Analyzing Supply Chains with Pluralistic and Agribusiness Systems Frameworks*

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* This is a collaborative study of the Curtin University of Technology, University of the Philippines in Mindanao, and SEARCA funded by the Australian Council for International Agricultural Research. The article is based on a paper presented at the SEARCA Agriculture and Development Seminar Series (ADSS) on November 6, 2003.

ABSTRACT

Special problems arise when analyzing supply chains because of the complexity of the relationships in the system. In addressing this concern for a research project on a vegetable supply chain in Mindanao, the authors of this paper use a pluralistic methodology. A soft-systems framework was used to structure and analyze the problem and identify relevant systems. Issues addressed are the extent of efficiency along the supply chain (including input supply (issues), output marketing, quality control and transport) and the relationships between the various participants in the supply chain. Qualitative and quantitative data collection methods have been used.

INTRODUCTION

It is widely recognized in the agricultural sector that if farmers are to be competitive in both domestic and international markets, their supply chains need to be more efficient and more effective. Improving the competitiveness of a supply chain relies upon improving the efficiency of all its elements from production, to processing, handling, distribution, and marketing.

To develop an understanding of the various relationships and variables affecting the efficient operation of supply chains, a systems framework is required. If we take a systems view to analyze the impediments to improving the efficiency of a supply chain, then we very quickly realize that it is too complex to analyze by using just one theoretical framework.

As has been argued by McGregor, Rola-Rubzen and Murray-Prior (2001), such complex systems require a pluralistic approach in their analysis. As the authors suggest, "more progress can be made by using more than one methodology, even though their assumptions may be incompatible and their results imply different solutions to the problem. The dialogue created by this diversity will provide better solutions than a reliance on one paradigm and its associated methodologies" (p. 63). Single disciplinary research has been found to be ineffective in meeting the challenges of addressing the problems of complex systems and is particularly ineffective when addressing the problems in the transitional economies. What appears to be required is a multi-disciplinary approach, and even within the disciplines, a multi-methodology approach.

This paper outlines an attempt to use a pluralistic approach in analyzing and improving the operations of a vegetable supply chain in the Philippines.

WHAT DO WE MEAN BY A PLURALISTIC APPROACH?

Jackson (1999), building on the earlier works of Jackson and Keys (1984), Jackson (1991), Gregory (1996), Mingers and Broxlesby (1996), and Mingers and Gill (1997), has argued that in management science, a meta-methodology is required when dealing with complex problems. This involves employing a range of methodologies, taking into account their combined insights when providing prescriptions for change. This is consistent with our belief that in analyzing complex systems, the choice of methodologies should be guided by the problems to be addressed. Elements of hard, and soft systems and other analytical systems' methodologies should be combined, where appropriate, to enhance flexibility, and benefit from more insights and answers in an intervention.

This implies that one paradigm will not dominate the analysis in the sense that the assumptions inherent in other paradigms are a subset of its paradigms. Nor does it imply that the analysis will involve mixing methods, models, and techniques so that they are separated from their theoretical foundations. Rather, as Jackson (1999) argues, theoretical consistency should be maintained within each methodology so that its assumptions, hypotheses, and methods can be tested and improved.

However, maintaining theoretical consistency while employing them side-by-side means that the results and answers they suggest may be inconsistent or even diametrically opposite. While this will create problems for researchers and other stakeholders, it could be very valuable in identifying areas where caution and further investigation are required. It is also to be expected

since all methodologies produce results constrained by their explicit and implicit assumptions, which need to be compared to reality. This is a major benefit of pluralism as it may force researchers using a particular methodology to question and perhaps defend or reject its assumptions to take into account the results and implications of alternative methodologies.

LOCATION AND CHARACTERISTICS OF PROJECT AREA

The supply chain that is the focus of this project is that arising from the cultivation of a variety of temperate vegetables in Kapatagan, a village in Southern Mindanao, Philippines. It is situated near Digos City in the province of Davao del Sur. True to its name, which is a local word for "flat lands", Kapatagan lies on a plateau measuring around 6,000 ha and located roughly between 1,000 and 2,000 meters above sea level. The vegetable production area covers approximately 2,000 ha of gently rolling hills on the slopes of Mt. Apo. It has year-round mild temperatures, no typhoons, and a short dry season, which allows rain-fed cultivation. Vegetable crops are rotated with corn and potatoes. The main vegetables cultivated are cabbages, carrots, and tomatoes. These are grown on small farms, usually no bigger than two hectares.

