Soft systems methodology: An alternative approach to improve agribusiness supply chain

Soft systems methodology: Suatu alternatif pendekatan untuk memperbaiki rantai pasokan agribisnis

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Abstrak

Masalah-masalah sosial yang biasanya melibatkan aktifitas manusia sering kali sulit untuk didefinisikan. Soft systems methodology (SSM) menyajikan cara yang efektif dan efisien untuk masalah yang mengandung sifat saling ketergantungan antara proses teknologi dan aktifitas manusia. Rantai pasokan agribisnis salah satu contoh masalah ini. Rantai pasokan agribisnis adalah suatu sistem sosial yang kompleks yang memiliki tujuan pemenuhan permintaan konsumen dari penawaran produsen secara efisien. Pentingnya peran faktor sosial seperti kerjasama, kepercayaan dan hubungan bisnis antara pelaku menjadikan SSM sesusi untuk mencari lebih dalam faktor penentu yang dapat memperbaiki rantai pasokan agribisnis tersebut. Tulisan ini mengungkap suatu penerapan SSM untuk memperbaiki performasi rantai pasokan agribisnis untuk hasil pertanian petani kecil di lahan kering Pulau Lombok, Indonesia. Beberapa kemungkinan penelitian lanjutan dari hasil pemikiran ini juga diungkapkan

Kata kunci: Soft systems methodologi, rantai pasokan, pertanian lahan kering

Abstract

Social problems that usually associated with human activity are frequently poorly defined. Soft Systems Methodology (SSM) provides an effective and efficient way to carry out a systems analysis of problems where technological processes and human activities are interdependent. Agribusiness supply chain is one clear example of the problems. Agribusiness supply chains are complex social systems, which have the objective of efficiently matching consumer demand with product supply. The importance of social factors such as cooperation, trust and relationships among actors suggest that SSM has some potential for exploring improvements to agribusiness supply chains. This paper notifies on an application of SSM to improve agribusiness supply chain performance for dryland farming products from small-scale farmers in Lombok, Indonesia. Some possible future research opportunities are also explored.

Keywords: Soft systems methodology, supply chain, dryland farming

Introduction

Agribusiness supply chains, while similar to the supply chains associated with manufactured products, have a specific nature associated with the characteristics of agricultural products. This is that the products are often bulky and fresh therefore requiring special handling, are time and place sensitive and are produced in high-risk environments subject to the vagaries of global biological and climatic processes. Bailey *et al*. (2002), Boehlje, (1998), Singgih dan Wood (2003) studies agribusiness supply chain and identified common problem of agribusiness supply chain as a system that associated with human interaction along the process that was very complex, unstructured and poorly defined.

Traditional methodology that usually applies to solve social problems is normally based on the technique associated with reductionism, which solves a problem by fragmentation, one stage at a time. This technique is appropriate for simple and highly structured problems that are able to be well defined, particularly in terms of inputs and outputs. For those problems that very complex and unstructured system methodology is considered more appropriate.

Prussia and Shewfelt (1993) noted that over the past 50 years several systems approaches have been developed, ranging from formalised mathematical procedures for optimising a system to broad guidelines for thinking about situations involving both technical and human components. They also argued that systems approaches became more necessary as designed systems became more complex and as our understanding of natural systems expanded.

The question now is what kind of systems approach, or approaches, are suitable for analysing agribusiness supply chains. Yoshida (1999) tried to analyse the kind of methodologies that can be applied to improve the effectiveness of supply chains and in particular focused on the need to incorporate the human-to-human and human-to-chain interactions.

Patching (1990) explains how soft systems methodology (SSM) can help to unpack complexity using a mixture of systems thinking in the systems world, and practical activities in the real world. It is argued that the standard formal logic of the accepted reductionist or mathematical systems theory may be inappropriate for knowledge elicitation as a learning process, and SSM is identified as providing a suitable theoretical framework.

Stowell and West (1989) states that a more heuristic and subjective approach should be taken to analyse complex and poorly defined problem is SSM. Similarly, Curtis (1989) and Rodger and Edwards (1989) conclude that the alternative approach of SSM is appropriate for the development of problem-driven expert systems like social complex problem.

This paper provides the information of SSM step by step as problem solving methodology and the rule of this approach in the analysis agribusiness supply chain with the case of dryland Lombok,s farming.

Soft systems methodology

SSM is a qualitative methodology developed by Peter Checkland and his colleagues at Lancaster University. It applies systems concepts to qualitative research (as does the Snyder process). Checkland (1993) and Checkland and Howell (1998) have explained how it is intended to deal with complex situations while maintaining adequate standards of rigour. He also explicitly identifies it as an action research methodology.

