



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Agricultural Marketing and Agribusiness Supply Chain Issues in Developing Economies: The Case of Fresh Produce in Papua New Guinea

Paper Presented at the New Zealand Agricultural and Resource Economics Society
Conference 25-27 August 2006

Sandra Martin
Associate Professor in Agribusiness
Lincoln University
New Zealand
(martin@lincoln.ac.nz)

Ayyamani Jagadish
Agribusiness Supply Chain Consultant
Kuala Lumpur
Malaysia
(cachi@pd.jaring.my)

Summary

Large quantities of fresh produce can be grown in the Highlands provinces of Papua New Guinea, and this produce is then marketed to a range of markets, including the coastal cities of Port Moresby and Lae. However, it is often argued that the marketing system performs poorly, and various reasons for this are cited. In this paper, the results of a study on the marketing of smallholder produce originating in the Highlands provinces and destined for a range of markets, including the coastal cities, are presented. A defensible supply chain framework is used to evaluate a range of marketing issues and to evaluate the performance of the marketing system. The results of the study are refreshingly positive. It was found that the marketing system was remarkably vibrant, given the current level of market development in Papua New Guinea. It is characterised by entrepreneurial behaviour by the private sector, where businesses along the chain compete and innovate in order to expand their operations and meet the needs of the customers in their varied market segments. However, they are constrained in their endeavours by poor infrastructure, which raises their costs of doing business. It was concluded that the use of a Supply Chain Framework can yield a very robust and insightful understanding of the performance of the agricultural marketing system in developing economies.

Key Words: Agribusiness Supply Chain Framework; Agricultural Marketing; Papua New Guinea; Developing Economies.

Introduction

Much consultancy effort has been directed into fresh produce marketing in Papua New Guinea. The Papua New Guinea Highlands provides an ideal environment for the production of temperate fresh vegetables, while the major markets are situated in the more highly populated coastal areas around Port Moresby, Lae and Madang.

The conventional wisdom¹ seems to be that the fresh produce marketing system in Papua New Guinea performs poorly and a number of beliefs are held about this alleged poor performance. It has been suggested that smallholder farmers are receiving an inadequate share of the margin along the chain, that they are being exploited by marketers and retailers, both of whom are said to be making excessive profits. Alternatively, it has been suggested that farmers could make more money concentrating on production and should be discouraged from self-marketing, and that marketers (and some small marketers in particular) are not making excessive profits, and may even be making losses. It is often claimed that there is little loyalty between buyers and suppliers and that this is an impediment to good marketing performance.

It is also believed that the quality of fresh produce produced and marketed is substandard and inconsistent, that the quantity supplied is inconsistent, that post-harvest wastage rates are unacceptably high, that market information flows are poor and disadvantage smallholder farmers and that poor infrastructure is creating problems for the marketing system.

However, such conclusions do not appear to be derived from analyses that are conceptually rigorous. Often conclusions are drawn about the marketing system as a whole based on observations of one component of the system without recognition of how the different parts of the marketing system interrelate and interact. For example, discussion with supermarkets might reveal concerns about quality and consistency of supply, and on this basis, it may be concluded that quality is an issue in the marketing system in general.

In recent years, Supply Chain Management has begun to emerge as a discipline, and the authors argue that a supply chain framework can yield a deeper understanding of agricultural marketing issues in developing economies than more traditional approaches to agricultural marketing. Consultancy studies are usually forced to rely on rapid appraisal techniques because of resource and logistics issues, and the use of a more holistic but rigorous framework to guide information collection should lead to more powerful and insightful conclusions.

In this paper, some of the results of a consultancy study conducted by the authors into fresh produce marketing in the Highlands of Papua New Guinea are presented. The study utilised a Supply Chain Framework developed by the authors for consultancy purposes,

¹ This conventional wisdom is exhibited in in-house consultancy reports (which cannot be referenced), and government organisations. For these reasons, it is not possible to provide references to support this.

and it is argued that this approach yielded robust insights into the performance of the fresh produce marketing system. In the next Section, an abridged Supply Chain Framework is presented, followed by some comments on Method. Following this, the marketing system for fresh produce is discussed, with emphasis on different market segments and their requirements, the marketers who meet the needs of these segments and the farmers who supply to these marketers. An assessment is then made of the performance of the marketing system for fresh produce in PNG, and finally, some conclusions are drawn.

A Supply Chain Framework

As noted above, conclusions on marketing performance in developing economies are often system-wide and very generalised, and the authors believe that a comprehensive supply chain framework could yield a more accurate picture of the performance of the marketing system. In this Section, a framework that has been developed by Martin and Jagadish (2005) is presented in an abridged form. Although this framework is intended primarily for analysis of individual supply chains in a consultancy context, it nevertheless provides a useful structure for analysing marketing issues in a more generalised way.

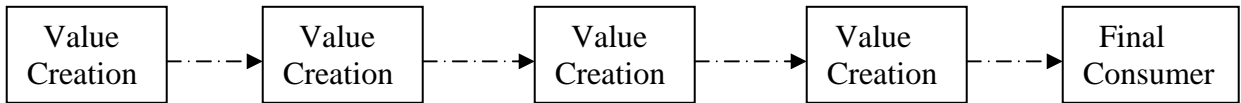
Despite being intended for consultancy use, the framework has a rigorous theoretical foundation. The value creation concepts draw on Porter (1985), while the integration of processes, logistics, quality and information components draw on accepted supply chain theory (for example, see Bowersox et al, 2002; Gattorna and Walters, 1996; Gattorna, 2003; Handfield and Nichols, 2002). Likewise, the incorporation of relationships (and vertical integration) as governing chain mechanisms draws on supply chain and agribusiness literature and research (see for example, Reddy and Reddy, 2001; Peterson and Wysocki, 1998; Westgren, 1998; Patterson, et al, 2005). The authors have used this framework successfully as both a training and analysis tool in developing countries.