Vegetables produced in Kapatagan are marketed mainly in the so-called "wet markets" of the surrounding towns, including Digos, Kidapawan, and Davao City. However, an emerging market outlet are the supermarkets, most of which are found in Davao City. Supermarkets cater to the middle and upper classes whose income allows more quality-conscious and discriminating standards. To satisfy their clientele, supermarkets buy their vegetables from as far away as Baguio City in the northern island of Luzon.

"Middlemen" do the marketing, buying from the farmers and transporting the produce in "jeepneys" and trucks. The vegetables are usually packed in plastic bags or 'onion bags' that are sold to wholesalers in the city, who then on-sell the produce to various retailers and food service outlets. "Middlemen" usually double as financiers, lending money for the purchase of seeds and inputs at planting time and collecting the loans at harvest. While this arrangement assures the farmers of a market, the price the farmers receive for their produce is governed primarily by supply and demand. With the produce purchased in bulk and with minimal grading, there is little incentive for quality.

OBJECTIVES OF THE PROJECT

The objectives of the project include:

- Understanding the various production and marketing systems being practiced by the farmers;
- Examining the efficiency of the agribusiness supply chain for vegetables;
- Identifying the extent to which farmers are able to satisfy the needs of the market intermediaries, and vice versa;
- Identifying the extent to which agricultural marketing cooperatives may improve farmers' income;
- Facilitating the greater adoption of quality management systems; and
- Suggesting appropriate policies and strategies to improve the efficiency and efficacy of the supply chain.

GLOBAL AGRIBUSINESS SYSTEM SETS THE CONTEXT OF STUDY

The global agribusiness system sets the context in which this project takes place. Increasingly, both the farmer and the firm are being forced to compete with vertically integrated food and fiber systems in a global context. Two factors having a major impact on the operations of vegetable supply chains are globalization and the emergence of value chains.

1. Globalization effects

Technological improvements and the increasing influence of concepts of economic efficiency have been instrumental in the rise of global food supply chains which have gradually been taking over the reins held by local food supply chains. Multilateral trade negotiations conducted under the auspices of the World Trade Organization and bilateral trade negotiations have substantially

reduced a range of institutional barriers and other trading blocks between countries, thereby ensuring potential benefits for the transitional economies. At the more micro level, improvements in information technology, logistics, and food technology have improved the speed and quality of information flows, resulting in the more rapid and more efficient distribution of perishable products while greatly extending their shelf life.

Consumers are demanding the year-round supply of their favorite products, as well as more choices, more information, and greater safety, all at more competitive prices (Baines 2002). Competition to keep up with these changes is accelerating the trend to fewer, larger, and more sophisticated farm input suppliers, finance and other service sector organizations, primary processors and manufacturers, retailers, and food service firms. The management skills needed to cope with these changing demands are increasing. Supply chains that are not able to respond, particularly those involving small farmers, face a declining market.

2. The emergence of value chains

In another sense, we are also witnessing a change from the dominance of mass markets, which deliver commodities to consumers, to the proliferation of a number of value chains, which deliver differentiated products to selected consumer segments. Differentiated products obtain their value from their features which incorporate and correspond to a range of attributes that are desired by their target consumers.

These changes in the food supply chains are increasingly being driven by consumer demands that require the firms to deliver the desired products quickly and to be responsive, flexible, and efficient. However, retailers are increasingly holding the real power in the value chains; in the industrialized countries, large food retailers have taken power and control over food chains away from food manufacturers (Burch & Goss 1999; Dixon 1999).

If we consider relationship as power, we see a reversal of the normal representation of a supply chain. The demand for quality and safety means that retailers are forced to establish food safety and traceability systems and will only purchase products from firms throughout the supply chain that can meet their standards. Increasingly, commodity-based supply chains are being fragmented by the expansion of differentiated products delivered by the value chains. In the Philippines, as in most parts of Southeast Asia, there is an emerging middle class, with a shift in demand towards more high-valued commodities.

