3b: Marketing efficiency	Negative	-.298*	Supported
H3d: Cost and wastage reduction	Negative	.303*	Not supported
Business performance is related to:			
H5a: Market turbulence	Negative	-.309*	Supported
H4a: Technical efficiency	Positive	-.518*	Not supported
H4b: Marketing efficiency	Positive	.314*	Supported
H4c: Innovation	Positive	-.308*	Not supported
H4d: Cost and wastage reduction	Positive	.659***	Supported
H4e: Access to credit	Positive	-.338*	Not supported
Relationship between supply chain capabilities:			
H6a: Technical efficiency/marketing efficiency	Positive	.403*	Supported
H6b: Technical efficiency/innovation	Positive	.218*	Supported
H6c: Technical efficiency/cost and wastage reduction	Positive	.629***	Supported
H6d: Technical efficiency/access to credit	Positive	-.561***	Not supported
H6e: Marketing efficiency/innovation	Positive	.292*	Supported
H6h: Innovation/cost and wastage reduction	Positive	.295*	Supported

\*\*\*p<.001; \*\*p<.01; \*p<.05.

### Relationship between supply chain capability variables

Technical efficiency was positively related to marketing efficiency, innovation as well as cost and wastage reduction. The results indicate that improvement in access to grading and packaging, leads to reduction of marketing costs and wastage, promotes produce quality and encourages continuity of supply. Technical efficiency was, however, negatively related to access to credit. This is not as expected and may relate to the timing of delivery of inputs supplied by buyers on credit. If these were late, as respondents indicated was often the case, this adversely affected grading, sometimes to the extent that the produce became unacceptable to the buyer. Furthermore, the contractual

relationship between the buyer and supplier may restrict access to alternative markets.

Innovation was positively related to technical and marketing efficiency as well as cost and wastage reduction. Innovative behaviour in the horticultural industry may lead to a reduction of produce loss through pests, diseases, rot or shrinkage. For instance during the time the survey was undertaken, new low cost cooling facilities (using wet hessian sacking and plastics) were being tried by smallholder horticultural producers. They found this simple technology to be effective in reducing produce shrinkage. Innovation also results in improved produce quality and ability to ensure continuity of supply through the introduction of packaging and storage facilities. This explains the positive

relationship between innovation, marketing and technical efficiency.

### **Relationships between supply chain capabilities and business performance**

Marketing efficiency was positively related to perceived business performance. It would be expected that respondents would see improved quality and continuity of supply as having a beneficial effect on their business performance.

Cost and wastage reduction was also positively associated with business performance because in perishable product industries waste has a major impact on business returns.

However, technical efficiency (access to packaging and grading infrastructure and availability of alternative markets) was significantly negatively related to performance. The explanation for the negative relationship between technical efficiency and performance is probably that farmers believed that investment in grading and packaging needed to meet the technical specifications required by buyers to be excessive.

Innovation was also negatively related to performance. It is possible that respondents saw product changes needed to meet customer requirements (for example, in response to changes in the specifications imposed by export market buyers) as more of a cost than a benefit - at least in the short term.

Access to credit was also negatively related to business performance. It appears that managers may view the costs associated with getting access to credit as being too high. This could be due to the high interest rates and perceived inequities in profit sharing between the channel partners. Some farmers felt that credit and other inputs supplied by some export and domestic buyers were over-priced. However, they were not in a position to change the situation, especially with respect to export buyers that had strict guidelines on inputs and packaging.

### **Relationship between environmental uncertainty and business performance**

Market turbulence As hypothesised the relationship between market turbulence and business performance was negative. Instability in production and demand limits the organisation's ability to plan production to the requirements of the market. The relationships between the other two measures of environmental uncertainty and business performance were not significant.

## **5. Managerial and policy implications**

The horticultural sector in Zimbabwe shows a high degree of environmental uncertainty, driven by both aggregate supply and demand changes and changes in the requirements of demanding export markets. This requires continuous adaptation by all channel members. Channel participants recognised the need to innovate in terms of product development, packaging and storage, but also believed that the cost involved in doing this exceeded the benefits, at least in the short term, giving rise to the negative relationships between business performance and three of the supply chain capability variables (technical efficiency, innovation and access to credit). Market turbulence also had a direct negative impact on performance, indicating the need for improved market intelligence.

The policy implications for both government and the major export buyers are that farmers, in particular smallholders, while recognising the need to adapt, require adequate support in terms of technical support and the availability of credit. This is not always well-understood by overseas buyers who in any case, can always seek alternative suppliers. In this environment, there may be a case for government or non-governmental organisation to support better market intelligence and the development of infrastructure such as cool storage and grading facilities

## **6. Research contributions and implications for further research**

The main contribution of this paper is that it has linked three constructs; environmental uncertainty, supply chain capabilities and individual business performance. These relationships have not been previously investigated. To do this has required the development of a new construct, supply chain capabilities along with the development of an appropriate measuring instrument. Supply chain capabilities were measured in a subjective way, by asking respondents their perception of the performance of the particular supply chain they used relative to alternative channels in the same industry. Previous measures of supply chain performance have generally been objective - but it is managers' perceptions of reality, not the reality itself, that drives decision-making. Therefore, there is a need for further research using subjective measures of supply chain and business performance. The use of structural equation modelling allows simultaneous analysis of multiple relationships. There is scope for further use of structural equation modelling in analysing the complex dimensions of supply chain performance. Finally

the research was carried out in a developing country, addressing a deficiency recognised in prior research. The context-specific nature of the research provides opportunities for replication in other locations and industries. The five supply chain capabilities constructs were developed for the present research and were designed to capture the idiosyncrasies of the Zimbabwean horticultural sector. There are opportunities for further refinement of the perceptual measures of supply chain capability as well as developing alternative measures and relating them to environmental uncertainty, business performance and strategy in other context.