In this Supply Chain Framework, a chain is envisaged as a value-creation process, whereby all firms in a chain link and align with each other to create value for the chain as a whole. This conceptual view of a chain is shown in Figure 1. It is argued that value creation occurs through firm operations, integration of processes, and logistics and quality control (product maintenance). It is further argued that value creation throughout the chain is supported by information flows, and achieved through vertical integration and relationship management

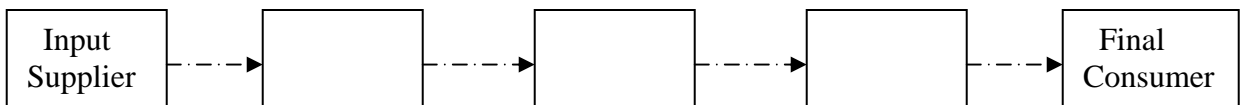
Value creation occurs primarily through operations. This is achieved through product transformation (processing) or product enhancement (cleaning, grading, packaging or presentation). Value is also created through the integration of processes along the chain; that is, the seamless meshing of processes as the product moves from one point in the chain to the next. Value is further created through logistics (where product is transported from one point in the chain to the next in a cost and time effective manner) and quality control (where the quality of the product is maintained through packing, transporting and cool or cold chain procedures).

Figure 1: Functional Representation of a Supply Chain

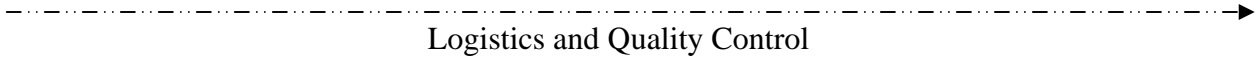
Value Creation through Operations:



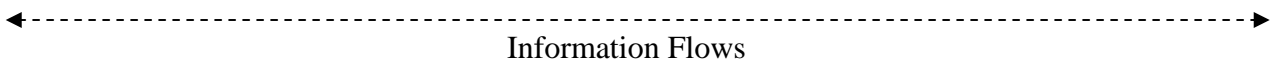
Value Creation through Integration of Processes and Logistics/Quality Control:



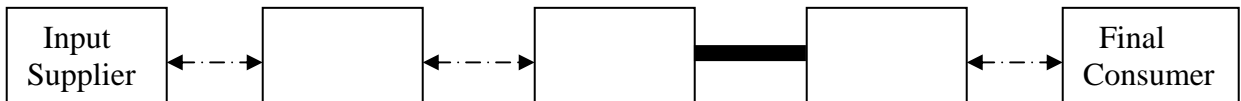
Integration of Processes



Supported by:



Achieved through:



Vertical Integration and Relationship Management

This value creation is supported by clear information flows up and down the chain. These information flows link suppliers and intermediate customers with market demands (such as product form, quality and quantity required), and markets with supply (such as quality and quantity available).

It is argued that value creation is achieved through vertical integration and relationship management. Vertical integration often occurs when the key player in the chain – the chain leader – undertakes a number of processes (for example, production, processing and distribution) itself and retains ownership of the product while doing so. This is shown in Figure 1 by the solid line linking two of the processes. Value creation can also be achieved through the management of relationships between various parties as the product moves down the chain (shown by the dotted lines with double headed arrows in Figure 1). In most cases, but not always, these relationships will be associated with changes of ownership of the product. Chain relationships can cover a spectrum, ranging from arms length (open market) to some involvement (contracts) to extremely close (strategic alliances or even joint ventures).

Method

The framework developed by Martin and Jagadish (2005) has been operationalised as a consultancy tool. Questionnaires that elicit physical, financial and social information have been developed for a range of typical businesses along a chain, and analysis of these questionnaires allows a picture of the chain and its performance to be built up.

In this study, comprehensive whole chain information on three chains were collected, and in addition a further sample of retailers, marketers and smallholder farmers were interviewed to gain further information on a range of market segments and those businesses servicing these segments. The sampling principle used was to seek diversity within the financial and logistical constraints placed on the study.

In total, eight representatives from six marketing operations were interviewed. This sample of marketers interviewed included large commercial marketers in Ht Hagen and Port Moresby, as well as smaller marketers in Mt Hagen, Goroka and Port Moresby. Four farmer groups were interviewed in the Mt Hagen and Goroka regions, as well as three supermarkets in Lae and Port Moresby, two institutional buyers in Lae and Port Moresby, an international hotel in Lae, a distributor in Port Moresby, a transport company in Goroka and a shipping company in Lae.

The Marketing System

Introduction

In this Section, some insight into the marketing system for fresh produce is gained by identifying the market segments for fresh produce in PNG and the requirements of these market segments. This is followed by a description and analysis of the marketing positions adopted by different marketers who source fresh produce from the Highlands. Finally, some comment is made on the situation of farmers (and in particular, smallholder farmers), who operate through such marketers.

Market Segments for Fresh Produce

As implied in the Supply Chain Framework outlined above, the starting point for any value creation is the consumer. The consumer requires particular product attributes and it is those attributes that they expect to receive from their suppliers. If those product attributes are not present, then they will not buy the product, and instead, will search elsewhere. Likewise, if attributes are present that they do not value, then they will not be prepared to pay for these superfluous attributes.

In Papua New Guinea, it was found that the key market segments that marketers supply are supermarkets of various types, institutions of various types, kai bars, distributors and urban markets. These different market segments require different product attributes from their suppliers. In this study, it was found that:

- Top-end supermarkets require high quality produce that meets strict quality standards, good shelf-life, continuity of supply, and certain quantities
- Mid-range supermarkets are usually prepared to accept product that is lower quality, but still require good shelf-life, continuity of supply, and certain quantities
- Top-end institutions (such as international hotels) require high quality but there may be some latitude in what they accept; they also require continuity of supply, and certain quantities
- Other institutions (such as universities, mines, etc) do not have particularly high quality requirements, but will want continuity of supply, and certain quantities
- Kai bars will require relatively low quality produce, continuity of supply, and certain quantities
- Distributors perform the intermediation function of bringing buyers and sellers together; as such, they will determine what each of the above segments might require in a week (in terms of quality and quantity) and match this with supply from marketers or self-marketing farmers who approach them
- The urban markets also perform an intermediation function of matching buyers with sellers, and all quantities and qualities are available for sale, with the discipline of the market leading to prices that reflect the demand and supply of various quantities and qualities.