DUALISTIC VIEW OF MINDANAO's AGRIBUSINESS SYSTEM

To help illustrate the implications of the development of value chains for the Mindanao agribusiness system, we introduced the concept of a dualistic agribusiness system to help us with our analysis. Since we have suggested that the consumer is the driving force behind value chains, let us consider the case of the food markets in Mindanao or specifically, in Davao. We conceive of two markets: the 'wet' market, which is part of the 'price-driven' agribusiness system, and the supermarkets, which are part of the 'value-driven' agribusiness system (Figure 1).

Of course, this is a simplification but it illustrates the two extremes that exist in Mindanao. In the wet market, there is very little differentiation of products and there is strong price competition. There are no agreed quality standards and hence no quality or food safety systems. Contrast this with the 'value-driven' system that exists for some products in the supermarkets. Here there are various sets of food quality and safety standards, where consumers employ a different set of attributes in their decision to purchase.

In essence, these systems supply to different groups of consumers, which have different abilities to pay for product attributes as outlined in Table 1. In the main, there are different groups of producers supplying these agribusiness systems. It is safe to assume that the 'value-driven' system will source its products from firms and chains—either in the Philippines or from overseas—which can meet the technical and functional standards required. The question is: What can be done in Mindanao to improve the efficiency of producers and firms who supply both the 'value-driven' and 'price-driven' systems? Providing the answer to this question is critical to the development of Mindanao, because unless improvements are made,

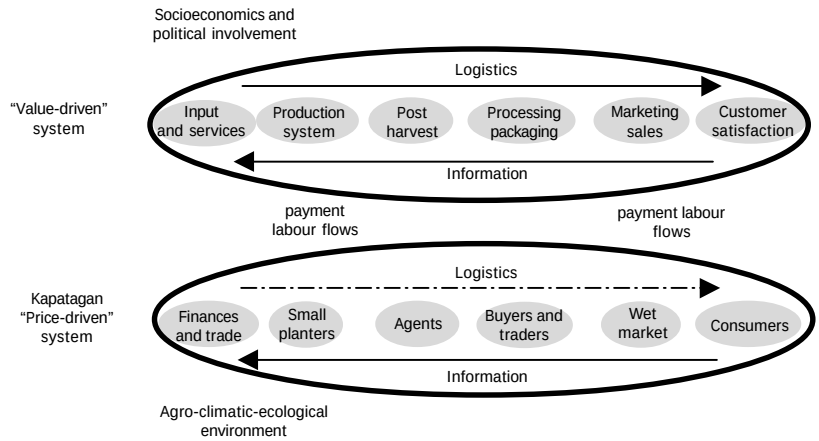

Figure 1. Dual agribusiness systems in Mindanao

Table 1. Representation of characteristics of product attributes emphasized by consumers in dual markets of Mindanao.

Food Product Attribute	Shopping/Cooking/Eating Mode	
	Price-driven Wet markets	Value-driven Supermarkets
Price	✓ ✓ ✓	✓
Convenience	✓ ✓	✓
Appeal to children	✓ ✓	✓
Value	✓ ✓	✓ ✓
Safety	✓	✓ ✓
Health	✓	✓
Taste	✓	✓ ✓
Welfare/Environment		✓ ✓
Status		✓ ✓
Source		✓ ✓
Authenticity		✓ ✓
Romance		✓ ✓

Source: Adapted from Hughes 2000.

Mindanao food supply chains will not be able to compete in the more profitable 'value-driven' chains and hence will remain in the poorer 'price-driven' chains.

METHODOLOGICAL FRAMEWORK

Because we needed to understand first the system incorporating the vegetable supply chain in Kapatagan, we used a soft systems framework to begin the analytical process. This was necessary because initially we did not have an understanding of the elements of the system or even a clear view of the system boundaries. An implicit assumption of a soft-systems view is that the observer does not have a clear picture of the system. This contrasts with the hard-systems view which assumes that such an understanding exists, as illustrated in Figure 2.

