

Information structure in coordination of vegetable supply chains in Nepal

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Abstract

Previous research conducted in information structure and chain coordination points out the need to develop appropriate information structures for the various supply chain coordination structures that could exist. To fulfil the information gap between vegetable producers and consumers, the identification of appropriate information structure is required in Nepalese vegetable supply chains.

With the purpose of exchanging information efficiently among producers, and increasing volume of production and gaining market power, smallholder producers in Nepalese vegetable chains have organized into groups and cooperatives. This initiative changes the nature of chain coordination, adding a horizontal coordination dimension to what was previously a vertically coordinated chain. The purpose of this research is to identify information structures that exist in vegetable supply chains, and to detect and explain patterns between information structure and chain coordination in these chains.

The results from two contrasting case studies of informal vegetable supply chains in Nepal are presented in this paper. In the first case, the cooperative is one among a number of sources of information for producers and information is disseminated from one actor to another mainly within dyads. This information structure is associated with weak horizontal coordination at the producers' level. This weak horizontal coordination at producers' level, and the flow of information mainly between transacting parties, is associated to weak vertical coordination in the whole chain. However, in the second case, the cooperative is the main source of information and it disseminates the same information to actors working at different stages of the chain. This results in strong horizontal coordination at the producers' level. This strong horizontal base at the producers' level, along with the flow of the same information to all supply chain actors, is associated with strong vertical coordination in the whole chain.

Introduction

Globally, retailers consolidated and gained economic power over manufacturers in distribution channels during the 1980s and 1990s (Coyle, Bardi & Langley, 2003). This power shift brought changes in the business environment in every sector and every region in the world. Businesses started to adopt more consumer focussed strategies to enhance their chances of business success.

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The Global agribusiness sector was also affected by this power shift. In this sector, dedicated supply chains have emerged to fulfil the interests of consumers. However, the needs of consumers are changing continuously, and these changing consumers' needs, in turn, change market demand. To better match demand and supply in this changing environment, improvements are required in information exchange and coordination patterns (de Moura, 2002).

In the past, researchers covered some aspects of the relationship between information exchange and chain coordination, with emphasis on the impact of information flow on material flow (Kaipia, 2007; Sahin & Robinson 2002, 2005; Sari, 2007) and chain relationships (Claro, 2004; Clements, Lazo & Martin, 2008; Li & Wang, 2007; and Williams & Moore, 2007). Although the studies by Claro (2004), and Clements, Lazo and Martin (2008) did focus on the fresh produce sector, the information gap between the producers and consumers of a fresh produce supply chain has been relatively poorly addressed in previous research. This omission is significant, since the information gap between producers and consumers can be reduced by developing an appropriate information structure that assures timely flow of accurate information along the chain (Li and Wang, 2007).

The information gap between the producers and consumers are more severe in a country like Nepal where large numbers of smallholder vegetable producers are involved in a long and complex chain. There are five to six stages from input suppliers to consumers in these chains where actors are loosely aligned to make transactions. The chain actors exchange information, along with the vegetables, normally in dyads. As the information passes on from one dyad to another towards both ends of the chain, mainly through face-to-face communication and telephone, distortion of information can occur.

Vegetable production sites lie mainly in the rural areas of middle hill range and southern plain of Nepal. These sites have been developed in road accessible areas as the Government has given priority to produce high value crops that includes vegetables in road corridors (HMG 2004). Since majority of farmers are smallholders, they are involved in groups to receive production technologies from the Government and non- Government Organizations and to increase volume of production (Pyakuryal, 1997). The members of these groups produce different types of seasonal vegetables to sell them in the markets. To further increase the volume of production and to gain market power, the concept of amalgamating groups into cooperatives was introduced in late 1990s (Chapagain & Gautam, 2006). These cooperatives transact production inputs and vegetables, and also collect and disseminate required information to the producers and other actors in the chain.

Organizing vegetable producers into groups and cooperatives and linking production sites to markets began to align producers horizontally. This horizontal alignment among producers could create a foundation for stronger vertical alignment between the actors. These vegetable chains are newly emerging, and the flow of information within these emerging structures has an unknown impact on this alignment. Therefore, the aim in this research is to identify information structures that exist in vegetable supply chains for Nepal, and to detect and explain patterns between information structure and chain coordination (both vertical and horizontal) in these chains.

Theoretical framework

Information structure and chain coordination are the core constructs used in this research. The research intends to identify how these constructs are configured in different supply chain structures with the actors that exhibit different behaviours. Patterns of relationships between chain actors are central to Transaction Cost Economics (TCE) (Choi et al., 2001) and the behaviour of actors in maintaining relationships is central to Network Theory (NT) (Bititci et al., 2004), and the research is anchored in these two bodies of theory.