Hence, all market segments desired particular quantities and a continuous supply of product, but they required varying levels of quality.

To ensure that they met their customers' requirements, supermarkets, institutions and kai bars assessed their potential sources of supply and then made decisions on how to access this supply. Many different arrangements were observed. These included supermarkets and institutions who had informal contracts for a particular quality with sole (or few) suppliers, who then received a fixed price to supply them with a certain quantity (that was largely fixed, though might vary a little over the year). At the other end of the spectrum, very opportunistic relationships were also noted. These included situations where suppliers would turn up at the supermarket or institutional buying point, the buyer would accept or reject the produce, and then contact distributors (either local or overseas) or go to the open market to make up any shortfall. These varying arrangements seemed to be dictated by the ease of availability of produce of the desired quality and quantity, and the strategic policies of the supermarkets or institutions.

Marketers

The marketers interviewed were very aware of the market segment (or segments) that they supplied and the product attributes that these segments required. They consciously identified the needs of their market segment(s) and matched the resources of the chain with these needs, thereby fulfilling the role of chain captain. In doing this, there were various marketing and risk positions that they took.

The positions adopted by the various marketers differed. For example, one small marketer in Mt Hagen supplied a number of mines with a wide range of relatively low quality, low-priced fresh produce, which was flown into mining sites as backload on mining company aircraft. He had contracts with these mines, and growers brought produce of acceptable quality to him (an open-market arrangement), which he then packed and moved to the market very rapidly. He was self-funded, had very little investment in fixed assets (no cool chain), low-paid labour, and ran a low-cost, low-risk, but very profitable business, meeting the needs of an institutional market segment that required a continuous supply of a particular quantity of a range of relatively low-quality fresh produce. His biggest risk would be an inability to access supply of produce of the required quality, but he did not indicate that this was a problem for him.

Another larger marketer (and producer) in Mt Hagen had a more specialist operation, focussing largely on potatoes, the majority of which is sold to kai bars in Port Moresby, with a lower proportion of product being sold to supermarkets and fast food outlets. They had some fixed cost investments (such as trucks in the Highlands and Port Moresby), and also used family labour. They are known to suppliers as marketers of potatoes and suppliers will bring their product to them. Relationships with buyers, however, were quite antagonistic, open market transactions. This is a relatively low-price, low quality market segment requiring a staple product that keeps well. This marketer was very cost-conscious, was confident that logistics issues had been sorted, and also ran a profitable operation. Their biggest risk would be their high exposure to one product, and indeed,

their business suffered financially as a result of this exposure when the country was struck by potato blight.

Another small marketer adopted yet another different marketing position. This Highlands marketer supplied a range of standard fresh vegetables (such as carrots, cabbage, potatoes and kau kau) sourced from local suppliers to markets in Port Moresby. About half of the produce was sold to open market buyers, and the rest to institutions and supermarkets. This range of outlets allowed him to match different qualities with the needs of the different markets, and the open market (where he is well-known to buyers) provides him with a fallback position should the higher quality markets not take his produce for any reason. This means that he is well insulated against this risk. He has some fixed cost investments, but these are not a large component of his costs, and he works very hard to ensure smooth logistics, thereby reducing wastage in his chain. He is very cost-conscious, and this is a profitable, low-risk, low-cost, opportunistic chain catering to the lower end of the market, but attempting to shift some product towards more lucrative market segments.

Another small marketer operated a shorter chain from the Highlands to Lae for a range of fresh vegetables, including tomatoes. This marketer sourced from two villages, where he had good established relationships. Tomatoes were his key product, and these were sold to two supermarkets and to institutions, such as an international hotel and university caterers. Any product that remained after the needs of these markets were satisfied was then sold in the urban market. This marketer was a sole supplier to the top supermarket and one of the institutions, and was one of two or three suppliers to the other outlets. He had informal contracts for a fixed price and quantity, although the supermarkets might vary the quantity from time to time. Unlike some of the other marketers studied, this marketer was supplying a much higher proportion of product to upper-end markets. His short logistics chain, the care he took with grading and quality, and his good relationships with his suppliers, reduced his risk of being unable to deliver more demanding quality to these higher market segments. He was also extremely cost-conscious, and funded his operation through internally generated capital using family labour, thus further reducing his risk exposure. All these factors ensured that he ran a profitable marketing operation.

A quite different marketing position was adopted by another larger marketer in Mt Hagen, which was supplying a range of perishable fresh vegetables to Port Moresby. About 60% of this produce was high-quality product supplied to supermarkets, while the remaining 30% was supplied to institutions (that were prepared to take lower-quality product) with the remainder going to the open market. This was a very commercial operation using hired labour, and with investment in a cool chain, (a cool room and a chiller container), as well as trucks and a packing shed. Its logistics were well-synchronised, and along with its unbroken cool chain, this minimised losses from wastage and maximised shelf life, thus reducing risk from this source. However, it reported difficulty in maintaining continuity of orders with buyers, and this, in turn, made it difficult for it to lock in suppliers. This uncertainty in orders and supply creates a risk for what is a relatively high fixed cost operation. It is thought that this operation was quite profitable, but this profitability was associated with relatively high risk.

These very different marketing positions adopted by different marketers illustrates that there are different ways for marketers to be successful. Some cater for lower-quality market segments, and endeavour to keep their cost structures very low. Others cater to higher quality segments and ensure that they are in a position to meet the demands of these markets. Each marketing position has different risks associated with it. The common element is that all marketers identify the requirements of their target market segments and meet the demands of these markets in terms of quantity, quality and continuity of supply. In doing so, they keep their cost structure as low as possible and minimise their exposure to risk.