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## Appendix A: Relevant sections of questionnaire (Used for all respondents)

### Section 1: Environmental uncertainty

To what extent does each of the following characterise the environmental and market factors in which your business operate? (Seven-point Likert scale - 1 = "strongly disagree"; 7 = "strongly agree")

- a) The demand for the products we sell is unpredictable.
- b) The volume of production in this industry is very stable.
- c) Sales forecasts for our products are accurate.
- d) It is difficult to monitor price changes for our products in this market.
- e) New products are introduced to this market regularly.
- f) New competitors enter this market regularly.
- g) There are a few new competitors for this product.
- h) There are other horticultural products that can be used as substitutes.
- i) There are non-horticultural products that can be used as substitutes.
- j) The major source of competition in our industry is pricing.
- k) Product quality in our market is rapidly rising.
- l) The quality of other growers' products is threatening our survival.

- m) In our line of business, customer preferences change rapidly.
- n) Customers in this market are very price sensitive.
- o) There are always new customers demanding this product.
- p) It is very difficult to keep customers for a long time in his market.

### Section 2: Market Channel Used

In answering the following question, please think of the main channel through which you market your horticultural products (A channel refers to the producers, distributors, transporters and retailers involved in the marketing of your products).

Which of the following organizations are involved in the marketing of your horticultural products? (Tick appropriate)

- a) Farmer
- b) Horticultural agent
- c) Formal wholesaler
- d) Informal retailer
- e) Processor
- f) Export agent
- g) Direct export
- h) Outgrowers
- i) Retailer.

Now lets talk about this channel and how it performs in comparison to other horticultural marketing channels on the following issues;

Marketing costs	Much higher	1	2	3	4	5	6	7	Much lower
Wastage.	Much higher	1	2	3	4	5	6	7	Much lower
Promotional activities	Much higher	1	2	3	4	5	6	7	Much lower
New product introduction	Far above	1	2	3	4	5	6	7	Far below
Sharing of market information	Much better	1	2	3	4	5	6	7	Much worse
Sharing of technology for production	Much better	1	2	3	4	5	6	7	Much worse
Joint ownership of infrastructure	More extensive	1	2	3	4	5	6	7	Very limited
Access to credit facilities	Much harder	1	2	3	4	5	6	7	Much easier
Grading facilities	Much better	1	2	3	4	5	6	7	Much worse
Packaging facilities	Much better	1	2	3	4	5	6	7	Much worse
Access to inputs	Much easier	1	2	3	4	5	6	7	Much harder
Alternative markets	Many more	1	2	3	4	5	6	7	Much fewer
Continuity of supply	Much better	1	2	3	4	5	6	7	Much worse

### Section 3. Organizational Performance

Please indicate your organisation's performance in the past year compares to the previous year

Market share growth	Much better	1	2	3	4	5	6	7	Much worse
Sales volume	Much higher	1	2	3	4	5	6	7	Much lower
New product introduction	Big increase	1	2	3	4	5	6	7	Big reduction

## Appendix B: Constructs, Related Questions and Scale Reliabilities

Variable	Measurement	Cronbach Alpha
<b>Environmental Uncertainty Dimensions</b>		
Environmental volatility	a) In our line of business customer preferences change rapidly. b) The quality of other growers' products is threatening our survival. c) There are always new customers demanding this product. d) There are non-horticultural products that can be used as substitutes. e) Customers in this market are very price sensitive.* f) It is difficult to monitor price changes for our products in this market.*	0.64
Competitive intensity	a) New competitors enter this market regularly. b) The major source of competition in our industry is pricing. c) It is very difficult to keep customers for a long time in this market. d) The demand for the products we sell to is unpredictable. e) There are a few new competitors for this product.* f) Product quality in our market is rapidly rising.*	0.57
Market turbulence	a) There are other horticultural products that can be used as substitutes b) Sales forecasts for our products are accurate. c) The volume of production in this industry is very stable. d) New products are introduced to this market regularly.*	0.65
<b>Supply Chain Capability Dimensions (Comparison with other channels) See questions in Appendix A</b>		
Technical efficiency	a) Grading facilities b) Packaging facilities c) Alternative markets	0.70
Innovation	a) Promotional activities b) Marketing info shared c) New product introduction	0.69
Marketing Efficiency	a) Continuity of supply b) Product quality	0.70
Wastage reduction	a) Cost and wastage reduction b) Reduction of marketing costs	0.77
Access to credit	a) Access to credit	-
<b>Business Performance Dimensions</b>		
Performance compared to previous year	a) Market share growth b) New product introduction c) Sales growth	0.99

Note: The Cronbach alpha of 0.99 for the three business performance measures shows that respondents did not distinguish between them.