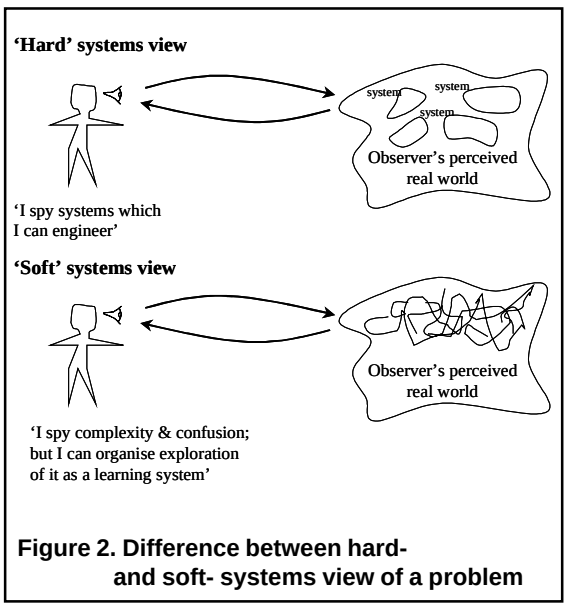

Figure 2. Difference between hard- and soft- systems view of a problem

Source: Adapted from: Checkland, P. 1999, p. A11.

According to Jackson (1999), a soft-systems framework could be a useful starting point when examining complex systems. This does not imply that the whole program is to be conducted within the soft-systems paradigm, only that it could be used to generate a better understanding of the system; thus, the relevant subsystems could be analyzed by using both 'hard' and 'soft' systems paradigms. This approach is implicit in the learning cycle of soft systems as shown in Figure 3.

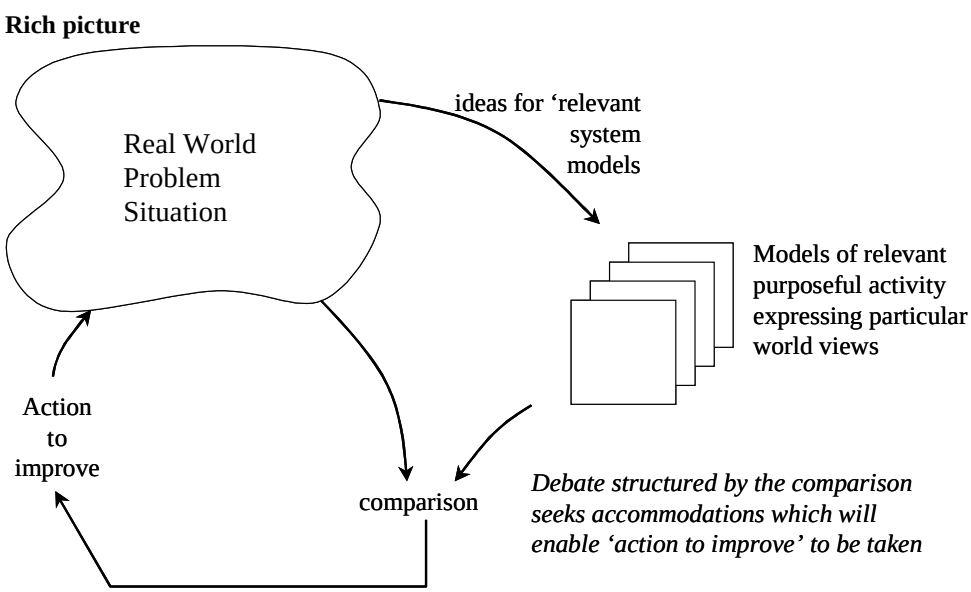

Figure 3. Learning cycle of soft systems methodology

Source: Adapted from Checkland and Scholes 1990, p. 7, with added inputs from Checkland from a personal communication transmitted in November 23, 2000