Smallholder Farmers

In general, it was found that those smallholder farmers who are operating at subsistence level produce a range of crops at minimum cost. They have minimal capital (such as bush knives, grass knives, spades and knapsacks), farm communally owned land and use family labour. While some may have small-scale borrowings, those spoken to in this study used internally generated funds to meet variable costs (such as seeds and insecticides) and to purchase capital items.

It was found that these subsistence farmers receive only a small proportion of the price that a product can fetch in the final market and variable costs eat up a high proportion of the returns that they receive (see the Appendix). Not surprisingly, they make every effort possible to get the best returns they can for their products, and this means that they will exhibit little loyalty to buyers. The range of crops that they grow showed good risk management, but it can mean that they cannot get the best returns from a particular crop because of the competing demands of other crops.

Farmers buy their inputs from available input suppliers. Their relationships with these suppliers are opportunistic, but those interviewed for this study reported little difficulty in buying capital items. However, they did express concern about the availability and quality of seed. Since very few borrowed, no concerns were expressed about access to credit.

Financial analyses done in this study suggested that returns for such farmers could be improved by increasing the amount of product that they produce, and at the same time, trying to making marginal improvements to the quality of products produced and marginal improvements to post-harvest handling. This strategy for improving their situation is low-risk as it represents a marginal shift in current practice, and is centred on sharper management practices. That is, improvements in yields and quality for very little increase in costs. Such a strategy would require access to better quality seed and for seed to be available at the right time.

Other farmers interviewed for this study (in the Mt Hagen region) had moved well beyond any subsistence focus and were running highly successful commercial businesses. They either borrowed or self-funded capital purchases, used commercial labour, were

able to produce products of sufficient quality that they sold to established marketers or self-marketed to kai bars in Mt Hagen, and experienced few logistics problems. In short, they were viable, profitable businesses, capable of further expansion.

Assessment of the Performance of the Marketing System

Introduction

In this Section, some assessment is made of the performance of the marketing system for fresh produce in PNG. The criteria used for this assessment of performance are based on those derived by Martin and Jagadish (2005), which are in turn, based on standard measures of marketing and supply chain performance.

Following the abridged supply chain framework outlined in Figure 1, comment is made on value creation, logistics (and infrastructure), quality management, information flows, and relationships. An aggregate assessment of marketing performance is then made by considering the distributions of margins along chains, and effectiveness, efficiency, risk management and innovation.

Value Creation

In the previous section, the needs of the different market segments were outlined, and the positioning of marketers in response to these needs was discussed. This discussion gave an indication of how marketers can create value for their identified market segments. Similarly, the discussion on smallholder farmers in the previous section illustrated how they too are part of this value creation process, and how low profitability can reduce their commitment to chains, and so make it more difficult for marketers to deliver value to their customers. Likewise, lack of alignment of input suppliers with the needs of particular chains – for example, the timely provision of high quality seed – can disrupt the value creation process along a chain.

In the following Sections, these value creation issues are discussed in more depth by considering the supply chain functions of quality management (maintenance of product value), logistics and infrastructure, information flows, and relationships.

Logistics and Infrastructure

It was clear from this study that poor logistics and infrastructure creates problems for the marketing of smallholder produce from the Highlands. However, the extent to which it does this will be product and chain specific. Less perishable products targeted to lower-quality market segments in relatively short chains will be better placed to cope with difficult logistics. By contrast, perishable products targeted to higher-quality market segments in long chains face much stronger logistics challenges. The extent to which logistics poses problems depends on where a product or chain sits between these two extremes.

Poor infrastructure can have two key impacts on supply chains. Firstly, it can reduce the effectiveness of a chain; that is, its ability to meet the needs of its customers through the provision of product of the required quality and quantity at a specified time. Secondly, it can increase costs in the chain, thereby reducing efficiency and returns to all participants along the chain. In more extreme situations, where there are no roads, it can even deny smallholders market access.

In this study, transport operators, marketers and farmers all commented on the impact of poor roads, which increased wear-and-tear on vehicles and caused delays in getting product to market. A shipping operator noted that outdated port infrastructure made it difficult to maintain shipping schedules, which can also cause unexpected delays in getting product to market. Unreliable airline schedules will have the same impact.

The impact of this poor infrastructure is compounded by cool chain practices. For some products, particularly less perishable products destined to low-quality market segments, investment in cool chain facilities along the entire chain could be an unnecessary expense. However, poor infrastructure may make it necessary for some marketers to consider such an option. If infrastructure along the chain was better, then any cool chain decisions would be more related to market needs rather than poor infrastructure, thereby keeping costs at an appropriate level, and reducing the risk associated with big investments.

Poor infrastructure means that transport costs are very high for farmers and marketers transporting produce from the Highlands to distant markets. It is not clear whether these high costs are exacerbated by any monopoly power held by particular transport providers, but an effective monopoly position will usually lead to either monopoly profits, or inefficiency (high costs) within the firm, or both.

In summary, this study found that poor infrastructure (and the associated difficult logistics) was a very strong impediment to marketing performance. Any improvement in infrastructure is likely to be non-distorting and should benefit all smallholders, marketers and businesses operating in the end-user market segments. Those businesses where logistics is a severe impediment to their operations would benefit more than those businesses where it is not so critical; however, all businesses would benefit to some extent.

Quality Management

It will be clear from the previous discussion that quality issues will be product and chain specific. Less perishable products targeted to lower-quality market segments in relatively short chains will be relatively well-placed to cope with difficult logistics, and therefore, they are likely to face few issues in relation to quality management and wastage, particularly where the marketer is well-attuned to the needs of the market and transmits these needs back down the chain.

