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# A pluralistic methodology for analysing supply chains

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A collaboration of the Curtin University of Technology, University of the Philippines in Mindanao and SEARCA

## Abstract

Special problems are presented when analysing supply chains because of the complexity of the relationships. In addressing this problem for a vegetable supply chain in Mindanao a pluralistic methodology is used. A soft systems framework was used to structure and analyse the problem and identify relevant systems. Issues we are addressing are efficiencies along the supply chain (including input supply issues, output marketing, quality control and transport) and relationships between the various participants in the supply chain. Qualitative and quantitative data collection methods have been used. Analysis is being conducted with qualitative data analysis techniques, LP farm household models, transaction cost economics, gap analysis, factor analysis and structural equation modelling.

## 1. Introduction

Increasingly, it is being recognised that competition in the agricultural sector is occurring not so much within as it is between supply chains. If farmers are to be competitive in both domestic and international markets, their supply chains need to be competitive. Improving the competitiveness of a supply chain relies upon improving the efficiency of all its elements from production, to processing, handling, distribution and marketing. In order 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 analyse the impediments to improving the efficiency of a supply chain, then we very quickly realise that it is too complex to analyse 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 economically poorer nations. What appears to be required is a multi-disciplinary approach but even within the disciplines, a multi-methodology approach.

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

## **2. What do we mean by a pluralistic approach?**

Jackson (1999), building on earlier work (Jackson and Keys 1984; Jackson 1991; Gregory 1996; Mingers and Broxlesby 1996; 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 analysing complex systems, the choice of methodologies should be guided by the problems to be addressed. Elements of hard, soft and other systems analysis methodologies should be combined where appropriate to enhance flexibility, 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.

Maintaining theoretical consistency while employing them side-by-side however, 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 is 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.

## **3. Location and characteristics of project area**

The supply chain that is the focus of this project is the range of temperate vegetables grown in Kapatagan, in the Philippines. Kapatagan is a village in Southern Mindanao near Digos City in the province of Davao del Sur. Kapatagan, a local name meaning “flat lands”, is on a plateau of around 6,000 hectares at between 1,000 and 2,000 metres above sea level. The vegetable production area covers approximately 2,000 hectares 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. Vegetables 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 surrounding towns, including Digos, Kidapawan and Davao City, in so-called “wet markets”. However, an emerging market outlet are supermarkets, most of which are found in Davao City. Supermarkets cater for the middle and upper classes who have the income to be more quality conscious and discriminating. Consequently, supermarkets buy their vegetables from as far away as Baguio City in the northern island of Luzon.

Marketing is done by “middle men” who buy from the farmers and transport the produce in “jeepneys” usually packed in plastic bags or ‘onion bags’. They sell these to wholesalers in the city, who then sell the produce to the retailers. “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 farmer of a market, the price the farmer receives for their produce is governed by supply and demand. With the produce purchased in bulk and with minimal grading, there is little incentive for quality.

#### **4. Objectives of the project**

The objectives of the project include:

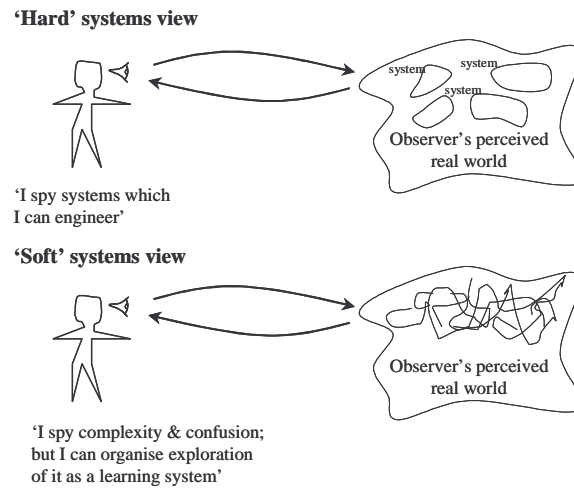
- Understand the various production and marketing systems being practiced by the farmers
- Examine the efficiency of the agribusiness supply chain for vegetables
- Identify the extent to which farmers are able to satisfy the needs of the market intermediaries and vice versa;
- Identify the extent to which agricultural marketing cooperatives may improve farmers’ income
- Facilitate greater adoption of quality management systems
- Suggest appropriate policies and strategies to improve the efficiency and efficacy of the supply chain.

#### **5. Methodological framework**

Because of the need initially to understand the system incorporating the vegetable supply chain in Kapatagan, a soft systems framework was used 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 1.