To explore in-depth relationships between information structure and chain coordination, complete information structure and well-coordinated chains have been disintegrated into their dimensions. Symmetric information and high willingness of actors to exchange information are the dimensions of a complete information structure (Phlips, 1988). Similarly, dimensions of chain coordination can be horizontal and vertical (Poulton & Lyne, 2008). Complete and consistent information that is exchanged timely and at required frequency and enabling operational efficiency of chain actors are the key attributes of symmetric information. Similarly, information power built within the chain, chain focussed behaviour of actors, and transparency, signifies high willingness of actors to exchange information. Strong alignment of goals and objectives among producer members of groups and cooperatives and vertical alignment of these groups and cooperatives with other chain actors are the key attributes of strong horizontal coordination. Likewise, chain activities focussed towards satisfying the consumers, vertical alignment of goals and objectives along the chain, and interdependencies are the key attributes of strong vertical coordination.

The relationships between the key attributes of information structure and key attributes of chain coordination have been examined to detect the overall relationship between information structure

and chain coordination. This is done by examining the associations between the level of completeness of information structures and the strength of chain coordination.

Methodology

Case study is the method employed in this research, since it can identify the complexities of existing information structures in vegetable supply chains and explore the processes and relationships between them (Creswell, 2003) to improve them. Case studies of two⁴ domestic vegetable supply chains were carried out. Both these chains pass through six stages and are informal. Input suppliers, producer farmers, assemblers, wholesalers, retailers and consumers are the actors in these chains. There is involvement of cooperatives in both chains, but they perform different functions in different chains. These cooperatives are also working as service providers by providing information to the chain actors. Government and non-Government Agencies, transport operators and cold storages are other service providers of these chains.

The unit of analysis is the entire supply chain. An embedded multiple-case design (Yin, 2003) is employed with every step of the supply chain is considered as a sub-unit for data collection and analysis. The data were collected by conducting interviews, group discussion, site and participant observation, and by reviewing published and unpublished documents. The data collected from interviews with farmers, assemblers, wholesalers, retailers and service providers are the main sources of primary data. Recorded interviews are transcribed and coded for analysis. The data collected from interviews, observation and secondary sources were triangulated to increase the reliability of findings. Qualitative data analysis techniques: pattern matching, explanation building and cross-case analysis are employed to derive the results (Yin, 2003).

Results and Analysis

The comparative analysis of these two cases is helpful to find out the existing information structures in these chains, the ways to make information structure more symmetric and complete, and the effects of information structure in chain coordination.

⁴ Four case studies were carried out for the whole research, but only two cases have been analysed to derive the preliminary results presented in this paper.

Information Structure

Information structures in both chains have been influenced by demand and supply uncertainties, and the composition of the information that is exchanged between parties. Demand and supply uncertainties arise from changing consumer preferences, the rise and fall in domestic production, and unpredictable import and export to and from India. These demand and supply uncertainties increase asymmetries in information structure. The information that is exchanged between parties consists of sources and destinations, types and quality of information, communication means, and frequency of information exchange. The similarities and differences in the information structures within these two chains and are presented separately.

Chain One

The majority of producers of this chain sell their produce to assemblers in different markets. As a result, they rely on the information provided by the assemblers when conducting transactions. However, they also receive information from the cooperative, Market Boards and Government Agencies. The producers use the information supplied by the cooperative and other agencies for reference purpose. Although the producers sell their vegetables on the basis of information provided by the assemblers, they trust the information supplied by the cooperative and Government agencies more. This contradiction does not occur in other steps of the chain where the dyadic partners show greater trust towards each other.

Price is the most widely distributed operational information along this chain. In many cases, the producers and assemblers predict demand and supply situation from the prices. Producers and assemblers also give high importance to the behaviour of each other. Neither party is fully transparent and often behave opportunistically towards each other. The assemblers usually come from outside the producers' area. Even if they are local, they seem to have greater affinity towards their buyers. However, both producers and assemblers agree on the point that knowledge, skills and attitude have an impact on the behaviour of people. In this chain, there are some producers and assemblers with better education, training and involvement in social activities and their behaviour is more cooperative. Such people exchange reliable and complete information with each other at the required time.

Information exchange between the actors mostly takes place through face-to-face meeting and telephone (including cell phone) conversations. They rely less on the published information in websites and documents. Information exchange between input suppliers and producers, and producers and assemblers takes place during the actual transaction and is inadequate, but in other dyads, it takes place not only during the transaction but also at other times at required frequency.

In this chain, only the information required to make production decisions are exchanged among producers in groups and cooperatives. These producers sell their produce individually to different markets and normally do not exchange the information required to make marketing decisions with other producers. Therefore, the information exchanged among producers aligns their goals and objectives for production purpose only. Vertically, the information exchanged between three of the dyads - input suppliers and producers, assemblers and wholesalers, and wholesalers and retailers is reliable, complete and timely. However, due to the mistrust between producers and assemblers there is suspicion that the information shared between them does not have these characteristics. As a result, the information structure is incomplete with asymmetries.

Chain Two

All producers of this chain bring their produce to the cooperative's market yard for sale. They either sell their produce directly to the buyers (assemblers, wholesalers and retailers) or supply to the cooperative to sell on their behalf. Even if they sell produce to different buyers, they rely on information provided by the cooperative to assist them in their transaction. The information disseminated by the cooperative is considered very reliable as it collects information from different sources and updates the information regularly. The producers and buyers exchange a lot of information during transactions, but any change in prices, demand, supply, quantity margin, etc. reaches the cooperative quickly for record. The producers and buyers also get information from buyers, market boards and Government Agencies as well, but they use this information for reference purpose only.