By contrast, perishable products targeted to higher-quality market segments in long chains that face strong logistics challenges will find it less easy to maintain the quality of the product and preserve its value on its journey from the producer to the market. If information flows back down the chain are poor, so that market needs and transport schedules are not being clearly transmitted along the chain, then these difficulties will be exacerbated.

There are many intermediate positions between these two extremes, and it was not possible to state that quality issues, in general, are creating marketing problems. Neither was it possible to state that quality was not an issue, as this was clearly not true for some products or chains. Hence, generic recommendations to improve quality management practices are not defensible, and any such recommendations should be done on a segment-by-segment basis, in order to establish whether value would be created for the end-consumer (and therefore, chain participants) if quality were to be improved, or alternatively, if extra cost would be added by improving quality because the end-consumer does not value the quality improvements.

Information Flows

Value creation along a chain is supported by information flows. This information flow is bi-directional, linking suppliers with the market, and the market with suppliers. Information flows tend to be embedded in the chain, and will reflect the orientation of chain participants, particularly the chain leader. More cooperative chains, or cooperative segments of chains, will be characterised by good information flows, but this is not usually the case with opportunistic chains, or opportunistic segments of chains.

The adequacy of information flows in chains observed in this study tended to vary. These ranged from good information flows for a reasonably short chain led by a small marketer, to less satisfactory information flows in other chains. In the short chain, the small marketer enjoyed preferred supplier status in key market segments, which facilitated good information-sharing from the market back down the chain. This same marketer had also built good relationships with suppliers in two villages, allowing him to transmit market requirements to suppliers.

However, it was observed that a longer chain selling perishable produce found it difficult to find out what supermarkets wanted from week to week, and also to find out what supply was available from farmers. In this chain, the orientation of the supermarkets and their relationship with local suppliers is the fundamental cause of these unsatisfactory information flows. The supermarkets that this marketer is selling to are unlikely to view the marketer as a preferred supplier, and instead, appears to treat them more as a residual supplier, which would explain why the marketer seems to have difficulty getting good feedback on supply from the supermarkets. To improve this information flow along this chain, this marketer would need to try to build a better relationship with the supermarkets by being able to demonstrate that they can better meet the supermarkets' needs than alternative suppliers. At the same time, it will need to begin the process of locking in its farmer suppliers by building better relationships with them. The extent to which it can be

successful in this endeavour will depend on whether it can convince the supermarkets that it can add value to the supermarkets' businesses, and whether it can offer sufficient incentive to its farmer suppliers to cement in their loyalty, and so enable it to deliver the required value to the supermarkets.

For a number of chains studied, it was observed that there was an information breakdown between input suppliers and smallholders with respect to seed supply. A number of farmers in different chains reported difficulty in accessing quality seed and/or in being able to purchase seed at the right time. While it is usually difficult for outside agencies to intervene successfully in chains with respect to the provision of information (particularly towards the market end of the chain), some intervention to improve the information flow between input suppliers and smallholders could be quite beneficial to improving chain performance and smallholders' returns.

There can be interrelationships between the adequacy of information flows, poor logistics, and quality. Established marketers who have linked the requirements of the market back to their sources of supply will be able to hold back supply at its source if transport schedules are disrupted, which better preserves product quality. The same is not likely to apply to self-marketing farmers who are taking excess production to markets in Port Moresby 'on spec'. These farmers can arrive in Lae with their produce, unaware that the shipping schedule has been disrupted, and the consequent delay in shipping can destroy much of the value of their produce.

In summary, the adequacy of information flows along the chains observed tended to vary, and differences between chains seemed to reflect the orientation of the chains themselves. However, it is possible that intervention at the opportunistic segment of the chain between farmers and input suppliers, particularly in relation to the provision of seed, was likely to benefit both smallholder farmers and the chain in general.

Relationships

Value creation along a chain (and the information flows that support this) is achieved through chain relationships. These relationships underpin the functioning of the chain, and therefore, chain functions such as value creation, quality management and information flows, cannot be considered in isolation of chain relationships.

The types of relationships that characterise a chain will usually be driven by product characteristics and market segments. By their nature, urban markets are opportunistic, and this opportunism will then permeate relationships along the rest of the chain. This was observable in this study, where chains that catered predominantly to urban markets or kai bars were characterised by spot market relationships along the chain. Such relationships are appropriate for chains operating in these market segments and are an efficient way of transacting business in such chains.

Smaller chains that targeted supermarkets or institutions seemed to have more cooperative relationships at the market end, with marketers having preferred supplier

status with these buyers. This tended to be in the form of informal contracts, which gave them a degree of certainty with respect to quantity and price. Although their relationships with their own suppliers tended to be more opportunistic, the prices that they offered their suppliers were good enough to ensure enough loyalty to get the necessary supply. However, some instances were observed whereby supermarkets were engaging in very opportunistic behaviour with their suppliers, suggesting that these suppliers had residual rather than preferred status. As noted above, the challenge for these marketers is how to improve their status with these supermarkets. It was also noted above that relationships between smallholders and input suppliers tended to be very opportunistic, with detrimental consequences for smallholders, and it was suggested that intervention at this level of chains might be beneficial.

Usually, chain leaders will internalise critical chain functions through vertical integration of key processes that create competitive advantage for them. While there was some evidence that this was occurring, by and large, vertical integration of functions was not a feature of the fresh produce chains observed in this study. This is a reflection of the relatively opportunistic orientation of most of these chains, which in turn, reflects the characteristics of the market segments.

In summary, the types of relationships that were observed in chains reflect the orientation of these chains, which in turn is driven by the conditions in the market segments in which they operate. Intervention at the input supply end to improve access by smallholders to seed and market-linked interventions with smallholders (such as marginal improvements in quantity and quality) may be beneficial, but any further attempts at intervention to improve the functioning of chains is not likely to be successful.