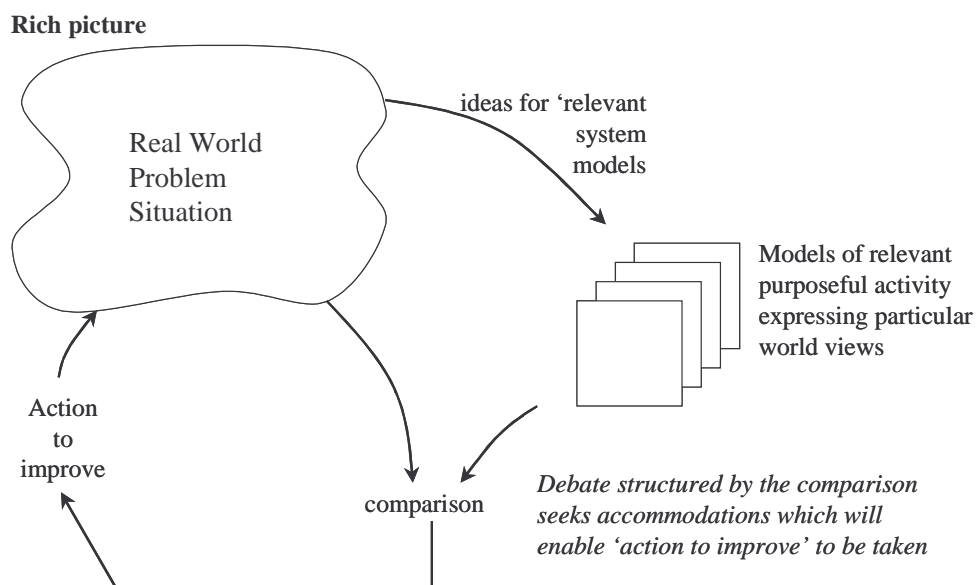
**Figure 1: Difference between hard and soft systems view of a problem**



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

Jackson (1999) also implied that a soft systems framework can 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 was used to generate better understanding of the system so that analysis could be conducted of the relevant subsystems using both 'hard' and 'soft' systems paradigms. This approach is implicit in the learning cycle of soft systems as shown in Figure 2.