In the earlier version, SSM is a seven-step process that may be described as follows Checkland (1993):

1. the researcher is immersed in the problem situation;
2. the problem systems and their immediate context are defined;
3. root definitions of the relevant systems (comprising the essence of the systems) are defined;
4. conceptual models of the systems, intended as improvements, are developed;
5. the conceptual models are compared to reality;
6. feasible and desirable changes are identified;
7. action is taken to improve the situation.

Then SSM is described by Checkland (1988) and Tsouvalis and Checkland (1996) as an iterative cycle of action research that illustrated in Figure1.

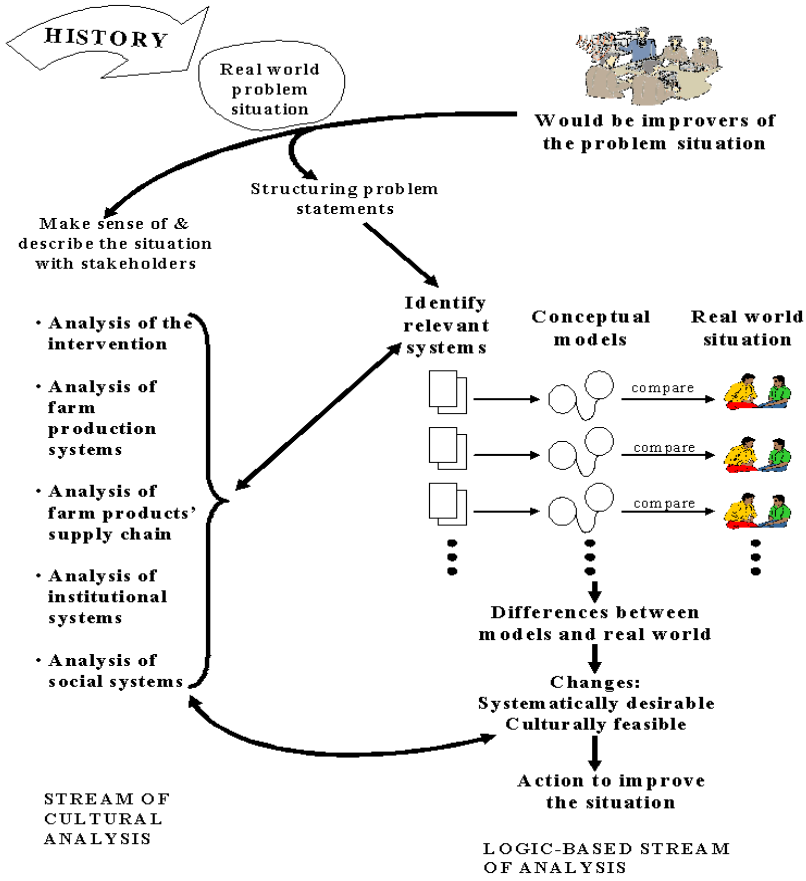

Figure 1. Soft systems methodology as an iterative cycle of action research

The basic schema used to categorize a situation in SSM can be expressed in terms of a mnemonic - "CATWOE", which Checkland and Scholes (1990: p35) explains as follows:

C customers the beneficiaries *or the victims* of T
A actors those who would do T
T transformation process the conversion of input to output
W *Weltanschauung* the world view which makes T meaningful in context
O owners those who could stop T
E environment elements outside the system which it takes as a given

The core of CATWOE, explains Checkland and Scholes, (1990; p35), "is the pairing of transformation process T and the W, the *Weltanschauung* or world picture which makes the T meaningful. For any purposeful activity, there will always be a number of different transformations, by means of which it can be expressed, these deriving from different interpretations of its purpose." Furthermore, the authors also suggest that decisions should be measured against five (originally three) criteria, known as the '5Es':

Efficacy Does the means (i.e. the proposed technical process) work?
Efficiency Are minimal resources being used to produce the desired outcome?
Effectiveness Is the desired outcome being produced?
Ethicality Is the action fitting, moral, etc?
Elegance Is the result aesthetically pleasing?

Figure 1 represents the pattern of activities in the methodology that does not necessarily impose a sequence in which it should be applied. As Wilson (1984: p64) says "the analyst may start with any activity, progress in any direction, and use significant iteration at any stage". The line between the real world and the systems thinking defines the boundary between the use of everyday language and systems language.