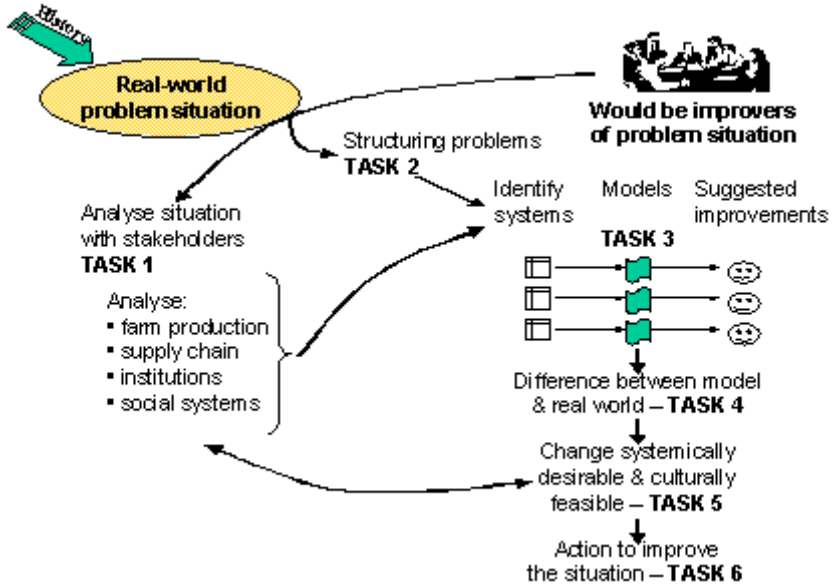

Figure 4. Methodological framework for Kapatagan supply chain project

Source: Adapted from Checkland and Scholes 1990, p. 7.

The model in Figure 3 served as the basis for developing a methodological framework for designing and conducting the research which is outlined in Figure 4. Initial phases in the investigation were structured within the soft-systems paradigm until a clearer understanding of the system was obtained. Research activities in this phase included: reviewing literature and relevant documents, maps and statistics; field visits to the Kapatagan area and other parts of the supply chain for observation and informal and semi-structured interviews with officials, farmers, business people and other participants in the supply chain; focus groups; and local features and resource mapping.

As part of this process, individuals in the team developed rich visualizations of the system, which were then used as part of a discussion process to improve our understanding of the system and its problems. This was interlaced with, and enhanced by, the focus group discussions with farmers and vegetable agents, which were conducted by using tools from the Goal-Oriented Project Planning Method. The outcome of this process was the input for Task 2 shown in Figure 4.

The main problem areas identified were:

- Poor knowledge and application of technology, both of which affect productivity, quality control, and food safety.
- Poor infrastructure support such as roads, electricity, telephones, and cool storage facilities, which affects both logistical and information flows.
- Poor market information.
- Limited access to finance and capital, which ties producers to particular agents and traders.
- An imbalance in power relationships at the social, economic, and political levels, which affects economic exchange, the allocation of resources, and the operation of partnership and cooperative institutions.

- Problems of land tenure which lead to insecurity and decrease the incentive for productive capital investments.
- Inappropriate supply chain orientation.

The elements and issues along the supply chain which were identified as part of this process are shown in Figure 5. The main actors identified in the supply in the initial phase of the research consist of the following:

- ***Financiers*** – Often, they also function as traders who may then take a share of the harvest, depending on the financial arrangement.
- ***Planters*** – This is the term used by the people in Kapatagan to refer to farmers.
- ***Cariadors*** – They transport the products from the farm to the trading post through the use of horses. Some *cariadors* are also farmers who assume a different role in the supply chain when their own farm is not due for harvest.
- ***Kargadors*** – They manually load the products to the hauling trucks.
- ***Agents*** – They find a buyer for the products of a farmer or a group of farmers. They first came into existence after the trading post was established.
- ***Traders*** – They purchase the farmers' products wholesale and transport them to different points in Mindanao and in the Visayas. Some traders are both wholesalers and retailers. Some of the people at Kapatagan said that the latter type