**Figure 2: Learning cycle of soft systems methodology**

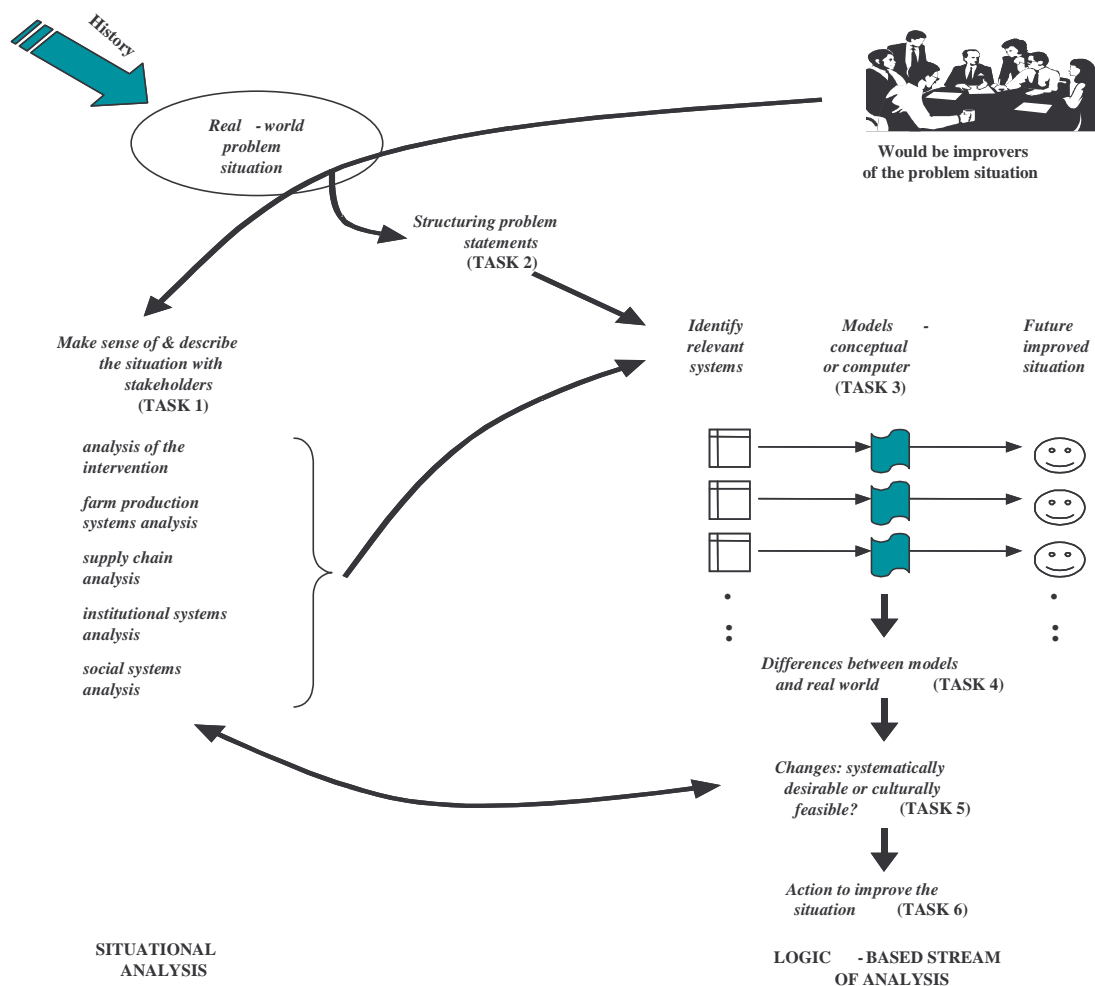


Source: Adapted from Checkland and Scholes 1990, p. 7 and Checkland 2000, pers.comm..

The model in Figure 2 served as the basis for developing a methodological framework for designing and conducting the research which is outlined in Figure 3. 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, 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 pictures 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 using tools from the Goal-Oriented Project Planning Method. The outcome of this process was the input for Task 2 shown in Figure 3.

**Figure 3: Methodological framework for Kapatagan supply chain project**



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

The main problem areas identified were:

- lack of finance/capital
- inequitable/imbalance in power relationships

- poor knowledge and application of appropriate technologies
- poor technical quality (product) outputs from the supply chain
- poor functional quality (delivery capabilities) arising from inadequate investment in roads, irrigation and cool chain storage
- poor market information
- inappropriate supply chain orientation.

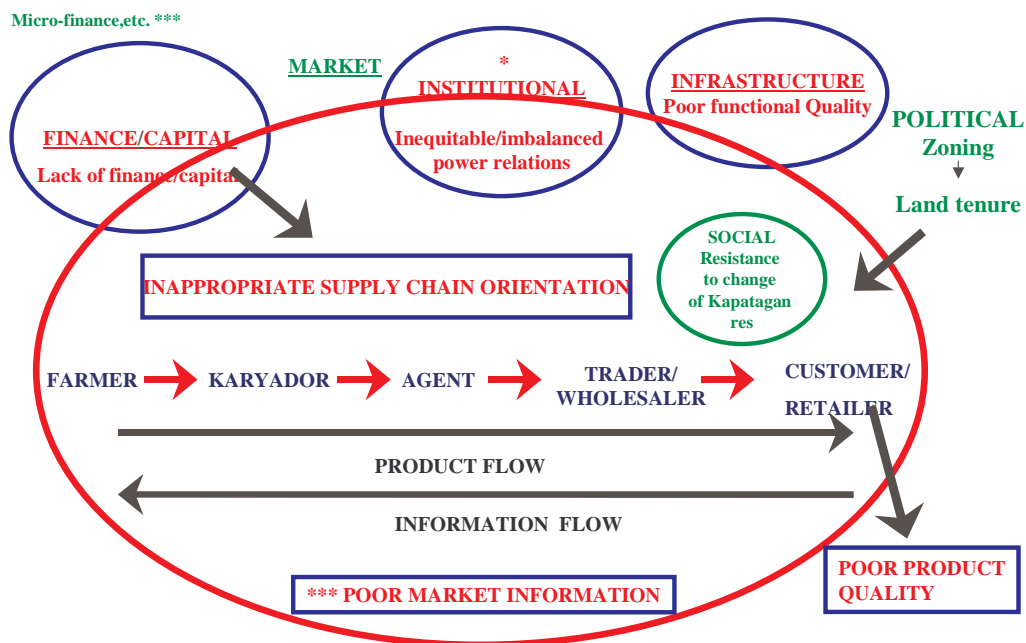
The elements and issues along the supply chain identified as part of this process are shown in Figure 4. The main actors identified in the supply in the initial phase of the research included:

- ***Financiers*** – Often also traders who may take a share of the crop depending on the financial arrangement.
- ***Planters*** – Planter is the term used by the people in Kapatagan to refer to a farmer.
- ***Cariadors*** – The *cariadors* are the transporters of 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*** – This group of people are those that load the products to the hauling trucks manually.
- ***Agents*** – An agent finds a buyer for the products of a farmer or a group of farmers. Agents first appeared after the trading post was established.
- ***Traders*** – The traders are those who buy/purchase (in wholesale) the farmers products and transport them to different points in Mindanao and in the Visayas. Some traders are also wholesalers/retailers. Some of the people at Kapatagan said that these traders get the highest net income in the marketing of vegetables.
- ***Retailer/wholesaler*** – Depending on the destination this may be the same as the trader, particularly if sold in the wet market.