The Soft Systems approach is an evolving methodology that has been steadily developed into a systemic process of enquiry structured around a comparison between a real-world problem situation and conceptual models of relevant systems of purposeful activity (Checkland and Scholes, 1990). This comparison activity is normally conducted under face to face discussion and serial workshops. All the steps above are intended to produce some recommendations that can be used to improve problem situation. The application of SSM can be learned from the following case study about agribusiness supply chain for dryland farming products in Lombok.

Case study of agribusiness supply chain

Dryland farming is carried out in the northern and southern zones of Lombok Island. Differences in the topography and soil-types in these two zones determine the farm production systems adopted and the products produced. Farmers in the northern zone normally cultivate maize, peanut, and cassava while those in the southern zone grow paddy. The generalised agribusiness supply chain is shown in Figure 2.

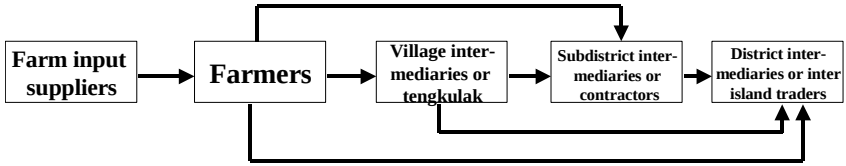

Figure 2. Supply chain of dryland farm products of Lombok Island

The main groups with an interest in the agribusiness supply chain include (1) farm input suppliers, (2) farmers, (3) village intermediaries, (4) subdistrict and district intermediaries, (5) farmer cooperatives, (6) farmer groups/organisations, (7) inter-island traders, (8) government agencies, (8) state and private banks, (9) religious/informal leaders, and (10) commercial transportation services.

Each member of each supply chain is acting in most cases as an independent profit maximiser and utilising their power over those below them in the chain. To date there have been no attempts to develop an integrated approach to the supply chains and in many cases supply chain participants only knew their immediate supply chain partners.

This situation led to a number of problems including the adoption of business practices that led to the highest profit at any point in the chain without considering business sustainability; practices based on the desire to suppress competitors or less powerful business partners; increasing farm debt; and decreasing farmer's solidarity because some of them were involved at arms length of traders. Overall, the supply chains operated in an atmosphere of confrontation rather than collaboration.

Other important factors included a low level of farmer education; a reliance on traditional values by farmers where the word of religious leaders was unquestionable; and the significant role of the Indonesian government officials at sub-district and village levels in planning agricultural inputs, production and marketing. A 30-year history of government intervention left many farmers afraid to question local government officials. A further situational variable was the high levels of collusion between city businessmen and government personnel.

The emphasis of research into agribusiness supply chains has to date relied on the use of neo-classical economic principals (Kaihara, 2001 and Lazzarini *et al*, 2001) but increasingly a new group of authors have highlighted the need to explicitly look at the qualitative factors involved in the chains either separately (Klein *et al*., 1996; Beamon, 1999; Pan and Kinsey, 2002; Singgih and Woods, 2003; Bryceson, 2003) or in a pluralistic fashion (Holmberg, 2000). It is this complexity that leads some writers (Metz, 1998; Yoshida, 1999; Holmberg, 2000; Bailey *et al*, 2002; Castano, 2002; Gencoglu et al, 2002; Cadilhon et al, 2003; Zylbersztajn and Filho, 2003) to advocate the application of systems thinking and analysis to capture their inherent complexity.

The nature of supply chains as a system has been tested by Lee *et al* (1997). They found that distortions in information flows from one end of a supply chain to the other can create significant effects on the whole system's performance. Holmberg (2000) noted that although individual companies in a supply chain might adopt systems analysis principles there was no guarantee

that such principles would be adopted along the chain as a whole, thereby leading to sub-optimal outcomes for the chain.

Furthermore, Flood (1988) and Flood and Jackson (1991) suggested a system analysis can be used to illustrate the concept of situational complexity. Soft Systems Methodology has been used to provide the theoretical framework for the study of the unstructured social problem situation including supply chain (Gencoglu *et al.*, 2002; Prussia and Shewfelt, 1993; Yoshida, 1999; Kreher, 1994). The model developed of this system analysis for agribusiness supply chain is expected to be a reference for other agribusiness context.

The case study focuses upon the issue of effective agribusiness supply chain. It is a systems investigation that is examining the interaction of participants along the agribusiness supply chain within human activity systems in Lombok. It clearly illustrates that not only are there economic issues, but also social ones including organizational structure and efficiency, community training and education, and government intervention.