Margins along Chains

In this study, detailed financial analysis of costs and margins along a number of chains was undertaken. Appendix 1 gives a typical example of price points along a chain, and the costs and profits for a typical smallholder farmer, marketer and retailer. It was found that, as expected, farmers only capture a small proportion of the margin along the chain for different types of fresh produce. In the particular example shown in Appendix 1, the farmer is operating at subsistence level with little profit available as a reward to labour, effort and to build up the business. Other examples of costs and profit showed a greater proportion of profit with greater reward for labour and effort and more scope for expansion. Therefore, the concern that farmers do not receive a good return for their effort, thus enabling them to improve their situation, is well justified.

However, it was also found that middlemen (marketers) and others in the chain were not making excessive profits at the expense of smallholders. A number of marketing businesses were financially evaluated, some of which were small semi-commercial businesses while others were fully commercial larger marketing businesses. Similar patterns of costs and profits were observable for other businesses; that is, there was no evidence to support the argument that they were making excessive profits at the expense of smallholders. The example in Appendix 1 shows a marketer who has made an

adequate profit, which can be used to reward the marketer, family members and others in the community who have been involved in the business and for future expansion. However, this profit is not excessive.

There was also no evidence to suggest that retailers are making excessive profits at the expense of other players in the chain. In the example shown in Appendix 1, the buying price of the fresh produce accounts for over half the selling price, with the remainder being made up of costs and profit. Similar proportions were observed for different types of fresh produce sold to different supermarket outlets. It was not possible to break costs and profit down into individual components, which is not surprising since it is very difficult to get this type of information from retail businesses in any country. However, the proportion of the selling price made up of costs and profit is very typical of supermarket fresh produce internationally, and might even be considered a bit low by international standards.

It was concluded that no chain participant was making excessive margins at the expense of other participants. Hence, smallholder farmers were not being 'exploited'. However, the fact remains that the returns that they were making are quite meager. This suggests that the cost structure of these chains is relatively high.

Aggregate Performance – Effectiveness, Efficiency, Risk and Innovation

In general, the supply chains examined in this study performed well on a number of criteria, taking into consideration the conditions within which they had to operate. Most chains scored quite well on effectiveness (the extent to which they met the needs of their customers). Those chains targeting lower quality market segments performed well in this regard, although there was some room for improvement in long chains targeting top-end market segments for perishable products in distant markets such as Port Moresby.

With respect to efficiency (meeting customers' needs at the lowest possible cost), the efforts of marketers in stripping costs out of their chains was particularly impressive. They used a range of innovative ways to reduce their costs and boost their profitability. Despite this, they are hampered by poor logistics and infrastructure (and perhaps some near-monopoly operators in this part of the chain), and law-and-order problems. These factors raise the costs of doing business, which in turn, impedes the performance of these marketers and that of their chains.

The ability of businesses to manage risk along chains was very impressive. Smallholder farmers grow a range of crops and will sell to a range of outlets. Marketers manage variable quality by selling to a number of different market segments, and these market segments manage their supply risk either by forging closer relationships with reliable suppliers or by having multiple sources of supply.

Markets for fresh produce in Papua New Guinea are highly competitive. There is easy entry into all market segments, which enforces a high degree of market discipline on all

operators. Marketers interviewed reported that many operators entered the industry but then exited again when they could not make sustainable profits. Those marketers who had survived in the industry for a number of years were clearly very successful operators. This high degree of competition in the fresh produce industry will enhance performance of supply chains. Associated with this high degree of competitive pressure is innovation by successful businesses. New entrants have come into the system as self-marketers, then became small marketers as their businesses grew, and finally progressed to fully commercial larger marketers.

In summary, the supply chains analysed performed relatively well on a number of criteria. They appear to be reasonably successful in meeting the needs of their customers in the different market segments. However, they operate in a difficult environment, which raises their costs and reduces their efficiency. Despite this, they cope with their challenging environment through careful risk management. The competitiveness of the industry forces discipline onto marketers and appears to encourage innovation.

Conclusions

The wider economic environment forms the context within which supply chains operate. The PNG economy is at a particular level of development and industrialisation, and the balance between the different market segments for fresh produce reflects this. Currently, the informal sector and the urban markets, which cater for very large numbers of lower income consumers, is a very important segment, providing a range of qualities of different products at a range of prices. At the other extreme, the high-end formal markets, such as supermarkets, cater for a much smaller group of high income consumers, who are more demanding in terms of the product attributes that they require, including quality. This is a much smaller, though very lucrative, market segment.

These different market segments are serviced by many marketers, who range from large marketers, to smaller marketers, to self-marketing farmers. Within these marketers, there are varying degrees of commercialisation, with some being fully commercial, while others are making the shift from semi-subsistence. Likewise, farmers can range from fully commercial to subsistence operators.

If the PNG economy continues to grow and the level of industrialisation accelerates, the balance between the different market segments for fresh produce will change. The influence of the informal sector and the urban markets will decline and the influence of the formal sector, including the supermarkets, will increase. Associated with this will be a tightening of product requirements and an increased demand for quality products. These changing consumption patterns will be met by highly commercial marketers and increasingly commercial farming operations. However, if growth in the PNG economy slows or stalls, then this industrialisation process will also slow down. In this case, the patterns of consumption and relative importance of the different market segments will lie somewhere between the two scenarios outlined above. Likewise, the shift to fully commercial marketing and farming operations will also be constrained.

Therefore, the current level of market development for fresh produce reflects the current level of income and growth in the wider economy. Because of this, the informal sector, including urban markets and kai bars, exerts a strong influence, and along with lower-quality institutional markets, dominates the wider marketing system. The smaller market segments for higher quality produce, such as supermarkets and top-end institutions (eg international hotels), provides an outlet for smaller amounts of higher quality produce that can be sold at relatively high prices.

This wide variety of market outlets provides many opportunities for smallholders and marketers to meet the needs of these different market segments. As noted in previous sections, marketers have very different orientations and position themselves in different market segments. Likewise, the circumstances of farmers will vary, ranging from smallholder subsistence farmers, growing small amounts of produce and having immediate cash requirements, to larger farmers who have made the shift to more commercial production and are considering further growth.