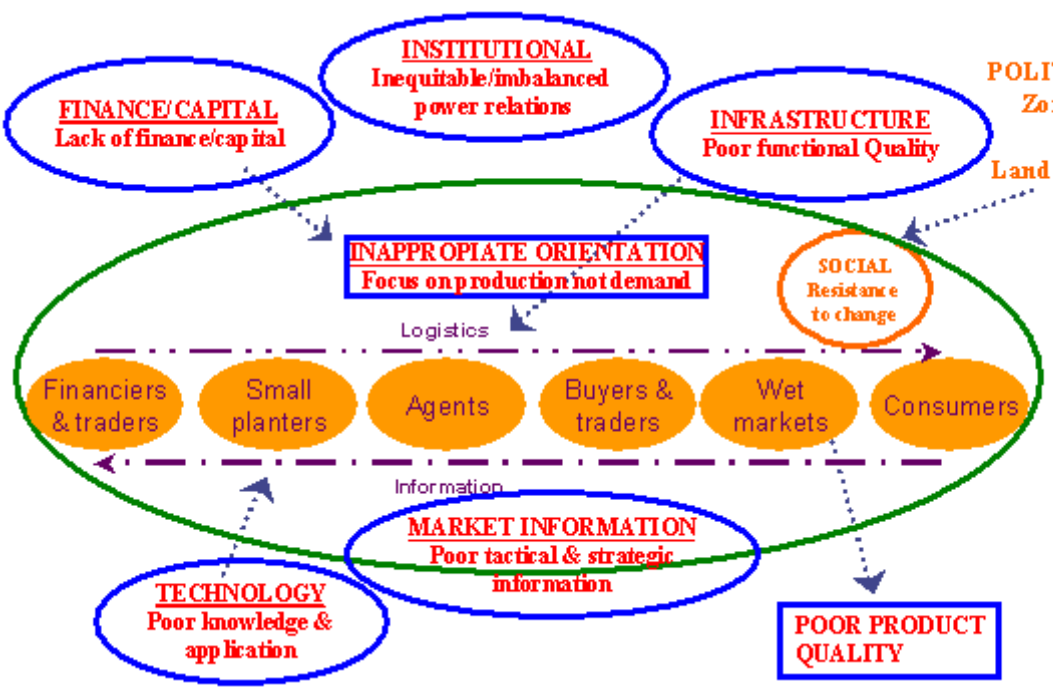

Figure 5. Elements of Kapatagan supply chain and associated problems

of traders earn the highest net income from the marketing of vegetables.

- ***Retailer/wholesaler*** – Depending on the destination, this may be the same as the trader, particularly if the product is sold in the wet market.

People may play multiple roles within the chain, and the products may pass through additional hands not mentioned here.

APPLICATION OF RESEARCH METHODOLOGIES IN THE PLURALISTIC FRAMEWORK

1. Understanding the issues

In order to address the issues raised, a number of investigations were conducted by using a range of methodologies and theoretical perspectives. The methodologies drew information from four main questionnaires orientated to the Kapatagan and supply chain actors. The topics covered by the questionnaires were: farmer social organization, farmer marketing, farm production, and supply chain operations. These questionnaires were developed to serve the following main purposes:

- Obtain qualitative and quantitative information about the operations of the supply chain. (This also includes the social and institutional framework by which the various players in Kapatagan operate.)
- Provide information for a mathematical programming model initially focused at the farm household level to investigate the efficiency and profitability of the production and marketing processes.

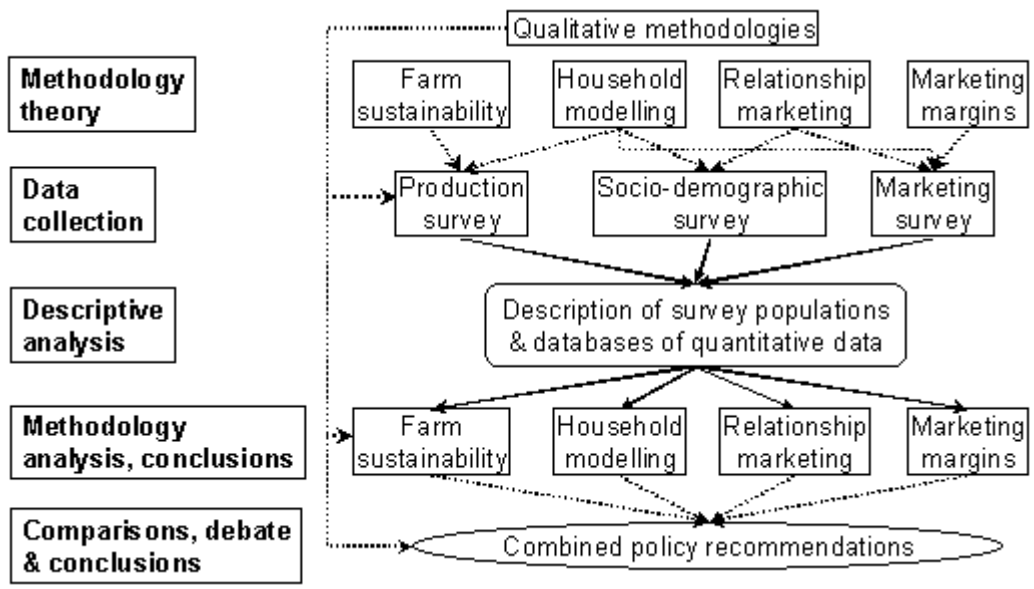

Figure 6. The pluralistic process used to combine methodologies

- Investigate the relationships between the actors in the Kapatagan supply chain from a relationship marketing perspective by using gap analysis, factor analysis, and structural equation modeling.
- Investigate the efficiency of the supply chain through the use of marketing margins and price transmission elasticities.