Application of SSM to improve agribusiness supply chain

Describing rich picture

The first two stages of Soft Systems Methodology involve the examination of the background of the problem that can effectively be traced from history of the situation. This is expressed the form of the "Rich Picture" (Appendix 1) which aims to show the activities and interaction among participants along the agribusiness supply chain. This also describes elements of slow-to-change *structure* and elements of constantly-changing *process* within the situation being investigated.

The Rich Picture can be applied to the initial stages of SSM as learning process to help develop a representation of relevant domains, and an understanding of the views of people within each domain. Stowell and West (1990) suggest that the Rich Picture is very useful as a summary of problem situation from the researcher. The analyst can use it as a prompt for discussions with other experts, as an aid for assimilating learning process, and as a means of identifying the areas in which knowledge is limited.

Developing root definition and CATWOE

In this stage a choice is made of relevant systems that the analyst believes will produce insight into the problem situation. The chosen systems are expressed in statements as the Root Definitions, which incorporate the points of view that make the activities and performance of the systems meaningful. The initial Root Definition for this study of technology transfer has been formulated as follows:

Relevant system. A system to increase communication and interaction among all participants along the dryland farming agri-food supply chains to improve the whole supply chain process.

Root definition. A system in which farm production from field yard is distributed under a coordinated supply chain with fair distribution of profits and involving reliable information flows in both directions within the chain.

The formulation of "good" Root Definitions is decisive to the creation of the conceptual model in Stage 4. Therefore, the Root Definition is tested against a group of elements known by the mnemonic CATWOE, that defines a check-list for **C**ustomer, **A**ctors, **T**ransformation process, **W**eltanschauung (worldview), **O**wner, and **E**nvironment. Invoking the CATWOE for this study results in:

Costumers: Input suppliers, farmers, village intermediaries, *tengkulak*[1], subdistrict intermediaries, inter-island traders, state banks and other governmental agencies.
Actors: All supply chain participants including government and religious officials.
Transformation: The distribution of farm produces through a coordinated supply chain owned by farmers, intermediaries and inter-island traders.
Weltanschauungen: Improve standard quality product with fair share of profit margin and increase value added of product in every step along the supply chain.
Owner: All participants who actively involved in the supply chain including those government agencies having an interest in the chain's function and outputs.
Environment constraint is the culture or habits of almost all supply chain participants that are very difficult to change and the condition of communication infrastructure that is still absent in the village and of transportation infrastructure that is still very poor.

The elements of CATWOE emphasize the need for what Shaw (1985) terms constructive alternativism: that it is important to examine the problem from a number of viewpoints. The Root Definition and CATWOE provide the analyst with a framework for ensuring that all points of view and interest are considered in the knowledge elicitation process.

Creating conceptual model

This stage is where a logical expansion of the Root Definition is made into the minimum necessary set of activities to define what the system actually does at a particular resolution level. The qualitative modelling process uses

[1] *Tengkulak* is a kind of village intermediary who normally does not have enough money but they are assigned by subdistrict or district intermediaries to collect farm produce in village area.

pictures and diagrams to define and communicate structure, logic, ideas and relationships. The Conceptual Model should be expressed by verbs.

The logical expansion of the Root Definition for agribusiness supply chain results in a basic conceptual model of five subsystems that expressed in Figure 3.

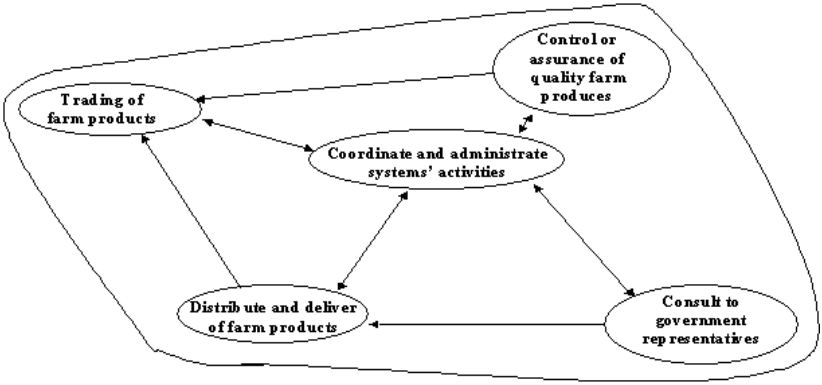

Figure 3. Basic conceptual model of agribusiness supply chain.

Every subsystem in basic conceptual model then was developed to be one or two conceptual models. This case study only developed every subsystem to be one conceptual model therefore basic model in Figure 3 has been developed to be Figure 4.