In this study, it was found that the market system functioned well. It was characterised by entrepreneurial behaviour, a high degree of competition and innovation, and sound risk management by all participants. This was in spite of the difficulties posed by poor infrastructure, which raised the costs of doing business for all participants.

The conclusions reached in this study tend to conflict with the conventional wisdom that the fresh produce marketing system is performing poorly. The exception was poorly performing logistics, which results from poor infrastructure, and was found to have a negative impact on the whole marketing system. However, other instances of poor performance that were observed were found to be chain or segment specific. Extrapolation of these chain- and segment-specific observations of poor performance to the marketing system as a whole can distort and obscure the picture of the vibrant marketing activity that is also occurring within the PNG fresh produce marketing system. Therefore, it is concluded that the use of a Supply Chain Framework can yield a very robust and insightful understanding of the performance of the agricultural marketing system in developing economies.

References

- Bowersox, D.J., Closs, D.J., Cooper, M.B. (2002). *Supply Chain Logistics Management*. McGraw-Hill.
- Gattorna, J.L., Walters, D.W. (1996). *Managing the Supply Chain: A Strategic Perspective*, Palgrave.
- Gattorna, J.L. (ed) (2003). *Gower Handbook of Supply Chain Management (5th Edition)*.
- Handfield, R.B., Nichols, E.L. (2002) *Supply Chain Redesign: Transforming Supply Chains into Integrated Value Systems*, Prentice-Hall.
- Martin, S., Jagadish, A. (2005). *Agribusiness Supply Chain Management Concepts*. Paper prepared for the CARD Agribiz program, College of Economics, University of Hue, Vietnam.
- Patterson, A., Martin, S., Mollenkopf, D. (2005). *Niche Agribusiness Supply Chains and the Channel Coordinator's Role in their Creation and Management*. Proceedings of the conference of the NZARES, pp 214-222, August 2005, Nelson.
- Peterson, H.C., Wysocki, A. (1998). *Strategic Choice along the Vertical Coordination Continuum*. Staff paper No 98-16, Department of Agricultural Economics, Michigan State University.
- Porter, M.E. (1985). *Competitive Advantage. Creating and Sustaining Competitive Advantage*. The Free Press.
- Reddy, R., Reddy, S. (2001). *Supply Chains to Virtual Integration*, McGraw-Hill.
- Westgren, R.E. (1998). *Innovation and Future Directions in Supply Chain Management in Agri-Food*. *Canadian Journal of Agricultural Economics* 46, pp 519-524.

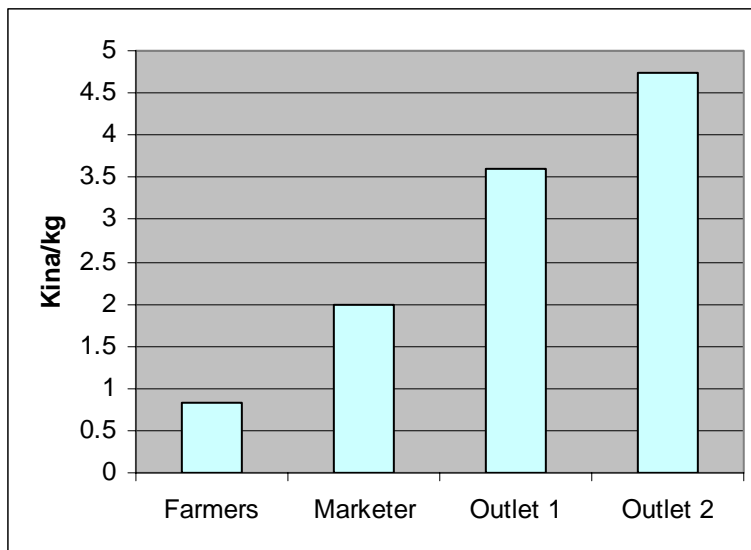
Acknowledgment

The research reported in this paper formed part of a consultancy conducted by the authors for the Smallholder Support Services Pilot Project, Department of Agriculture and Livestock, PNG. The authors are grateful to SSSPP (and in particular to John Hunt, International Advisor) for permission to use this material.

Appendix

Figure A1 gives price points along an illustrative chain for fresh produce produced in the Highlands of PNG and sold in coastal markets.

Figure A1: Typical Price Points along the Chain for Fresh Produce

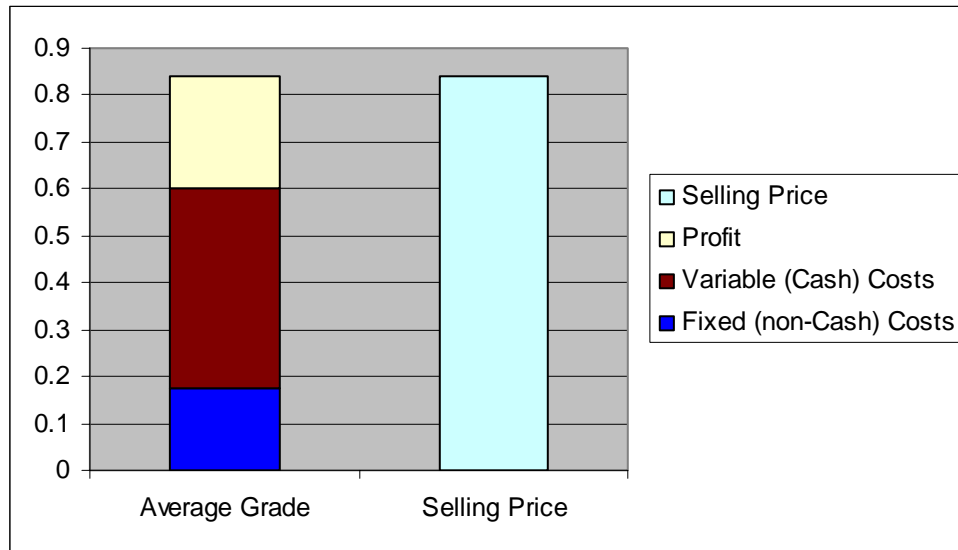


Note:

This pattern of price points was typical for different chains studied.