The information collected from these surveys was then incorporated into databases that were used to analyze the propositions derived in Task 2 from particular methodological orientations. The process for this is outlined in Figure 6.

Additional activities we undertook to further investigate some of the propositions identified included the following:

- Participative workshops were conducted among Kapatagan residents to create a local features and resource map. Discussion of the issues raised during this stage helped identify additional problem issues and aided the participants in understanding their own problems.
- One of the problems identified in the production of vegetables was poor technical expertise and knowledge, which appeared to be an important cause of inferior quality and poor yields. As a further part of the investigation of this issue, a quantitative and qualitative survey of farm practices was conducted. Information was collected on topography, soil characteristics (including chemical and microbial analysis), weeds, diseases, insects, cropping practices, and rotations over a range of farms selected by using criteria of productivity and perceived profitability.

2. Verifying the understandings

To verify the findings and corroborate these outputs yielded by the methodological analyses, we further embarked on the following activities, namely:

- Comparison of the findings with the qualitative and quantitative data obtained through the various data collection activities and with the findings of overlapping methodologies.
- Discussion of the findings with farmers, agents, buyers, traders, and other stakeholders in group discussions and workshops.

3. Debate desirable and feasible change

A key component of the pluralistic framework outlined in Figure 4 is the opportunity it provides to examine issues from a range of theoretical perspectives and findings based on the analyses conducted within these frameworks. Findings on various issues outlined in Task 2, such as the relevance of credit as an impediment, were discussed and debated by using results obtained from qualitative discussions, quantitative survey analyses and mathematical modeling. The feasibility of the proposals emanating from the conceptual and mathematical systems models was assessed through in-depth discussions.

Through activities such as a workshop with Kapatagan farmers and the SEARCA workshop, policy options were proposed, considered and assessed for relevance to supply chain participants and the vegetable supply chain.

4. Action to improve the situation

Based on the insights gained from the various discussions, the actions taken to improve the situation included the following:

- Linkages were developed by UP Mindanao with the Department of Agriculture, the Growth with Equity in Mindanao Project (USAID), the Philippine Institute for Development Studies, the Vegetable Industry Council of Southern Mindanao, and the Mindanao Business Council.
- Workshops were conducted among Kapatagan farmers to discuss the findings of research and possible actions for change.

- Training was conducted for the KALIDECO and Maharlika cooperatives.
- Support and participation was given to the 1st Mindanao Policy Review Forum, Davao, held in June 2003.
- A policy document was presented at the Fifth Mindanao Food Congress and subsequently submitted to the President for consideration.
- The paper "Toward an efficient vegetable supply chain: Prospects and challenges (A Policy Forum)" was presented at the SEARCA Forum held in Los Baños in November 2003.

These actions are ongoing, in a large part derived from the relationships established by UP Mindanao with the farmers in Kapatagan and the various firms and institutions that have contacts with Kapatagan and the broader Mindanao vegetable industry.

CONCLUDING COMMENTS

We have found the use of the pluralistic approach helpful in putting together the various qualitative and quantitative aspects of the project. In particular, the soft-systems approach was useful in providing a clear picture of the systems boundaries, the inter- and intra-relationships among various supply chain participants, and the institutional framework by which actors operate in the system.

The focus group discussions, farm and market visits, and the dialogue with participants formed the basis for a sound understanding of the issues involved in operating and improving the supply chain. The more formal surveys and their analysis using a fairly wide range of methodologies gave further insights and provided the data needed to quantitatively model the system and various policy scenarios.

On the whole, we reaped the greatest benefits when we situated the results and implications of the various methodologies within the context of the global agribusiness system and the dualistic agribusiness systems of the Mindanao vegetable industry.

ACKNOWLEDGEMENTS

This project was funded by the Australian Council for International Agricultural Research.

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