People may play multiple roles within the chain and as well the product may pass through additional hands not mentioned here.



**Figure 4: Elements of Kapatagan supply chain and associated problems**



## 6. Research methodologies

In order to address the issues raised, it was decided that a number of investigations would be conducted using a range of methodologies and theoretical perspectives. The methodologies would draw information initially from three main questionnaires orientated to the Kapatagan actors: social organisation, marketing and farm production. The questionnaires were developed to serve three main purposes:

- Get qualitative and quantitative information about the operations of the Kapatagan section of the supply chain. This also includes the social and institutional framework by which the various players in Kapatagan operate. Some of this is detailed in the paper presented by Montiflor and Concepcion at this conference.
- Provide information for a mathematical programming model initially at the farm household level to investigate the efficiency and profitability of the production and marketing processes.
- Investigate the relationships within the Kapatagan actors in the supply chain from a relationship marketing perspective using gap analysis, factor analysis and structural equation modelling.

Additional investigations that were conducted to further investigate some of the problems identified were:

- Participative workshops were conducted to create a local features and resource map. Discussion of the issues raised in this process helped identify additional problem issues and helped the participants with their understanding of their own problems.

- One of the problems identified in the production of vegetable was poor technical expertise and knowledge which appeared to be an important cause of quality and yield problems. 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 using criteria of productivity and perceived profitability.

Such a wide range of data sources requires a systemic approach to documenting, storing and analysing the research activity. Reports on all activities and visits are a key part of this. A process documentation method is used for these which aims to answer the important questions of What, Where, Who, Why and How. Qualitative data arising from this process is stored in Nud.ist where it is then analysed as appropriate using qualitative approaches. Much of the quantitative data is stored in SPSS. In some cases Nud.ist is used to help in categorising answers to questions, which are then entered into SPSS for further analysis.

## **7. 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 amongst various supply chain participants and the institutional framework by which actors operate in the system. The focus group discussions, farm and market visits and 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 gave further insights and provided the data needed to quantitatively model the system and various policy scenarios.

While the basic mathematical modelling work focuses on the farm-household capturing the production, consumption, marketing and credit relationships within the system, it is intended that the model will be extended to incorporate the whole supply chain. Such modelling work will be useful in providing insights on likely impacts on the incomes of farmers and the chain participants of alternative policy scenarios to improve the supply chain efficiency.

As part of the relationship marketing study, gap analysis was undertaken to identify the extent to which actors in the supply chain are able to meet the needs of their exchange partners, both up and down the chain. Initially proposed by Bolton and Drew (1991), in the context of the service industry, the parameters were adjusted to reflect the technical quality of the product (the product attributes), the functional quality (the means by which the product was delivered) and the service quality dimensions (the extra things an exchange partner performs to assist their partner) (adapted from Gronroos 1990). The more one moves towards the service quality

dimensions, the greater the expectation of repeat business, and the more likely partners are to enter into long-term cooperative buyer-seller relationships. Such relationships are founded primarily on the partners' satisfaction with the exchange, trust, commitment, the making of relationship-specific investments and the appropriate restraint of power (Batt and Rexha 1999). While the application of transactions costs can identify the various margins extracted by each of the actors along the supply chain and the activities that each perform, an analysis of the relationships themselves will identify the social dimensions of the exchange and in particular, the development of trust and the use of coercive influence strategies so often associated with power dependence. In the absence of formal contracts between the various actors and in the absence of any formal mechanism for redress, social relationships will play a critical role in the performance of the supply chain.

Further analysis of supply chain via structural equations modelling will further provide insights on factors that influence B2B and B2C relationships. Good and effective relationships are critical for the long-term sustainability of the supply chains.

In addition, the econometric modelling work on power relationships between actors in the supply chain will add to this understanding (see paper by Larry Digal at this conference for details of methodology).

Apart from the progressive work with the models, project staff will be working on capacity building of farmer participants. In the coming twelve months, training on agronomic aspects, pest control, improving postharvest processes, storage and handling, and marketing will be conducted with farmer participants, in response to the needs analysis conducted in the earlier phase of the project. In addition, modelling results will be presented to stakeholders for validation in line with the traditional soft systems methodology.

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