Figure A2 breaks the price received by the farmer (shown in Figure A1) into various types of costs and profit.

Figure A2: An Example of Costs, Profits and Prices for a Farmer Producing Fresh Produce



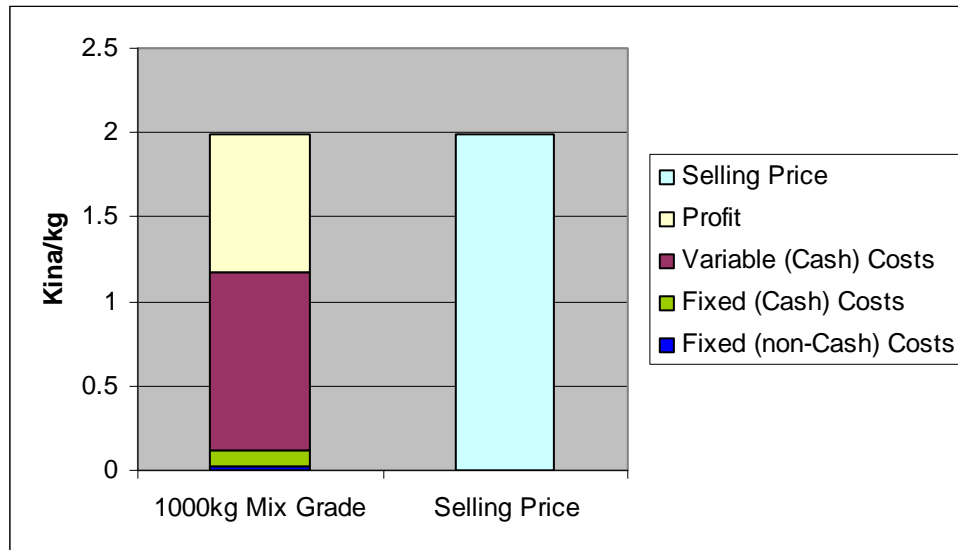
Note:

Variable (Cash) Costs include items such as seed, fertiliser, insecticide and other items necessary to produce a crop. Fixed (non-Cash) Costs shows the amount that would have to be put aside to maintain the assets of the farm, such as knapsacks, spades, knives, packing materials, etc. The profit that is left (the yellow area at the top) is what is available to reward the farmer, the farmer's family and the community for their labour, and to expand their farming operation in the future.

In this example, the farmer is operating at subsistence level with little profit available as a reward to labour, effort and to build up the business. Other chains showed a greater proportion of profit for smallholder farmers, and so a better reward for labour and effort and more scope for expansion.

Figure A3 breaks the price received by the marketer (shown in Figure A1) into various types of costs and profit.

Figure A3: An Example of Costs, Profits and Prices for a Small Marketer of Fresh Produce



Note:

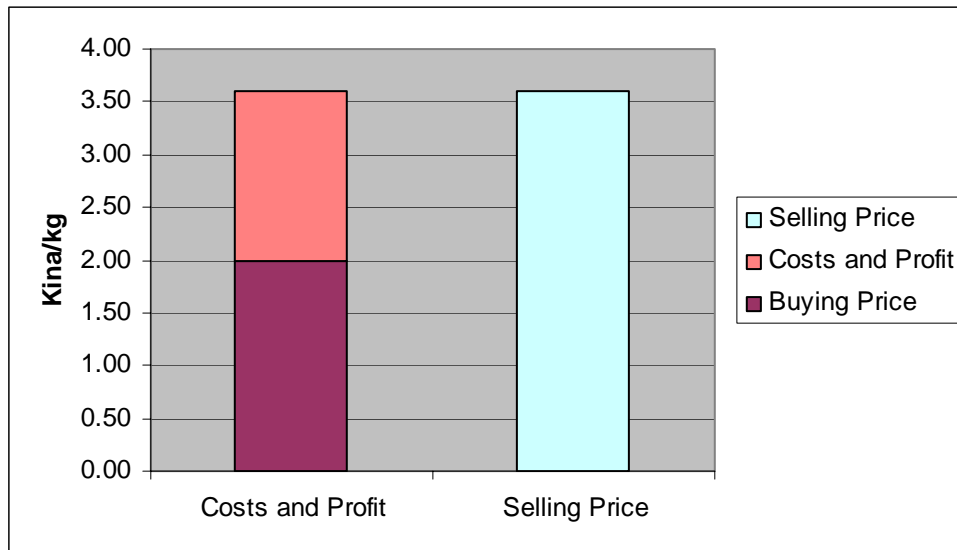
In this example, Variable (Cash) Costs are the biggest cost for the marketer and the biggest item is the cost of buying the fresh produce. Fixed (Cash) Costs (the cost of items incurred in the current period for all products – such as vehicle registration, repairs and maintenance, electricity, running costs of coolers, monitoring logistics, etc) are a much smaller component of costs, while Fixed (non-Cash) Costs (the amount that would have to be put aside to maintain the assets of the marketer – such as containers, trucks, long-lasting packaging materials, etc) are an even smaller component of costs.

In this example, the profit of the small marketer (the yellow area at the top) is what is available to reward the marketer, the marketer’s family and the community for their labour, and to expand the marketing operation in the future.

This pattern was observable for other marketers of fresh produce.

Figure A4 breaks the price received by the supermarket (shown in Figure A1) into buying price, and then an aggregate figure for costs and profit.

Figure A4: An Example of Buying Prices, Costs and Profits, and Prices for Fresh Produce Sold by a Supermarket



Note:

It was not possible to break costs and profit down into individual components since such cost information is commercially sensitive. It should also be noted that it is very difficult to get this type of information from retail businesses in any country.