Price is the most widely distributed operational information in this chain. Since, the cooperative involved in this chain undertakes input supply, assembling and wholesaling functions, it is aware of market demand and supply and the supply to markets from other sources. The behaviour of chain actors assists in the flow of operational information. Due to the active involvement of the cooperative, the chance of manipulating information is less likely. The actors are hesitant in

providing false information as its validity can be verified instantly by the cooperative. In addition, most of the assemblers who purchase vegetables from producers are the members of the same cooperative as producers. As a result, both of them should obey the cooperative rules and regulations, and so do not behave opportunistically. Hence, the producers and assemblers align their individual goals and objectives with the goals and objectives of the cooperative.

Information exchange between the actors takes place through bulletin board, face-to-face meeting and telephone (including cell phone) conversations. In this chain, the cooperative is an important actor performing a marketing function. Information exchange between the cooperative and producers, producers and buyers and the cooperative and buyers takes place at required frequency.

In this chain, the producers, who are also the cooperative members, share the information required for making production and marketing decisions among themselves. Therefore, their goals and objectives are aligned horizontally. Since, the actors from input supply to wholesaling exchange information with the cooperative, the chances of information distortion are low. The cooperative disseminates same information, which is reliable and complete, to all actors from its records. In this chain also, market information is exchanged for a set period of time, but the market situation changes frequently. As a result, the flow of complete information is very difficult. Therefore, the information structure in this chain is a bit incomplete but quite symmetric.

The summary of the status of components of information structure in both chains is presented in Table 1.

Table 1: Summary of similarities and differences in information structure in two chains

	Chain one	Chain two
1 Sources of information	Assemblers, cooperative, market boards and Government agencies	Cooperative, buyers, market boards and Government agencies
2 Principal source of information	Assemblers	Cooperative
3 Types of information exchanged		
Operational	Price	Price, demand, supply, sources of supply
Behavioural	Opportunistic behaviour between	Cooperative behaviour between the

	some producers and assemblers but cooperative in other stages	actors in all stages of the chain
4 Assemblers	Usually come from outside the production area; locals have also greater affinity towards their buyers and opportunistic to producers	Usually members of the same cooperative as producers, and are cooperative towards producers
5 Reliability, completeness and timeliness of information	Observed horizontally among producers exchanged for production purpose. Observed vertically between input suppliers and producers, assemblers and wholesalers, and wholesalers and retailers, but not between producers and assemblers	Observed horizontally among producers exchanged for production and marketing purposes. Observed vertically in all stages of the chain
6 Communication means	Face-to-face communication and telephone	Bulletin board, face-to-face communication and telephone
7 Frequency of information exchange	Inadequate between input suppliers and producers, and producers and assemblers; at required frequency in other stages	At required frequency in all stages
8 Horizontal alignment of goals and objectives	For production purposes	For production and marketing purposes
9 Information asymmetries occurred vertically between	Producers and assemblers	No parties

Coordination

Horizontal coordination is observed among the producers in both chains. The information structure in chain one is able to align the goals and objectives of the producers for production purposes but not for marketing. Therefore, horizontal coordination in this chain is moderate. The information structure in chain two horizontally aligns the majority of the producers both for production and marketing purposes. However, some of the producers in this chain are not cooperative members and sometimes sell their produce to other places. Hence, the horizontal coordination among producers in this chain is not quite strong but could be slightly stronger.

Vertical coordination in chain one is characterized by lack of trust between producers and assemblers, with producers and assemblers behaving opportunistically on some occasions when

exchanging information. This effect is exacerbated by the weaker horizontal coordination of producers. While, vertical coordination is strong between other parties in the chain. This weak link between producers and assemblers reduces the strength of the chain. On the contrary, there is strong cooperative behaviour at all levels in the second chain. The cooperative performs an information function within the chain and so facilitates flow of reliable, complete and updated information along the chain. This helps to develop trust, transparency and cooperative behaviour among the actors in the whole chain. In addition, the horizontal coordination at producers' level lies towards strong, which strengthens the vertical coordination in this chain.

Conclusion

The information structure in chain one was found to be incomplete with asymmetries. The demand and supply uncertainties, information withholding between producers and assemblers, and the flow of inadequate information within this dyad are responsible for this incompleteness. Similarly, the exchange of information in an opportunistic way between producers and assemblers, and the flow of information from one actor to another in the chain causes asymmetries. The information structure of the second chain was found to be incomplete but with no asymmetries. The demand and supply uncertainties are responsible for the incompleteness. However, in contrast to chain one, there is a flow of the same information from common source to the whole chain, and so the actors maintain transparency in information sharing. The dissemination of the same information from the same source means there is no asymmetry in information structure along the chain. It indicates that the flow of information from a common reliable source can help to develop symmetries in information structure in informal supply chains.

The flow of symmetric information along the chain is associated with strong horizontal and vertical coordination. Conversely, it was observed that both horizontal and vertical coordination were weaker in the chain where there is asymmetry in the information structure.

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