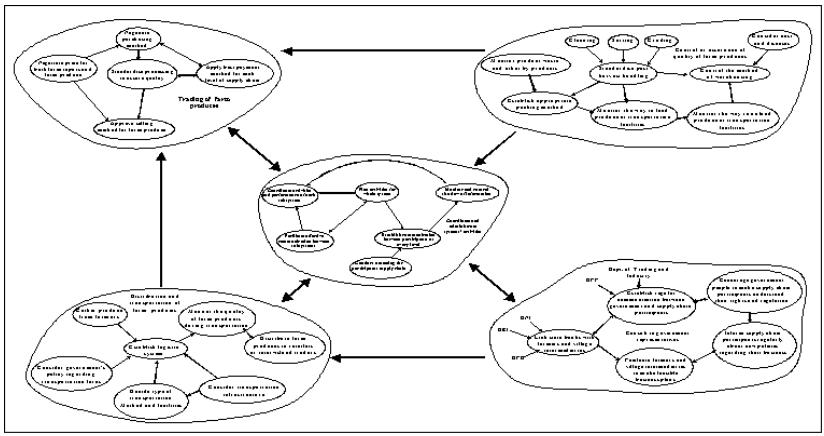

Figure 4. Detailed conceptual model of agribusiness supply chain

This detailed model represents a human activity system that can now be used to create a well-structured evaluation of the state of the real world. This is achieved by comparing the model with perceptions of present situation. It provides a means of enquiring into areas of expertise which seem difficult to understand or that have been poorly defined by the expert (Stowell and West, 1990).

Comparing conceptual model and real word

Comparison of the Conceptual Model with the real world is undertaken by comparing each of the second resolution activities within the model with the real world problem situation. This was achieved in this study by the rigorous interviewing some selected supply chain participants that actively involved in agribusiness. After information effectively gathered the comparison continued to some workshops that involved as many as supply chain participants.

Some discussion methods were firstly offered to the workshop audience. All of participants agreed to use brainstorming because this technique is commonly used in village office or farmer group meetings. Almost all of participants took an active part in discussions and made a serious attempt to understand the SSM process and were willing to learn more about it. However, some participants initially looked rather passive and found difficulties following the discussion because participants with high education levels tended to dominate the situation. Once they had developed an understanding nearly all participated in the discussion provided valuable insights and refocused their discussion around an approach that had the human activity systems as its core.

The discussion resulted in several differences being noted between the present practices and the approach suggested by the conceptual model. These gaps were then the focus of discussion which led to recommended actions for the supply chain as a whole but also identified agreed actions which could be focused on by each of the groups of supply chain participants.

Most participants recognised that collaboration between supply chain members would lead to longer term business sustainability compared to a situation of continued confrontation. However, despite some agreed outcomes relating to supply chain planning and resource sharing among supply chain participants the supply chain as a whole remained cumbersome.

Recommending pathways of improvement

The final part of the workshop was focused on trying to find changes that were considered systematically desirable and culturally feasible. The following four important actions were recommended.

1. Revitalise the role of farmer groups to collaborate among members and to bridge the interests of members to other supply chain actors both up and downstream.
2. Farmers and other supply chain participants should consider building post-harvest handling facilities to assist farmers and village intermediaries to control and assure the quality of farm produce.
3. Formal and informal meetings towards improving supply chain structure should be facilitated more often and be conducted regularly.
4. Government institutional should pay more attention to the process of supply chain improvement and should include it in their annual operational programs.

Conclusion

Agribusiness supply chain issues are clearly characterised by complex interactions between individuals at each stage and between groups along the supply chain, as well as between human and biophysical factors encountered in the food production process. The participative nature and strong focus upon human activity systems of this methodology has facilitated the development and testing of a systems model of a 'messy', poorly defined and complex problem area.

The case study illustrates the application of SSM to the problem of agribusiness supply chain management in Lombok Island and suggests that this approach is a suitable method for improving situation under expert system development.

The use of the model as a learning process has been successful, both in the quality of the information gathered, and in the response of the participants interviewed. It is pertinent to note that the majority of individuals claimed that their participation in the analysis has led to useful insights into problems they are having with supply chain management of dryland farming products in Lombok Island. Many have volunteered to take part in further studies.

The significant use of jargon in SSM was also an issue that had to be bridged with supply chain participants. In particular problems with language were of major concern in developing relevant systems, root definitions and the conceptual model. Much effort was needed to select the most appropriate words for use in discussion in order to keep the participants involved. Finally, many participants found it hard to differentiate between the current situation and the conceptual model and on a number of occasions the discussion moved from a focus on activities to one based on the supply chain actors.

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Appendix 1. Rich Picture of Agribusiness Supply Chain for Dryland Farming Products of Lombok Island